Egyptian J. Anim. Prod. (2020) 57(1):13-24

INFLUENCE OF TEMPREATURE -HUMIDITY INDEX LEVEL ON OVARIAN ACTIVITY AND CONCEPTION RATE IN EGYPTAIN BALADI COWS UNDER CLIMATIC CONDITIONS OF ASWAN GOVERNORATE

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Received: 18/9/2019 Accepted: 12/11/2019

SUMMARY

The present investigation aimed to study the effects of temperature-humidity index (THI) level, on the ovarian activity and conception rate of Egyptian Baladi cows. A total number of 40 Baladi cows was used in this study. The cows were divided into three groups according to time of calving. The first group (15 cows) calved during (December, January and February) where THI (68.1- 70.5) was considered as (non-heat stress), the second group calved during (November, March and April) THI (74.5- 76.9) (mild-heat stress=10 cows) and the third group calved during (May to October) THI (80.1- 83.9) (moderate-heat stress= 15 cows). The results demonstrated that the percentage of cows that resumed ovarian activity post-partum were significantly (P<0.05) higher 73.3% in the first group compared to 50 and 33.3% in the second and third groups, respectively. Incidence, of quiet ovulation was higher (20%) in the second and third groups compared to first group (18.2%). The percentage of anestrous cases was significantly (P <0.05) higher (50, 66.7%) in the second and third group compared with the first group (36.4%). Conception rate was significantly (P<0.05) higher (77.8%) in the first group compared to third group (50%). The intensity of estrus symptoms was significantly (P<0.05) higher in the first group compared to the second and third groups. In conclusion, the present results illustrated the detrimental effect of increased temperature-humidity index level (THI) on ovarian activity and conception rate of Egyptian Baladi cows. This study recommends the stockholders of cows in Aswan governorate to arrange the cows calvings during the cold months or use some procedures such as sprinkling by water and fan in order to reduce the hurtful effects of higher THI level on fertility in Egyptian Baladi cows.

Keywords: Temperature-humidity index, ovarian activity, conception rate, Egyptian Baladi cows

INTRODUCTION

Global warming is considered one of the vital issues at the last decade in the world. The heat stress had harmful effects on the livestock and influences all internal physiological activities in the body. Many researches recorded negative relationship between increasing the heat stress and impairment of the reproductive performance in cows. Sartori *et al*. (2002), De Rensis *et al*. (2002) and Sonmez *et al.* (2005) reported that increased environmental temperature and relative humidity affect the endocrine activity and decreases the reproductive performance in cows. Souza *et al.* (2007) recorded that luteinizing hormone (LH) secretion during pre-ovulation period decline by half amount in lactating dairy cows when exposed to heat stress. In addition, Ju (2005) and Hansen (2009) suggested that heat stress lead to impair oocyte growth and maturation. Khodaei-Motlagh *et al*. (2011) found that small size of ovulatory follicle/s and low luteinizing hormone (LH) secretion from the anterior pituitary gland in dairy cattle occur in heat stress. Soto and Smith (2009) and Zhandi *et al*. (2009) reported that heat stress activate apoptosis in bovine oocytes. De Rensis and Scaramuzzi (2003) suggested that heat stress in summer lead to increased occurrence of silent ovulation and reduced signs of estrus. Wolfenson *et al*. (1997) and Roth *et al.* (2001) found that increased environment temperature affects endocrine activity and impair the estrus expression. Singh *et al.* (2013) suggested that lower concentration of oestradiol during summer season, which causes impair intensity of estrus signs and increase silent heat in buffaloes. Collier *et al*. (2006) found that heat stress had a negative effect on manifestation of estrus behavior of dairy cattle. Kumar *et al*. (2014) suggested that environmental stress and inadequate nutrition are considered from important factors that affects the appearance anestrous cases in cows. De Rensis and Scaramuzzi (2003) found that percentage of anoestrus cases was higher in dairy cow during the heat stress in summer. Schüller *et al.* (2014) reported that conception rate was reduced from (30.4% to 14.4%) when temperature humidity index (THI) increased from (55 to 76) in dairy cows. Garcia-Ispierto *et al*. (2007) and Morton *et al*. (2007) observed similar trend, since they reported that the cows exposed to heat stress before mating demonstrated lower conception rate. Astiz and Fargas (2013) recorded that conception rate was lower in primiparous and multiparous cow during the hot season compared to cold season. Schüller *et al.* (2017) found lower conception rate in dairy cows when exposed to at the temperature humidity index (THI) above 72 at the day of estrus. Ferreira *et al*. (2011) and Gendelman and Roth (2012) reported that exposing the cows to heat stress lead to impair oocyte quality. Gendelman *et al.* (2010) and Silva *et al*. (2013) found lower embryo development in dairy cow under heat stress conditions. Furthermore, Amundson *et al*. (2006) observed negative correlation between temperature humidity index (THI) and pregnancy rate of crossbred cows. Aswan governorate is area which has higher ambient temperature during the hot season reaching more than (40°C) compared to other locations in Egypt. Little information about the effect of heat stress on the reproductive activity of Baladi cattle is available. The present investigation aim to, investigate the influence of temperature-humidity index level, on the ovarian activity and conception rate of Egyptian Baladi cattle under the climatic conditions of Aswan governorate.

