



Effect of Ovulatory Follicle Size on Fertility of Ovsynch-TAI Cows, Versus Spontaneous Estrous Cows Inseminated Based on Heat Detection

A.A. Ramoun^{1*}, M.M. El-Kholy², Sahr El-Nagar³, B.A. Heleil¹, I.I. El-Kon¹ and Essam A. Almadaly¹

¹ Theriogenology Department, Faculty of Veterinary Medicine, Kafrelsheikh University, Kafr El-Sheikh, Egypt.

² Veterinary Medicine Directorate, Tanta, Al-Gharbia province, Egypt.

³ Department of Animal Wealth Development, Faculty of Veterinary Medicine, Kafrelsheikh University, Kafrelsheikh, Egypt.

Abstract

THE OBJECTIVE was to study the effect of ovulatory follicle diameter (OFD) at the time of timed-AI (TAI) on the fertility response in Ovsynch-TAI cows in comparison with spontaneous estrous/ovulation cows inseminated upon heat detection (SOHD-AI). Fifty Holstein cows were equally assigned to Ovsynch-TAI and control SOHD-AI groups (n=25 for each). Transrectal ultrasonography (TUS) was performed to estimate OFD on Day 0 and corpus luteum volume (CLV) on Day 13 and diagnose pregnancy on Day 28-32 post-insemination. Blood samples were obtained on Day 0 for estradiol (E2) assay and on Days 5 and 13 for progesterone (P4) assay. The serum progesterone concentration was greater in conceived versus non-conceived group on Days 5 ($p = 0.002$) and 13 ($P = 0.001$) in the Ovsynch-TAI group and on Day 13 ($P = 0.002$) in SOHD-AI group. There is a positive correlation between OFD and CLV ($P = 0.02$) and between CLV and serum progesterone concentration ($P = 0.01$) simultaneously in the Ovsynch-TAI group. The conception rate was 32% and 24% in Ovsynch-TAI and SOHD-AI groups respectively.

It is concluded that OFD at the time of TAI could be used to predict the fertility response to Ovsynch protocol since it is positively correlated to CLV on Day 13 which in turn is correlated to serum P4 concentration on Day 13 post -TAI.

Keywords: Cows, Ovsynch-TAI, ovulatory follicle, CLV, Fertility.

Introduction

Unlike traditional insemination of cows based on (HD-AI), Ovsynch-TAI has become an essential part of the reproductive management in dairy herds because it allows insemination of all cows eligible for insemination, at the same time, without heat detection [1, 2]. A higher percentage of cows has been reported to receive TAI in comparison with cows that were bred based on HD [3]. Low heat detection rate of $\leq 50\%$ [4] and reduced estrous behavior in high-producing cows [5] affected AI service rate in cows bred based on HD-AI. Application of Ovsynch-TAI on a large scale resulted in dramatic improvement of the reproductive performance of dairy cows over the last 20 years [2].

The ovarian status and steroid hormones profiles at the time of TAI influence the pregnancy rate (PR)

in dairy cows subjected to ovsynch-TAI [6]. The ovulatory follicle status is a vital prerequisite for any reproductive management program that aims to optimize fertility in cows [7]. The chance of ovulation significantly increases with the increase of OFD [8]. The likelihood of conception is related to the size of the ovulatory follicle [9, 10] since it influences both the volume and endocrine function of the CL graviditatus [11]. Maternal requirements for conception include ovulation of a competent oocyte, adequate serum P4 secretion by CL graviditatus and optimum uterine environment [9, 12]. The size of the ovulatory follicle at the time of insemination is a strong predictor of; oocyte competence [13], follicle maturity and subsequent fertility [9, 14]. The TUS check of ovarian follicular status at insemination may be beneficial since the state of the preovulatory follicle at insemination has been closely

*Corresponding authors: Adel A. Ramoun, E-mail: ramoun2004@yahoo.com. Tel.: 01099868608

(Received 17/03/2024, accepted 20/06/2024)

DOI: 10.21608/EJVS.2024.277553.1929

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related to fertility [15]. Larger follicles produce larger CLs volumes and consequently high P4 concentration [10] which favours early embryonic development and establishment and maintenance of pregnancy [16]. However, the influence of OFD, at the time of TAI, is controversial since previous studies recorded absence of correlation [17] negative correlation [18] or positive correlation [19] between OFD and pregnancy outcome.

The present study tested the hypothesis of whether the size of the ovulatory follicle (OFD) at the time of insemination affects CL volume (CLV), CL-P4 secretory activity and subsequent fertility or not in Ovsynch-TAI in comparison with SOHD-AI. Therefore, the current study was designed to investigate the effect of the size of the ovulatory follicle at the time of TAI following an Ovsynch protocol on CL volume, post-TAI serum P4 concentration and subsequent fertility response in comparison with cows undergoing spontaneous estrous and inseminated on the basis of heat detection in dairy cows.

Material and Methods

Animals and management

Fifty lactating Holstein cows, maintained at a private dairy farm in Qutur district, Gharbia province, Egypt, were used in the current study, during the interval extending from late autumn 2021 to early summer 2022. The cows averaged 3-4 years in age and had a body condition score of 3.50 ± 0.50 Based on five points scale, 1= emaciated and 5= obese, [20]. The selected cows were for the first service between 55-75 days in milking (DIM).

The cows were housed in a loose housing system within yards with 25% sheltered area per yard. The cows were fed a ration that met both maintenance and milk production requirements according to NRC [21]. The cows were milked twice daily at 6 AM and 6 PM with daily milk yield of 28.4 ± 4.2 kg. The cows were confirmed to be healthy and had normal estrous cycles before enrolling in the study. The ovaries were scanned by two TUS at 10-days intervals before enrolment in the study to check cyclic activity. Detection of a mature CL in one of the two TUS examinations confirmed cyclic activity [4]. All procedures were approved by the Kafrelsheikh university committee for the use and care of animals (The agreement number was KFS-IACUC/168/2023).

Experimental design

Animal grouping

The cows were randomly assigned, according to the type of breeding into two groups: Ovsynch-TAI group (controlled breeding, n=25) and spontaneous estrous/ovulation cows that were bred on the basis of heat detection (conventional breeding, SOHD-AI

group, n=25). In Ovsynch-TAI group, cows received two IM injections of GnRH agonist (100 ug Gonadorelin equivalent to 1 mL Ovurelin[®], Bayer New Zealand) on Days -10 (Day of GnRH 1) and -1 (Day of GnRH 2) and single injection of PGF2 α (500 ug Cloprostenol sodium equivalent to 2 mL of Ovuprost[®], Bayer New Zealand limited, New Zealand) on day -3. Afterward, cows were inseminated at 16h after GnRH 2 (Day 0) with proven fertile frozen semen by the same technician.

In SOHD-AI group, cows were inseminated \approx 12h after initiation of standing heat (Day 0). Heat detection was conducted by Data Flow II system (Allflex, Livestock Intelligence, MSD, Animal Health Intelligence) and confirmed by observation. The OFD was measured by transrectal ultrasonography (TUS) at the time of insemination (Day 0) in both Ovsynch-TAI and SOHD-AI groups.

Scoring of cows based on OFD

The eventually diagnosed pregnant cows in case Ovsynch-TAI (n=8, induced ovulation) and SOHD-AI (n=6, spontaneous ovulation) were scored into five scores on the basis of the OFD on the Day 0. The OFD averaged 13- <15, ≥ 15 -<17, ≥ 17 -<19, ≥ 19 -<21 and ≥ 21 mm in scores 1, 2, 3, 4 and 5 respectively with an increment of 2 mm amongst successive scores from 1 to 5. The association between OFD-based scores and conception rate was studied.

Scoring of cows on the basis of CLV

Based on CLV on Day 13 Post-insemination, the eventually diagnosed pregnant cows were scored into five scores in either Ovsynch-TAI or SOHD-AI. The CLV averaged: 4-<8, ≥ 8 -<12, ≥ 12 -<16, ≥ 16 -<20 and ≥ 20 cm³ in scores 1, 2, 3, 4 and 5 respectively with an increment of 4 cm³ amongst successive scores from 1- 5. The association between CLV-based scores and conception rate was studied.

Ultrasonography

Determination of OFD and CLV

Using a multi-frequency linear array probe (3-8 MHZ, L561 V), the A6V SONOSCAPE ultrasound instrument (SONOSCAPE Medical Corp., Guadong, China) was used to perform transrectal ultrasonographic (TUS) investigations of the uterus and ovaries. In order to estimate OFD on Day 0 and CLV on Day 13 post-insemination in either conceived or non-conceived cows of both two groups, the ovaries of all the cows were inspected.

Determination of OFD

The ovulatory follicle's maximal area on the screen was frozen as an image. The integrated electronic calliper of the US equipment was used to measure the diameters of the vertical and horizontal

perpendiculars, from which the OFD was calculated by taking the mean of these measurements [22].

Determination of CLV

An ellipse was produced when a maximally sized image of CL was frozen on the screen. Using an integrated electronic calliper, the ellipse's vertical and horizontal axes were measured. The CLV (cm³) was computed using the 2-Axis approach, which is stated in the Sonoscape US device catalogue on page 3-38. The formula is $V = (\pi/6) \times A \times B^2$, where A is the long axis and B is the short axis of the ellipse. The cavity's volume was computed using the same procedure in the case of a CL that contained a cavity. To calculate net CLV, the cavity's volume was deducted from the total CLV.

Pregnancy diagnosis

During Days 28–32 post-TAI in the Ovsynch-TAI group or HD-AI in the SOHD-AI group, uterine TUS was used to diagnose pregnancy. A positive pregnancy test result is indicated by the presence of an anechoic sac containing an embryo proper with heartbeats. The conception rate was estimated by dividing the number of cows diagnosed pregnant by the whole number of inseminated cows in each of the two groups.

Blood sampling and hormonal assays.

Blood sampling

Blood samples were obtained by jugular vein puncture in 10 mL vacutainer tubes on Day 0 for measuring serum concentrations of estradiol (E2), and on Days 5 and 13 to measure serum concentrations of progesterone (P4). The blood samples were kept at 4°C for 24 hours and then, centrifuged at 1500 xg for 20 minutes. The extracted serum was kept at -20°C until the hormone test.

Estradiol assay

The serum E2 concentrations were measured by EIA using the E2 KIT (Biocheck, Inc., 323 Vintage Park, USA). The intra- and inter-assay coefficients of variation were 4.9% and 6.60%, respectively.

Progesterone assay

The serum P4 concentrations were measured by EIA using P4 KIT (Biocheck, Inc., 323 Vintage Park, USA). The intra- and inter-assay coefficients of variation were 7.1% and 12.6%, respectively.

Statistical analysis

All data were analysed using SAS (Statistical Analysis System, Version 9.1 for Windows; SAS Institute, Cary, NC, USA). Except the conception rates, all data were presented as means \pm SE. The means \pm SE of OFD and serum E2 concentrations on Day 0, CLV and serum concentrations of P4 on Days 5 and 13 were compared between Ovsynch-TAI and

SOHD-AI groups by using ANOVA. Pearson regression analysis was used to study the correlation between various parameters: 1) OFD and serum E2 concentrations on Day 0, 2) OFD and CLV and 3) CLV and serum P4 concentration on Day 13. The association between conception rate (CR) and OFD scores (1-5) or CLV scores (1-5) were determined by Chi-square test. Significant difference was considered when $P < 0.05$.