MATERIALS AND METHODS

Farm location and climatic conditions:

The investigation was carried out in an animal farm located in Kom Ombou area (32, 31' 23" East and 22, 28' 09" North), Aswan governorate. The cattle were kept in traditional farm under semi-shaded system. The climate of Aswan is higher ambient temperature and lower relative humidity especially during the hot season. Table (1) clarifies the average of the ambient temperature, relative humidity and temperature humidity index during the experimental period. Temperature humidity index (THI) was calculated according to the formula proposed by Mader *et al*. (2006):

THI= (0.8×Tmax db) + [(RH/100) × (T max db −14.4)] +46.4

Temperature-humidity index (THI) = 0.8 x ambient temperature + [(% relative humidity) 100) x (ambient temperature -14.4)] + 46.4

Table 1. The ambient temperature (°C), relative humidity (RH %) and temperature humidity index (THI) during the experimental period

Months of calving	Average Ambient Temperature (°C)		Average Relative humidity (RH %)	*THI*
	Min.	Max.		
January	13.2	21.2	22	64.9
February	15.9	24.2	23	68.1
March	18.3	32.2	20	75.8
April	20.1	34.0	17	76.9
May	22.6	40.7	16	83.2
June	25.3	41.4	16	83.8
July	26.2	41.2	17	83.9
August	26.0	41.0	18	83.9
September	23.8	38.4	20	81.9
October	23.1	37.2	17	80.1
November	20.4	31.3	18	74.5
December	16.1	28.3	21	70.5

Management and feeding of animals:

A total number of 40 Baladi cattle was used in the present work. Cows parity ranged between 3rd and 5th. Body weight and age of cows at calving are presented in table (2).Animals were fed on Egyptian clover (*Trifolium alexandrinum*) alongside the concentrate ration and wheat hay were offered during December to the end of April. Corn fodder, wheat hay and concentrate ration were used during the period from May to the end of November.

Table 2. Specifications (Mean ± SE) of cows none, mild and moderate- heat stress

Groups	Body weight (kg)	Age (years)
None –heat stress	383.25±12.23	6.36±2.42
Mild-heat stress	371.72±13.91	5.98±2.31
Moderate- heat stress	368.32±11.43	6.43±3.22

Experiment design:

Forty Baladi cows were divided into three groups according to time of calving (non-heat stress= 15 cows, mild-heat stress=10 cows and moderate-heat stress= 15 cows. The first group calved during (December, January and February), the second group calved during (November, March and April) and the third group calved during (May to October) as shown in table (3). The cows were followed up after one-week post-partum. Table (4) clarifies the classification of zones based on THI values in cattle with THI model according to (Samal, 2013).

Table 3. Classification months of calving and THI during the experimental period

Months of calving	Number	THI Range	Stress level
December, January and February	15	(68.1- 70.5)	None
November, March and April	10	(74.5- 76.9)	Mild
May to October	15	(80.1- 83.9)	Moderate

Table 4.Classification of zones based on THI values in cattle with THI model according to (Samal, 2013)

THI	Stress level	Response of cattle
<72	Non	Non-noticeable
72-79	Mild	Dairy cows will adjust by seeking shade, increasing respiration rate and dilation of the blood vessels. The effect on milk production will be minimal.
80-89	Moderate	Both saliva production and respiration rate will increase. Feed intake may be depressed and water consumption will increase. There will be an increase in body temperature. Milk production and reproduction will be decreased.
90-98	Severe	Cows will become very much uncomfortable due to high body temperature, rapid respiration (panting) and excessive saliva production. Milk production and reproduction will be markedly decreased.
>98	Danger	Potential cow deaths can occur.

Heat detection and pregnancy diagnosis:

Heat detection was performed by daily visual observation for cows in the morning at 6:0 am and night and 18:0 pm. Just, any sexual behavior symptoms display, cows were considered in heat. The cows were naturally inseminated once exhibited standing symptoms of heat. Rectal palpation (60 days post-mating) was used to diagnose and establish of pregnancy as described by Arthur (1964).

Conception rate: was calculated as the percentage of cows, which conceived from the first mating post-partum

Conception rate = Number of pregnant cows/Total number of mated cows x 100.

Detection ovarian activity:

The ovarian activity was confirmed by plasma progesterone concentration (once a week sampling), just plasma progesterone concentration rise up to the basal line (1ng/ml) blood, hence the ovary started its activity. Alongside, rectal palpation was performed for detection the corpus luteum on the ovary in weekly basis. Figure (1) clarifies metabolic mechanisms that affect reproduction during heat stress in dairy cows. In addition, figure (2) illustrate effects of seasonal heat stress and photoperiod on the endocrine mechanisms that control reproduction in dairy cows proposed by De Rensis*et al.* (2017).