Results

Ovarian status (OFD and CLV)

The OFD in either conceived or non-conceived cows in Ovsynch-TAI group did not differ compared with their counterparts in SOHD-AI group on Day 0. Also, there was non-significant variation in OFD between conceived and non-conceived either in Ovsynch-TAI or SOHD-AI groups (Table 1).

The CLV, on Day 13 post either TAI or HD-AI, did not differ between conceived and non-conceived cows either in Ovsynch-TAI or SOHD-AI groups. The CLV in non-conceived cows in the Ovsynch-TAI group showed a significant ($p=0.004$) decrease compared with either conceived or non-conceived SOHD-AI group ($p < 0.004$, Table 1).

Serum E2 and P4 concentrations

The serum E2 concentration in either conceived or non-conceived cows in Ovsynch-TAI group did not differ compared with their counterparts in SOHD-AI group. Also, there was non-significant variation in serum E2 concentration between conceived and non-conceived either in Ovsynch-TAI or SOHD-AI groups (Table 1).

The serum P4 concentration on Day 5 post-TAI in conceived or non-conceived cows in Ovsynch-TAI group did not differ compared with their counterparts in SOHD-AI group. Although the serum P4 concentrations on Day 5 showed significant ($p < 0.002$) decrease in non-conceived compared with the conceived cows in Ovsynch-TAI group, it did not differ between conceived and non-conceived cows in SOHD-AI group. The serum P4 concentration on Day 13 post-TAI in conceived or non-conceived cows in Ovsynch-TAI group did not differ compared with their counterparts in SOHD-AI group. The serum P4 concentration on Day 13 post-TAI or HD-AI was greater ($p < 0.001$) in conceived than non-conceived cows either in Ovsynch-TAI or SOHD-AI groups (Table 1).

Regarding the effect of post-TAI or HD-AI day on the serum P4 concentration, it was observed that the serum P4 concentration was greater ($p < 0.001$) on Day 13 than on Day 5 in conceived cows in both Ovsynch-TAI and SOHD-AI groups. On the other hand, the serum P4 did not differ between days 5 and 13 in non-conceived cows either in Ovsynch-TAI or

SOHD-AI groups (Table 1). *Correlation between OFD and serum E2 concentration:*

The overall correlation coefficient between OFD and serum E2 concentration on Day 0 showed non-significant correlation ($r = 0.45$, $p = 0.19$).

The correlation coefficient between OFD and serum E2 was 0.50 ($p = 0.3$) in conceived cows of Ovsynch-TAI group and 0.14 ($p = 0.80$) in conceived cows of SOHD-AI group (Fig. 2).

Correlation between OFD and CLV

The overall correlation coefficient between the OFD and CLV on Day 13 post-AI either in conceived ($r = 0.36$, $p = 0.2$) or non-conceived ($r = 0.27$, $P = 0.1$) cows showed non-significant correlation regardless the type of breeding system (Fig. 3)

In conceived cows, although there was a positive correlation between OFD and CLV in Ovsynch-TAI group ($r = 0.78$, $p = 0.02$), there was no correlation between OFD and CLV in case of SOHD-AI group ($r = 0.01$, $p = 0.98$). In non-conceived cows, although there was no correlation between OFD and CLV in the Ovsynch-FTAI group ($r = 0.08$, $p = 0.70$) there was non-significant correlation ($r = 0.39$, $p = 0.07$) in case of SOHD-AI group (Fig. 3).

Correlation between CLV and serum P4 levels

The CLV had a positive effect on serum progesterone concentrations on Day 13 Post-AI regardless the type of breeding in conceived cows. The overall correlation between CLV and serum P4 concentration in conceived cows was 0.90 ($p=0.01$, Fig. 4). Positive correlations were detected between CLVs and serum P4 concentrations in Ovsynch-TAI group ($r = 0.95$, $p=0.01$, Fig. 4) and SOHD-AI group ($r = 0.9$, $p = 0.02$, Fig. 4) in conceived cows.

Fertility response

The conception rate was 32% and 24% in Ovsynch-TAI and SOHD-AI groups respectively (Fig.5).

Ovulatory follicle diameter (OFD)

In Ovsynch-TAI group, it was observed that ovulatory follicles < 17 or > 21 mm in diameter at the time of TAI were less likely to support pregnancy ($p=0.49$). A similar CR (50%) was obtained in both score 3 (OFD averaged $\geq 17 - < 19$ mm) and score 4 (OFD averaged $\geq 19 - < 21$ mm) cows. In SOHD-AI group, it was noted that the highest CR (83.33%) was obtained in score 4 cows (OFD averaged $\geq 19 - < 21$ mm). However, only one cow (16.66%) conceived from score 2 (Table 2).

Corpus luteum volume (CLV) on Day 13

The CLV from 4 to < 20 cm³ supported pregnancy in Ovsynch-TAI group. A similar CR (20%) was obtained in the scores from 1 to 4 of CLV

based scores. In SOHD-AI group, the CR differed ($p < 0.0001$) amongst scores 4 (50%), 2 (33.34%) and 5 (16.66%, Table 2).

Discussion

The present study investigated the effect of OFD on Day of TAI in cows subjected to ovsynch protocol on CLV, steroid hormones profiles and subsequent fertility response compared with cows exhibiting spontaneous oestrous and inseminated based on heat detection. With regard to non-significant increase of OFD in SOHD-AI versus Ovsynch-TAI conceived cows, similar results were recorded in dairy cows [23] and heifers [9] that underwent spontaneous ovulation compared with those induced to ovulate. The non-significant increase of OFD in conceived compared with non-conceived cows in either Ovsynch-TAI or SOHD-AI group indicated that not only the OFD at time of AI could predict fertility status [6]. In agreement with our explanation, Perry *et al.*, [22] and Lynch *et al.* [18] concluded that OFD at time of TAI is not the main factor that affects subsequent fertility but also the physiological maturity of preovulatory follicle at the time of GnRH2 treatment contributes to subsequent fertility and luteal function. Moreover, although induced ovulation of large follicle is followed by development of large CL and secretion of high P4 levels, it results in low fertility [24] perhaps as result of oocyte aging [25]. Furthermore, Colazo *et al.* [26] reported that larger OFD were associated with higher incidence of late embryonic/early foetal losses in dairy cows subjected GnRH-TAI protocols.