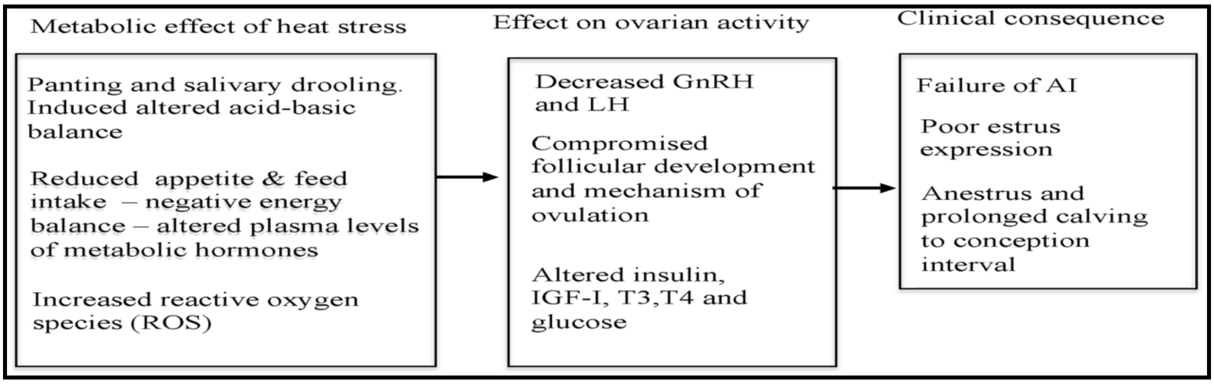


Figure 1. Metabolic mechanisms that effect reproduction during periods of seasonal heat stress in dairy cows (De Rensis*et al.* (2017).

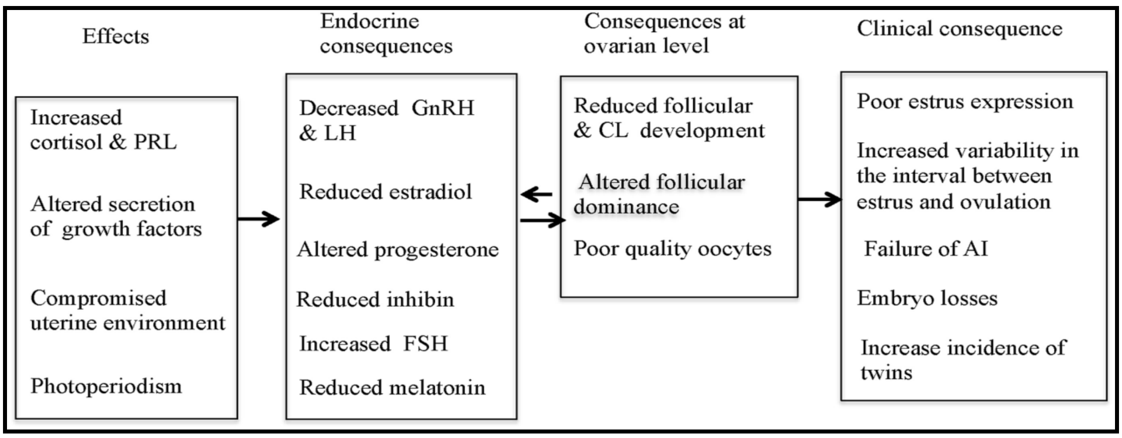


Figure 2. Effects of seasonal heat stress and photoperiod on the endocrine mechanisms that control reproduction in dairy cows (De Rensis *et al.* 2017).

Hormones analysis:

Blood samples (5 ml) were collected at estrus, day 7, 14 and 21 after mating in heparinized tubes from the jugular vein. The blood samples were centrifuged at 3000 rpm for 20 minutes for plasma harvesting. Plasma was separated and stored at -18ºC until the time of analysis. Progesterone (P4) hormone was determined using radioimmunoassay kit (Immunotech, France). Sensitivity value reported to be according to manufacturer information. The intra- and inter-assay variation coefficients were 5.3 and 12.4%, respectively.

Statistical analysis:

The statistical design included one factor (effect of temperature-humidity index (THI) on ovarian activity and conception rate), the analysis was performed by using SAS (2002). The following model was used:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where:

Y_{ij} = the observation trait

μ = overall mean

T_i = effect of THI (non-heat stress =1, mild-heat stress=2 and moderate-heat stress=3)

e_{ij} = experimental error

Duncan's Multiple Range test (Duncan, 1955) was used to test the significance of the differences between means. Chi Square was performed.

RESULTS AND DISCUSSION

Effect of temperature humidity index on resumption of ovarian activity of Egyptian Baladi cows:

Table (5) indicates the percentage of cows that resumed ovarian activity were significantly ($P<0.05$) higher 73.3% in Baladi cows that calved during the cool months (December, January and February) (non-heat stress) under temperature humidity index (THI) ranging between (68.1 and 70.5) compared with those calved during in the other months. The interval from calving to the first ovulation (considered one of the important indicators of resumption of ovarian activity after calving) was significantly ($P<0.05$) lower (50.9±18.8 days) in cows that calved during the cool months (non- heat stress) than the cows calved during the interval locate in mild or moderate heat stress table (5). The current result are in agreement with those reported by Sartori *et al.* (2002) and Sonmez *et al.* (2005) who found that increased environment temperature and relative humidity affect on endocrine activity and decline reproductive performance of dairy and beef cows. Wise *et al.* (1988) and Gilad*et al.* (1993) reported that heat stress affect on endocrine activities this lead to decline luteinizing hormone (LH) and follicle stimulating hormone (FSH) in dairy cows. Wolfenson *et al.* (1995) and Roth *et al*. (2000) observed that heat stress negatively affects on ovary via inhibiting of follicular growth and reducing quality of oocyte. Hansen *et al*. (2001) showed significant decline in the number of oocytes and development competence during heat stress conditions in dairy cows. Bearden and Fuquay (1992) suggested that heat stress lead to secretion of ACTH from the anterior pituitary gland, which causes in release of glucocorticoids from the adrenal gland. Glucocorticoids had inhibiting effect on luteinizing hormone (LH) from the pituitary gland. Souza *et al.* (2007) reported decline of luteinizing hormone (LH) secretion during pre-ovulation period by half amount in lactating dairy cows that exposed to heat stress. Wolfenson *et al*. (2000) reported that heat stress domination on the mechanism of hypothalamus-hypophyseal-ovarian axis in animals, via cause's hyper-prolactinemia, reduction in (LH) secretion and decrease maturation of follicle in ovary. Roy and Prakash (2007) reported that concentration of prolactin in plasma was higher during the summer season than winter season, which maybe associate with a cyclicity or infertility in buffaloes. Alamer (2011) and Singh *et al*. (2013) suggested that increase of prolactin level in the blood during heat stress was responsible for acyclicity and infertility in buffaloes. Wolfenson *et al*. (1993) reported that heat stress lead to decrease the number of granulosa cells, aromatase activity and secretion of androstenedione by theca cells. Heat stress caused delay growth and decline function of dominant ovarian follicles Hansen (1994). In another study, for Hansen (2007) suggested that the mechanisms effect of heat stress on oocytes growth by declining synthesis of preovulatory surge of (LH). The previous factors lead to bad follicle maturation and this leads to inactive ovaries in cows. Wilson *et al*. (1998) reported that decease viability of granulosa cells and/or additional alteration in steriodogenic enzymes may lead to odd ovarian dynamics during the heat stress in dairy cattle. Roth and Hansen (2004), Soto and Smith (2009) and Zhandi *et al*. (2009) suggested that heat stress activate apoptosis in bovine oocytes. Ju (2005) and Hansen (2009) reported that heat stress lead to impair oocyte growth and maturation. Paula-Lopes and Hansen (2002) found that oocyte exposed to high oxidative damage and apoptotic cell death during the heat stress. Hansen (2009) reported that heat stress impair follicular dominance via motivate multiple large (> 10 mm) follicles beside extended dominance of ovulatory follicles. Mihm *et al*. (1994) found that extended follicular dominance hold up normal oocyte maturation (eg. premature meiosis) and decline developmental competence. Khodaei-Motlagh *et al*. (2011) found that small size of ovulatory follicle/s and low luteinizing hormone (LH) secretion from the anterior pituitary gland in dairy cattle occur in heat stress. Curtis *et al*. (2017) reported that impair in appetite of cattle during heat stress conditions lead to reduce feed intake. Negative energy balance was observed in cattle that exposed to heat stress (Wheelock *et al*., 2006). Decline of DMI lead to reduce follicular growth by modifyjng LH secretion and/ or impair circulating IGF-I concentrations (Wilson *et al.,* 1998).

Table 5. Effect of temperature humidity index (THI) on resumption of ovarian activity during 90 days post-partum of Egyptian Baladi cows

Items	Heat stress level		
	None	Mild	Moderate
	THI		
	(68.1- 70.5)	(74.5- 76.9)	(80.1- 83.9)
No. of cases	15	10	15
Number of cows resumption of ovarian activity	11	5	5
Percentage of cows resumption of ovarian activity (%)	73.3[a]	50[b]	33.3[c]
1st Ovulation post-partum (days)	50.9±18.8[a]	71.8±7.9[b]	83.4±5.1[c]
Quiet ovulation (%)	18.2 (2)	20(1)	20 (1)
Anestrous cases (%)	36.4(4)[a]	50(5)[b]	66.7(10)[c]
Conception rate (%)[1]	77.8 (7)[a]	75.0(3)[a]	50.0(2)[b]

a, b and c: values within the same row having different superscripts are significantly different at (P <0.05)
1-Conception rate from first service

Effect of temperature humidity index on quiet ovulation of Egyptian Baladi cows:

Incidence of quiet ovulation was higher (20%) in Baladi cows in mild and moderate heat stress level compared to none heat stress (table 5). The current result corresponds with those reported by Hansen and Aréchiga (1999) and Lucy (2002) who found that higher occurrence of silent ovulation in cows. Lewis *et al*. (1984), Cavestany *et al*. (1985) and White *et al.* (2002) reported that heat stress caused decline intensity and duration of estrus and increases the incidence of quiet ovulation. De Rensis and Scaramuzzi (2003) suggested that heat stress in summer lead to increased occurrence of silent ovulation and reduced signs of estrus. Lee (1993), Wolfenson *et al.* (1997) and Roth *et al.* (2001) found that increase environment temperature affects endocrine activity and impair the estrus expression. Singh *et al.* (2013) suggested that lower concentration of oestradiol during summer season, which causes impair intensity of estrus signs and increase silent heat in buffaloes. Hansen *et al.* (1992), Hansen (1994) and Wilson *et al*. (1998) reported that heat stress causes a decline in circulating estradiol concentrations at first wave dominant follicle development and pro-estrus of dairy cows. Lyimo *et al*. (2000) recorded that there was positive correlation (r=0.7) between estradiol concentration and estrous behavior. Collier *et al*. (2006) found that heat stress had a negative effect on manifestation of estrus behavior of dairy cattle. Rodtian *et al.* (1996) and López-Gatius *et al*. (2008) suggested that ovulations without any estrous symptoms are more frequent during the hot months of the year. Wolfenson *et al*. (1997) and Roth *et al*. (2001) reported that the main effect of heat stress on heat detection rates due to decline the steroidogenic capacity of theca and granulosa cells lead to alternating in circulating estradiol concentrations. Britt *et al*. (1986) and Lopez *et al*. (2004) recorded that there is a positive association between intensity and duration of estrus and estradiol concentration in the blood.