Regarding the non-significant variation of the serum E2 concentration between conceived and non-conceived cows in ovsynch-TAI group in our study, similar results were recorded by Perry *et al.* [22]. Also, in line with our results in SOHD-AI cows, Ahmadi *et al.* [27] reported that follicle size did not influence serum E2 concentration on Day 0 when cows were detected in standing heat.

In ovsynch-TAI group, scoring of conceived cows based on OFD at the time of TAI revealed that the chance of conception was greater with presence of OFD of scores 3 ($\geq 17 - < 19$) and 4 ($\geq 19 - < 21$ mm) at time of TAI. Our findings may partially come in concurrence with Consentini *et al.* [1] who recorded greater CRs in cows ovulated medium-sized than those ovulated smaller or larger follicles. Also, Yotov *et al.* [6] reported that 78.4% of pregnant cows had OFD of 18.0 ± 1.2 mm on Day of TAI. In SOHD-AI group, it was observed that most of conceived cows (83.33%) had OFD of score 4 ($\geq 19 - < 21$ mm) ensuring that the highest chance of conception may be achieved with larger OFD that not exceed 21 mm. However, an OFD > 20 mm was predictor of gestation loss in cows exhibiting spontaneous estrous [28, 3] and Ovsynch-TAI cows [25].

The non-significant increase of CLV in conceived compared with non-conceived cows in either Ovsynch-TAI or SOHD-AI group came in agreement with Ricci et al. [29] in Ovsynch-TAI cows and Monroy et al. [30] in HD-AI cows. Such increase may be in a part due to comparable non-significant increase in OFD in conceived vs non-conceived cows in either of the two groups. Previous studies reported that larger follicles produced larger CL volumes in Ovsynch-TAI [10, 11] and HD-AI cows [29].

In accordance with the results of the present study in conceived cows, Perry et al., [22] recorded a positive correlation between OFD and CLV in ovsynch-TAI cows while Lynch et al. [18] found no correlation between OFD and CLV in SOHD group. The positive correlation between OFD and CLV in conceived Ovsynch-TAI cows may be due to premature GnRH2-induced ovulation of ovulatory follicles with variable numbers of granulosa and theca cells [31] that would develop to large and small luteal cells later and variation in the numbers of LH-receptors in both cell types as well. Diskin et al. [32] reported that GnRH-induced ovulation of premature ovulatory follicle with low number of both granulosa and theca cells results in the formation of small CL with reduced number of luteal cells. However, the equal distribution of corpora lutea (2CLs / score) on the four CLV scores (1– 4) in conceived Ovsynch-TAI cows supports our explanation that suggests that CLs volumes were correlated not only to size of ovulatory follicles but also to maturity status of the ovulatory follicle [33]. The absence of correlation between OFD and CLV in case of SOHD-AI group may be due to the fact that ovulation occurs when the ovulatory follicle is physiologically mature regardless of its size [33].

In the Ovsynch-TAI group, the lower serum P4 concentration on Day 5 in non-conceived vs conceived cows may be attributed to the fact that administration of GnRH2 in Ovsynch protocol likely initiates preovulatory LH surge before follicles become physiologically maturity. However, induced ovulation of immature follicles with fewer numbers of granulosa cells results in development of CLs with fewer numbers of large luteal cells and reduced capacity of P4 secretion [4, 34].

The luteal function and subsequent fertility depend on physiological maturity/ immaturity [10] and degree of vascularization and angiogenesis [35] rather than absolute size of ovulatory follicle at the time of GnRH2 in ovsynch-TAI protocol. In contrary, the non-significant variation of serum P4 concentration between conceived and non-conceived cows in SOHD-AI group, may be explained in the light of the fact that the ovulatory follicles undergoing spontaneous ovulation are thought to be mature with subsequent limited effect on the size and function of the developed CLs. The CLS in non-

conceived cows in ovsynch-TAI group are believed to continue to secrete P4 at lower rate than their counterparts in conceived cows, therefore the serum P4 concentration became lower in non-conceived than conceived cows on Day 13 post-TAI.

In accordance with our results, Lopes et al. [10] reported that serum P4 concentration diverged and became greater after day 5 post-TAI in cows eventually diagnosed pregnant compared to those eventually diagnosed non-pregnant. Cows having an earlier rise in P4 had embryos that developed earlier and produced increased level of antiluteolytic IFN-tau by day 16 [36] and consequently higher chance to maintain pregnancy than cows with slower P4 rise [37]. The greater serum P4 concentration on Day 13 in conceived compared with non-conceived cows came in agreement with Perry et al. [9], Gumen et al. [4] and Ricci et al. [29] in ovsynch-TAI and Mann et al. [34] and Gumen et al. [4] in SOHD-AI cows. Like previous studies, positive correlations were recorded between CLV and serum P4 concentrations during mid-luteal phase in conceived Ovsynch-TAI cows [22] and SOHD-AI cows [38].

In conceived cows, the presence of positive correlation between CLV and serum P4 concentration in both Ovsynch-TAI and SOHD-AI cows on Day 13 post-insemination and between CLV and OFD on Day 0 in Ovsynch-TAI cows only suggests dependence of serum P4 concentration on CLV which originally depends on ovulatory follicle size.

The conception rate recorded in the ovsynch-TAI group (32%) lies within the range (30 to 40%) reported by Pursley et al. [39] but being greater than that (23.2%) obtained by Nowicki et al. [40]. It came in agreement with that (33%) recorded by Lopes et al. [10]. The numerical increase in the CR in Ovsynch-TAI group compared with SOHD-AI group is consistent with Wiltbank et al. [3].

Presumably, the increased CR in Ovsynch-TAI group compared with SOHD-AI group may be attributed to performing TAI at a more optimal and consistent time relative to an induced ovulation compared with inseminating cows based on estrous detection, in which there is wide variation in timing of ovulation among cows based on the onset of activity associated with estrous [2, 41].

Conclusion

It is concluded that OFD at the time of TAI could be used to predict the fertility response to Ovsynch protocol since it is positively correlated to CLV on Day 13 which in turn is correlated to serum P4 concentration on Day 13 post-TAI in conceived cows. Also, the earlier increase in serum P4 on Day 5 post-TAI in conceived compared with non-conceived

cows could be used to predict the probability of conception in ovsynch-TAI cows.

Declaration of interest

There are no conflicts to declare.

Acknowledgments

The authors gratefully acknowledge both the owner (Mr. Saad Salama) and the manager (Mr. Mohamed Makled) of the Saad Salama dairy farm for their support during conducting the experimental part.

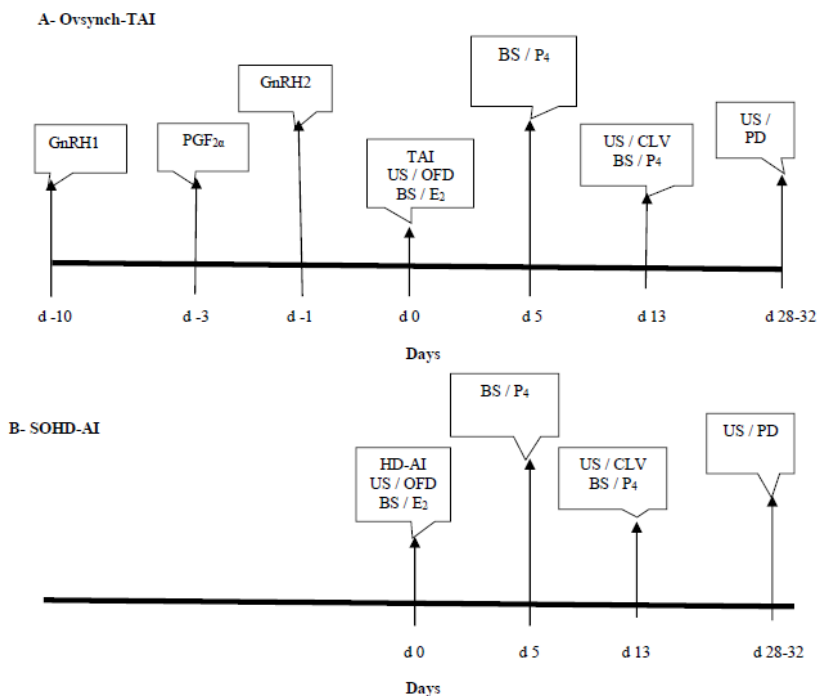


Fig.1. Schematic diagram of experimental design.

Ovsynch-FTAI = ovulation synchronization protocol (GnRH1 on Day -10, PGF_{2α} on Day -3 and GnRH₂ on Day -1 followed by TAI 16h after GnRH₂). SOHD-AI = spontaneous estrous/ovulation cows which were inseminated ≈ 12h from the onset of detected heat. TUS = Transrectal ultrasonography, BS = blood Sampling, E₂ = Estradiol, P₄ = progesterone, OFD = ovulatory follicle diameter, CLV = Corpus luteum volume and PD = pregnancy diagnosis.

TABLE 1. The ovarian status and steroid hormones concentrations in Ovsynch-TAI and SOHD-AI groups.

Parameters	Group				P value
	Ovsynch-TAI		SOHD-AI		
	Conceived (n=8)	Non-conceived (n=17)	Conceived (n=6)	Non-conceived (n=21)	
<i>* Ovarian status</i>					
- OFD (mm) on Day 0	18.59 ± 0.30	17.70 ± 0.59	19.30 ± 0.72	17.90 ± 0.59	0.54
- CLV on Day 13 post-AI (cm ³)	12.22 ± 1.41ab	8.49 ± 0.77b	15.82 ± 1.76a	12.33 ± 0.94a	0.004
<i>* Steroid Hormonal concentrations</i>					
- Estradiol level on Day 0 (pg/mL)	20.94 ± 3.13	14.98 ± 0.99	18.36 ± 1.20	16.84 ± 0.97	0.84
- Serum P ₄ on Day 5 post-AI (ng/ml)	3.46 ± 0.29a	1.99 ± 0.48b	2.89 ± 0.17ab	2.07 ± 0.11b	0.002
- Serum P ₄ on Day 13 post-AI (ng/mL)	8.29 ± 0.54a*	3.70 ± 0.66b	8.61 ± 0.64a*	3.67 ± 0.79b	0.001

OFD = ovulatory follicle diameter, CLV = corpus luteum volume, Ovsynch-FTAI = ovulation synchronization protocol (GnRH1 on Day -10, PGF_{2α} on Day -3 and GnRH₂ on Day -1 followed by TAI 16h after GnRH₂). SOHD-AI = spontaneous estrous/ovulation cows which were inseminated ≈ 12h from the onset of detected heat. Values with the same row and carrying different small letters are significantly different. P₄ values on Days 5 and 13 carrying asterix are significantly different.