Effect of temperature humidity index on anestrous cases of Egyptian Baladi cows:

Table (5) indicated that the percentage of anestrous cases was significantly (*P <0.05*) higher (50, 66.7%) in Baladi cows that calved during mild (November, March and April) THI (74.5- 76.9) and moderate (May to October) THI (80.1- 83.9) heat stress level**,** compared with cows that calved during none heat stress level. The present result agrees with that reported by Hansen and Aréchiga (1999) and Lucy (2002) who found that increase frequency of anoestrous cases when cows exposed to heat stress. Kumar *et al*. (2014) suggested that environmental stress and inadequate nutrition are considered from important factors that affects appearance anestrous cases in cows. De Rensis and Scaramuzzi (2003) found that percentage of anoestrus cases was higher in dairy cow during the heat stress in summer. Lee (1993), Wolfenson *et al.* (1997) and Roth *et al.* (2001) recorded that heat stress during the hot season influences the hormonal activity and impairs the estrus expression. Wise *et al*. (1988) and Gilad *et al.* (1993) suggested that heat stress influences endocrine activity, which causes decreases of (LH) and (FSH) hormones secretion in dairy cows. Wolfenson *et al.* (1995) and Roth *et al*. (2000) showed that heat stress had a negative effect on ovary via inhibition follicular growth. Souza *et al.* (2007) observed that decreased (LH) secretion during pre-ovulation period by half amount in dairy cows that exposed to heat stress.

Effect of temperature humidity index on conception rate of Egyptian Baladi cows:

Table (5) indicated that conception rate was significantly (*P <0.05*) higher (77.8%) of Baladi cows that calved during the cool months (December, January and February) (non- heat stress) under temperature humidity index (THI) ranging between (68.1 and 70.5) than other cows that calved throughout **(**May to October) (THI) ranging between (80.1- 83.9). The present result corresponds with that reported by Schüller *et al.* (2014) who found that conception rate was reduced from (30.4% to 14.4%) when temperature humidity index (THI) increased from (55 to 76) in dairy cows. Garcia-Ispierto *et al.*

(2007) and Morton *et al*. (2007) observed similar trend, since they reported that cows exposed to heat stress before mating demonstrated lower conception rate. Astiz and Fargas (2013) suggested that conception rate was lower in primiparous and multiparous cows during the hot season compared to cold season. De Rensis *et al.* (2002) reported that the metabolic stress leads to a decline in conception rate during the hot months by 20 to 30% compared with cold months in dairy cows. Schüller *et al.* (2016) suggested that there was a negative association between heat stress and conception rate of dairy cows that inseminated by fresh or frozen semen. Schüller *et al.* (2017) reported lower conception rate in dairy cows when exposed to at the temperature humidity index (THI) above 72 at the day of estrus. Similar trend recoded by Sonmez *et al.* (2005) who found impaired reproductive parameters of cattle when the temperature humidity index (THI) increased over 72. Peralta *et al*. (2005) reported lower pregnancy rate during heat stress in dairy cows due to reduced estrus detection rates. Paula-Lopes *et al*. (2012) reported that if the uterine temperature increases 0.9 º F conception rate decline by 6.9% in the cattle. Sonmez *et al*. (2005) reported that conception rate was higher in winter season (71.4, 73.3%) compared with summer season (48.7, 47.9%) in beef and dairy cows respectively. Cavestany *et al*. (1985) suggested that ambient temperature above 27°C on the day of mating was accompanied with decline of conception rates. Conception rates were 40% to 60% during the cold season decreased to 10% or 20% during hot summer season. Lopez-Gatius (2003) found lower conception rates in dairy cattle when the cows were exposed to hot months after mating. Shearer and Beede (1990) and Hansen *et al*. (1992) suggested that heat stress is responsible to re-distribution of the circulating blood flow in the animal body from internal to external, leading to increase reproductive tract temperature, decline nutrient exchange and modification in the volume and content secretions of oviduct and uterine. Paula-Lopes and Hansen (2002) and Soto and Smith (2009) reported that heat stress induces apoptosis in the cells of embryo in cows. Sugiyama *et al*. (2007) found that there is a detrimental effect of heat stress at the onset of service on oocytes and sperm leading to impair embryo development. Ealy *et al.* (1995) and Sakatani *et al*. (2004) recorded that cows exposed to heat stress during pre-implantation embryos suffer from impairment of the total cell number of blastocysts and decline their development. Telford *et al*. (1990) and De Sousa *et al.* (1998) reported that the time when the cow embryos at the 4- to 8-cell stage during zygotic genome activation (ZGA), is considered the most sensitive to heat stress. Ealy *et al*. (1993) suggested that when exposing the cows to heat stress at an early stage, embryo development decrease. Edwards and Hansen (1996) recorded that heat stress induced embryonic death via intermediate with synthesis of protein.Wolfenson *et al*. (2000) and Hansen (2009) suggested that heat stress causes embryonic death by oxidative cell damage. Wolfensen *et al*. (1993) and Bilby *et al*. (2008) reported that heat stress leads to embryonic death by decreasing production of interferon-tau for signaling pregnancy recognition. Vale (2007) and Sunil Kumar *et al*. (2011) recorded that increase in air ambient temperatures above 20 ºC to 25 º C causes to raise internal body temperature and inducing heat stress on livestock. Furthermore, Ferreira *et al*. (2011) and Gendelman and Roth (2012) reported that exposing the cows to heat stress leads to impair oocyte quality. Gendelman *et al.*(2010) and Silva *et al*. (2013) found that lower embryo development was observed in dairy cow under heat stress conditions. Oseni *et al*. (2005) showed that higher pregnancy rate (32%) of Holstein cows was during (September-November), but lower (24%) pregnancy rate was recorded during (March to May). Amundson *et al*. (2006) found negative correlation between temperature humidity index (THI) and pregnancy rate of crossbred cows.