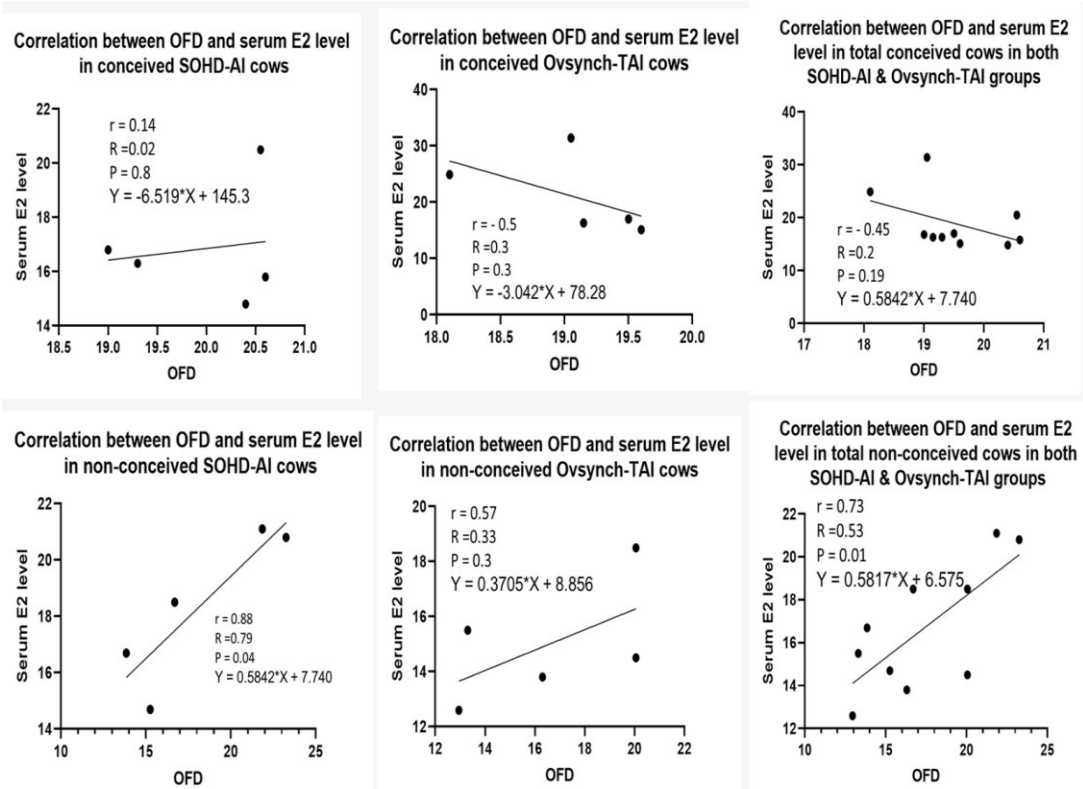


Fig. 2. The correlations between OFD and serum estradiol concentrations (E2) in conceived, non-conceived and overall conceived/ non-conceived in either SOHD-AI or Ovsynch-TAI group.

OFD = ovulatory follicle diameter, Ovsynch-TAI = ovulation synchronization protocol (GnRH1 on Day -10, PGF2 α on Day -3 and GnRH2 on Day -1 followed by TAI 16h after GnRH2). SOHD-AI = spontaneous estrous/ovulation cows which were inseminated \approx 12h from the onset of detected heat.

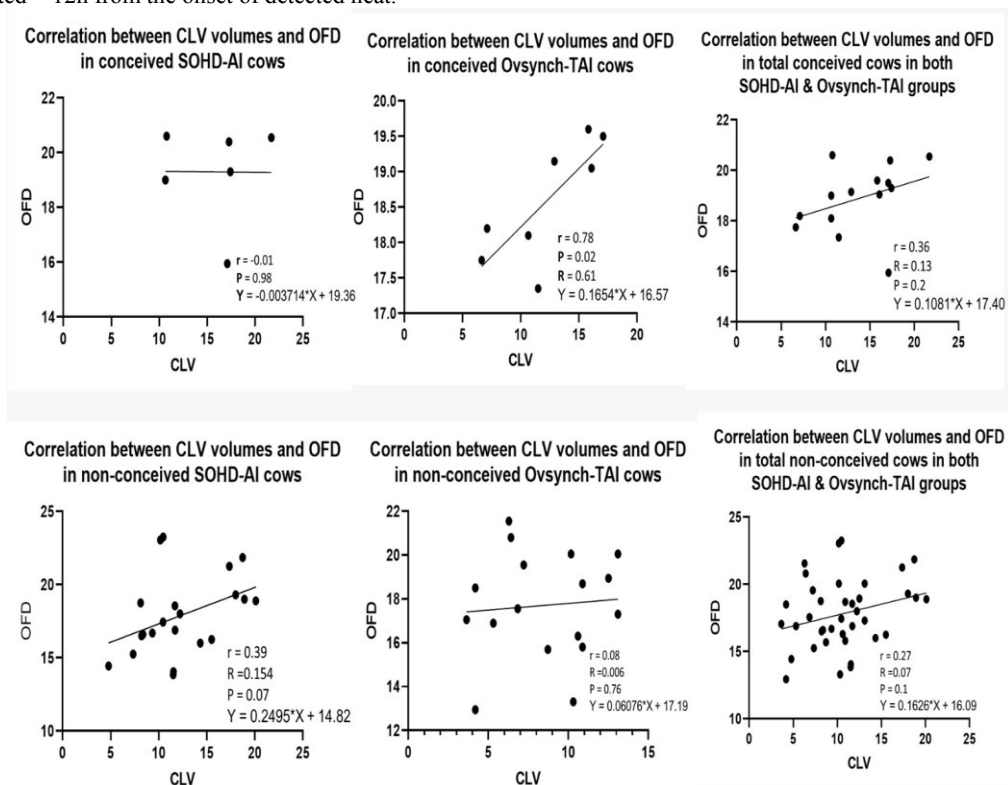


Fig. 3. The correlation between OFD and CLV in conceived, non-conceived and overall conceived/ non-conceived in either SOHD-AI or Ovsynch-TAI group.

OFD = ovulatory follicle diameter, CLV = corpus luteum volume, Ovsynch-TAI = ovulation synchronization protocol (GnRH1 on Day -10, PGF2 α on Day -3 and GnRH2 on Day -1 followed by TAI 16h after GnRH2). SOHD-AI = spontaneous estrous/ovulation cows which were inseminated \approx 12h from the onset of detected heat.

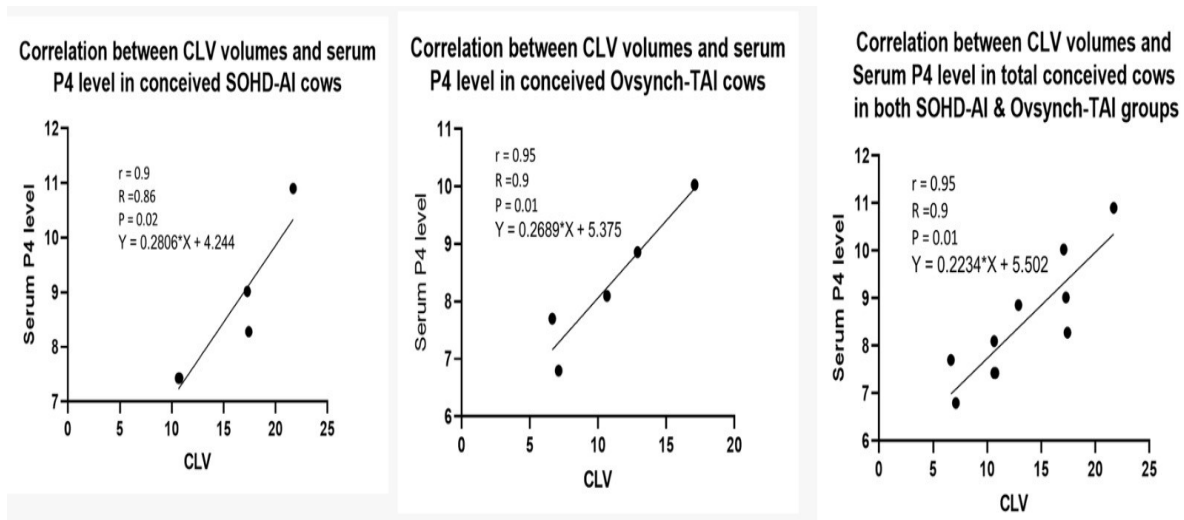


Fig. 4. The correlation between CLV and serum progesterone concentrations in conceived cows in either SOHD-AI or Ovsynch-TAI group, and overall conceived SOHD-AI/Ovsynch-TAI groups.

CLV =corpus luteum volume, P4= progesterone, Ovsynch-TAI = ovulation synchronization protocol (GnRH1 on Day -10, PGF2 α on Day -3 and GnRH2 on Day -1 followed by TAI 16h after GnRH2). SOHD-AI = spontaneous estrous/ovulation cows which were inseminated \approx 12h from the onset of detected heat.

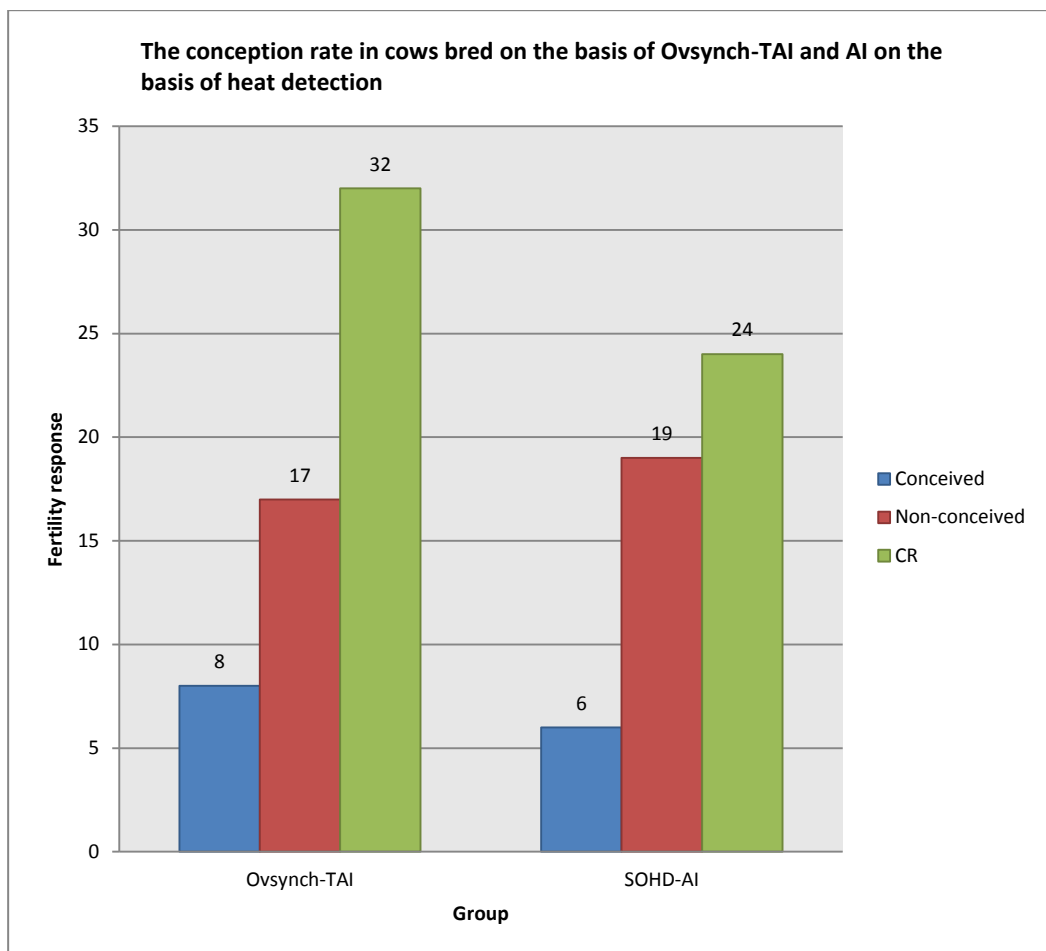


Fig. 5. The conception rates in Ovsynch-TAI and SOHD-AI groups.