Effect of temperature humidity index (THI) on estrus behavior of Egyptian Baladi cows:

Table (6) showed that the intensity of estrus symptoms was significantly ($P < 0.05$) more incidence of cows that calved during the cold months (December, January and February) (THI) (68.1- 70.5) compared to other cows that calved during (November, March and April) (THI) (74.5-76.9) or (May to October) (THI) (80.1- 83.9). This result is in agreement with that reported by Collier *et al*. (2006) who found that heat stress had a negative effect on estrus behavior of dairy cattle. Roelofs *et al.* (2010) reported that under heat stress conditions more than 80% of estruses are undetected in cows. López-Gatius *et al*. (2005) and Sakatani *et al.* (2012) found that persistency of high environmental temperature leads to reduce the duration and intensity of estrus symptoms in dairy cows. Wolfenson *et al*. (1997) and Roth et *al*. (2001) suggested that heat stress leads to reduce heat detection by decreasing steroidogenic capacity of theca and granulosa cells which causes impairment of estradiol concentrations in the blood of cows. Britt *et al.* (1986), Lyimo *et al*. (2000) and Lopez *et al*. (2004) reported that there was a positive association between circulating estradiol concentration and intensity and duration of estrus in dairy cows. Stevenson *et al.* (1983) reported a positive relation between intensity of estrus and fertility in cattle. Cummins *et al.* (2012) suggested that there is a relation between peak estrous activity and fertility in Holstein cows. De Rensis and Scaramuzzi (2003) found that heat stress lead to decline LH concentration in blood and development of the dominant follicle on the ovary low LH concentration cause to impair estradiol secretion, which resulted in estrus signs, is poor expression. Nmez *et al*. (2005) suggested that dairy and beef cows exhibited low estrus behavior during heat stress in the summer season compared to other seasons. Wise *et al*. (1988) and Badinga *et al* (1994) reported that during heat stress in summer season concentration of plasma estradiol was low in dairy cow. Wilson *et al*. (1998) indicated that heat stress reduces follicular growth during the preovulatory period, which lead to decline estradiol concentration at pro-estrus period. Orihuela (2000) suggested that estrus-detection was low and intensity of estrus were reduced during heat stress periods in cattle. Nebel *et al*. (1997) showed that motor activity and other behaviors symptoms of estrus decline and anestrus and silent ovulation increased during heat stress in summer season. White *et al*. (2002) reported that a mounted behavior recorded high frequent during estrus in cold months compared to in hot months. Pennington *et al.* (1985) recorded that there was a decline in mounts behavior frequent during the hot season compared to cold season Holstein cows. Schüller *et al*. (2017) recorded positive relation between mounting behavior at the day of estrus and increasing environmental THI around dairy cows.

Table 6. Effect of temperature humidity index (THI) on estrus behavior of Egyptian Baladi cows

Estrus symptoms	Heat stress level		
	None	Mild	Moderate
		THI	
	(68.1-70.5)	(74.5-76.9)	(80.1-83.9)
No. of estrus cases	9	4	4
Mounting behavior	(7/9) 77.8[a]	(2/4) 50[b]	(1/4) 25[c]
Vaginal mucus discharge	(6/9) 66.7[a]	(2/4) 50[b]	(1/4) 25[c]
Swelling of vulva	(4/9) 44.4[a]	(1/4) 25[b]	-
Bellowing	(6/9) 66.7[a]	(1/4) 25[b]	(1/4) 25[b]
Standing behavior	(9/9) 100	(4/4) 100	(4/4) 100

a, b and c: values within the same row having different superscripts are significantly different at (P <0.05)

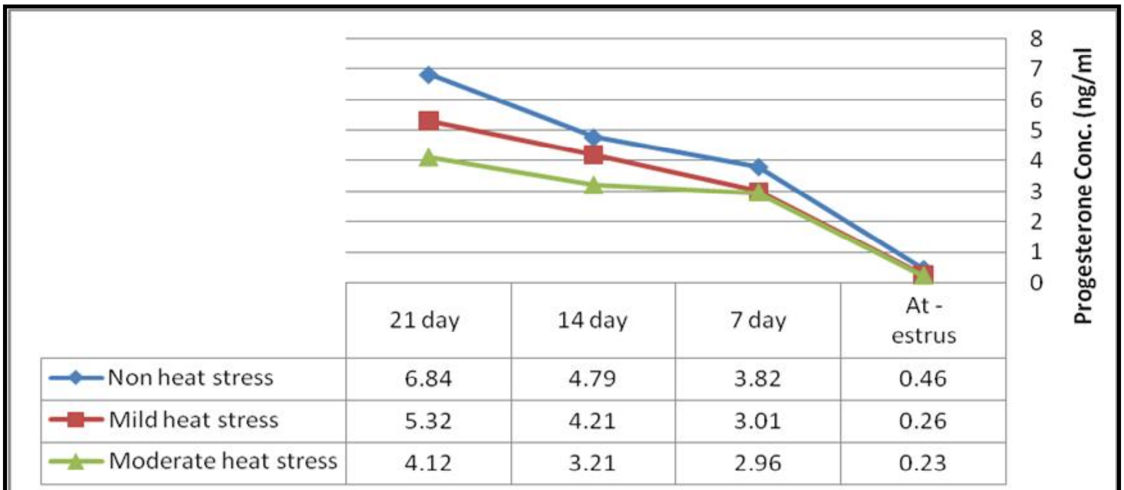
Effect of temperature humidity index on progesterone concentration:

Figure (3) and table (7) indicated that progesterone concentration during the estrous cycle in pregnant Baladi cows was significantly (*P <0.05*) higher under non-heat stress conditions compared with mild and moderate heat stress. However, progesterone concentration during the estrous cycle in non- pregnant Baladi cows was nearly analogical in none and mild heat stress compared to moderate heat stress figure (4). The current result corresponds with those observed by Howell *et al*. (1994), Burke *et al*. (2001) and Wolfenson *et al.* (2002) who found dairy and beef cows that exposed to heat stress lead to inhibition of luteal function and causing decline in progesterone levels in blood plasma. Alnimer *et al.* (2002) suggested that concentration of progesterone was higher during winter season compared with summer season in dairy cows. Khodaei-Motlagh *et al*. (2011) reported that heat stress lead to reduce plasma progesterone concentration in dairy cattle, hence cause for abnormal oocyte maturation, implantation miscarriage and ultimately early embryonic mortality. Wolfenson and Roth (2000) found that heat stress affects follicle quality and hormonal patterns in dairy cows. Schüller *et al.* (2017) suggested that concentration of progesterone < 1 ng/ml at the day of estrus decline permanently with increasing temperature humidity index THI ≥74 and size of follicle impair 0.1mm for each increasing in THI point at the day of estrus. West (2003) reported that concentration of progesterone was impaired when the cows were exposed to heat stress. Torres-Junior *et al*. (2008) found that progesterone concentration in plasma was altered with changes of environmental temperatures, heat stress causes fluctuation in progesterone metabolism. Rivera *et al.* (2011) suggested that low progesterone levels during follicular growth lead to decline quality of embryo in cows. Cerri *et al.* (2011) showed that higher progesterone concentration at pre and post-mating was related with improved fertility.

Table 7. Effect of temperature humidity index on progesterone concentration (ng/ml) (Mean ±SE) at estrus, seven, fourteen and twenty-one days post-estrus of Egyptian Baladi cows

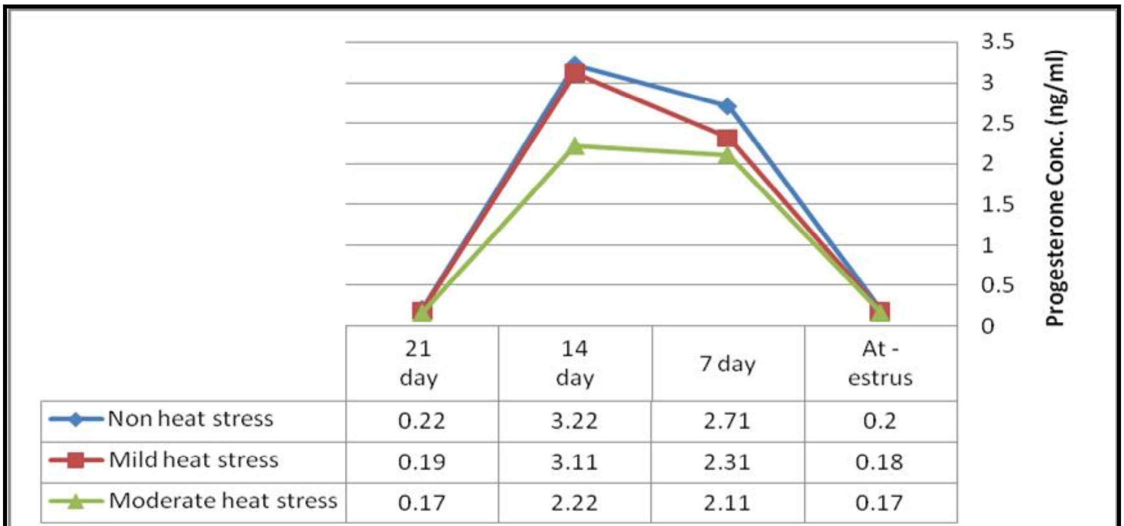
Days of estrous cycle	Heat stress level					
	None		Mild		Moderate	
	THI					
	(68.1-70.5)		(74.5-76.9)		(80.1-83.9)	
	Pregnant	Non-pregnant	Pregnant	Non-pregnant	Pregnant	Non-pregnant
At estrus Mean ±SE	0.46± 0.0[a]	0.20±0.02	0.26± 0.02[b]	0.18±0.02	0.23± 0.02[b]	0.17±0.02
7 day Mean ±SE	3.82±0.16[a]	2.71±0.10	3.01±0.16[b]	2.31±0.10	2.96±0.16[b]	2.01±0.10
14 day Mean ±SE	4.79±0.72[a]	3.22±0.42	4.21±0.72[b]	3.11±0.42	3.21±0.72[c]	2.22±0.42
21 day Mean ±SE	6. 84±0.61[a]	0.22±0.02	5. 32±0.61[b]	0.19±0.02	4. 12±0.61[c]	0.17±0.02