CLV =corpus luteum volume, Ovsynch-TAI = ovulation synchronization protocol (GnRH1 on Day -10, PGF2 α on Day -3 and GnRH2 on Day -1 followed by TAI 16h after GnRH2). SOHD-AI = spontaneous estrous/ovulation cows which were inseminated \approx 12h from the onset of detected heat.

TABLE 2. The association between conception rates and scores (1-5) based on either ovulatory follicle diameter (OFD) or corpus luteum volume (CLV) in dairy cows.

Parameter	No. (Total)	Number of conceived cows (n=14)		P-value	
		CR (%)			
		Ovsynch-TAI (n=8)	SOHD-AI (n=6)		
OFD based scores (mm)					
1 13 - < 15	0	0 (0)	0 (0)	0.049	3.83
2 ≥15 - < 17	1	0 (0)	1 (16.66%)		
3 ≥17 - < 19	4	4 (50%)	0 (0)		
4 ≥19 - < 21	9	4 (50%)	5 (83.33%)		
5 ≥21	0	0 (0)	0 (0)		
CLV based scores (cm ³)					
1 4 - < 8	2	2 (25%)	0 (0)	0.0001	33
2 ≥8 - < 12	4	2 (25%)	2 (33.33%)		
3 ≥12 - < 16	2	2 (25%)	0 (0)		
4 ≥16 - < 20	5	2 (25%)	3 (50%)		
5 ≥20	1	0 (0)	1 (16.66%)		

OFD= ovulatory follicle diameter, CLV =corpus luteum volume, Ovsynch-TAI = ovulation synchronization protocol (GnRH1 on Day -10, PGF2 α on Day -3 and GnRH2 on Day -1 followed by TAI 16h after GnRH2). SOHD-AI = spontaneous estrous/ovulation cows which were inseminated \approx 12h from the onset of detected heat.

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تأثير حجم جريب التبويض على خصوبة الأبقار المعاملة بنظام الأوفيسنك (Ovsynch-TAI)، مقابل الأبقار الملقحة على أساس تحديد وقت الشباع اثناء دورة الشبق

عادل ريمون¹، محمد على الخولي²، سحر حمدي النجار³، بسيوني عبدالقادر هليل¹، أسماعيل أسماعيل الفن¹
وعصام مصطفى المعدلي¹

¹ قسم التوليد والتناسل والتلقيح الاصطناعي - كلية الطب البيطري- جامعة كفر الشيخ - مصر.

² مديرية الطب البيطري- طنطا - محافظة الغربية - مصر.

³ قسم تنمية الثروة الحيوانية - كلية الطب البيطري - جامعة كفر الشيخ - مصر

الخلاصة

كانت الأهداف هي دراسة تأثير قطر جريب التبويض (OFD) في وقت TAI على حجم الجسم الأصفر (CLV)، وتركيز هرمون البروجسترون في الدم بعد TAI والخصوبة اللاحقة في مجموعة أبقار Ovsynch-TAI مقارنة بمثيلاتها في مجموعة الأبقار التي تم تلقيحها على أساس تحديد وقت الشباع خلال دورة الشباع (SOHD-AI)، المجموعة الضابطة). تم استخدام 50 بقرة لإجراء الجزء العملي وتم تقسيمهم إلى 25 بقرة لمجموعة Ovsynch-TAI (اليوم -10، GnRH1؛ اليوم -3، PGF2 α واليوم -1، GnRH2) وتم تلقيح الأبقار بعد 16 ساعة من GnRH2 في اليوم 0) و25 بقرة لمجموعة SOHD-AI (الأبقار التي لم تتلق أي علاج وتم تلقيحها بعد 12 ساعة من بداية ظهور علامات الشبق في اليوم 0). تم استخدام الفحص بالموجات فوق الصوتية عبر المستقيم (TUS) لتقدير لقياس قطر جريب التبويض (OFD) في اليوم 0 وحجم الجسم الأصفر (CLV) في اليوم 13 وإجراء تشخيص الحمل في اليوم 28-32 بعد التلقيح. تم جمع عينات الدم في اليوم 0 لتقدير مستوى الاستراديول (E2) وفي اليومين 5 و13 لتقدير مستوى البروجسترون (P4) في الدم. كان تركيز مستوى البروجيسترون في الدم أعلى في المجموعة العشار مقابل المجموعة الغير عشار في الأيام 5 (ع = 0.002) و13 (P = 0.001) في مجموعة Ovsynch-TAI وفي اليوم 13 (P = 0.002) في مجموعة SOHD-AI. كانت هناك علاقة إيجابية (P = 0.02) بين حجم جريب التبويض (OFD) وحجم الجسم الأصفر (CLV) وبين حجم الجسم الأصفر وتركيز البروجيسترون في الدم (P = 0.01) في نفس الوقت في مجموعة Ovsynch-TAI. كانت نسبة العشار 32% و24% في مجموعات Ovsynch-TAI وSOHD-AI، على التوالي.

الخلاصة: تم التوصل إلى أنه يمكن استخدام قطر جريب التبويض (OFD) في وقت TAI للتنبؤ باستجابة الخصوبة لبروتوكول Ovsynch لأنه يرتبط بشكل إيجابي بـ CLV في اليوم 13 والذي يرتبط بدوره بتركيز P4 في المصل في اليوم 13 بعد TAI.