a, b and c: values within the same row having different superscripts are significantly different at (P <0.05)



	21 day	14 day	7 day	At - estrus
Non heat stress	6.84	4.79	3.82	0.46
Mild heat stress	5.32	4.21	3.01	0.26
Moderate heat stress	4.12	3.21	2.96	0.23

Figure (3). Progesterone concentration (ng/ml) of pregnant Baladi cattle during non, mild and moderate heat stress



	21 day	14 day	7 day	At - estrus
Non heat stress	0.22	3.22	2.71	0.2
Mild heat stress	0.19	3.11	2.31	0.18
Moderate heat stress	0.17	2.22	2.11	0.17

Figure (4). Progesterone concentration (n/ml) of non-pregnant Baladi cattle during non,mild and moderate heat stress

CONCLUSION

The present results illustrated the detrimental effect of increasing temperature-humidity index level (THI) on ovarian activity and conception rate of Egyptian Baladi cows. Therefore, this study recommends the stockholders of cows in Aswan governorate to arrange the cows calvings during cold months or use some procedures such as sprinkling by water and fan use in order to reduce the harmful effects of increasing THI level on fertility in Egyptian Baladi cows.

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تأثير مستوى دليل الحرارة والرطوبة على النشاط المبيضى ومعدل الحمل فى الأبقار البلدية المصرية تحت الظروف المناخية لمحافظة أسوان

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يهدف البحث الحالي الى دراسة تأثير مستوى دليل الحرارة والرطوبة على النشاط المبيضى ومعدل الاخصاب فى الابقار البلدية المصرية. استخدم فى الدراسة عدد ٤٠ بقرة بلدية. بناء على ميعاد الولادة تم تقسيم الابقار الى ثلاثة مجموعات المجموعة الاولى عددها ١٥ بقرة ولدت خلال الاشهر(ديسمبر، يناير و فبراير) تراوح دليل الحرارة والرطوبة ما بين (٦٨.١ -٧٠.٥) ، المجموعة الثانية عددها ١٠ بقرات ولدت خلال (نوفمبر، مارس و ابريل) تراوح دليل الحرارة والرطوبة مابين (٧٤.٥- ٧٦.٩) والمجموعة الثالثة عددها ١٥ بقرة ولدت خلال (مايو حتى اكتوبر) حيث كان مدى دليل الحرارة والرطوبة (٨٠.١- ٨٣.٩). اظهرت النتائج ان النسبة المئوية للابقار التى استعادة نشاطها المبيضى بعد الولادة فى المجموعة الاولى كانت اعلى معنويا ٧٣.٣% عنه فى مجموعة الابقار الثانية والثالثة حيث كانت ٥٠ و ٣٣.٣% على التوالى. كان معدل حدوث التبويض الصامت اعلى (٢٠%) فى ابقار المجموعة الثانية والثالثة بالمقارنة بالمجموعة الاولى (١٨.٢%). كانت نسبة حالات السكون الجنسي اعلى معنويا ($P < 0.05$) ٦٦.٧,٥٠% فى ابقار المجموعة الثانية والثالثة على التوالى بالمقارنة بالمجموعة الاولى (٣٦.٤%). كان معدل الاخصاب اعلى معنويا ($P < 0.05$)(٧٧.٨%) فى المجموعة الاولى للابقار عنه فى المجموعة الثالثة (٥٠%). كانت كثافة مظاهر الشياع اعلى معنويا ($P < 0.05$) فى ابقار المجموعة الاولى بالمقارنة بالمجموعتين الثانية والثالثة. أظهرت النتائج التأثير الضار لارتفاع مستوى دليل الحرارة والرطوبة على النشاط المبيضى ومعدل الاخصاب فى الابقار البلدية المصرية. لذلك توصى الدراسة الحالية مربي الابقار فى محافظة اسوان ترتيب الولادات فى الابقار بحيث تكون خلال الأشهر الباردة كذلك من الممكن استخدام بعض الطرق مثل الرش بالماء ومراوح الهواء لتقليل التأثيرات الضارة لارتفاع دليل الحرارة والرطوبة على الخصوبة فى الابقار البلدية المصرية.