EFFECT OF BIOLOGICAL ADDITIVE ON PHYSIOLOGICAL AND PRODUCTION PERFORMANCE OF BUFFALOES DURING COLD WAVES STRESS IN MID EGYPT

OMRAN, FAYZA I., A. A. S. MAHGOUB and T. A. FOODA

Animal Production Research Institute, ARC, Dokki, Giza, Egypt.

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Abstract

The experimental work was done at Sids experimental farm (Beni Suef Governorate), Animal Production Research Institute, Agricultural Research Center, Egypt. The work was conducted to examine the role of supplemented diets to alleviate effects of waves of cold stress on pregnant buffaloes. Ten buffaloes at late gestation were available for experimental work, their production range between the 4th and 5th parity. Animals were divided into two groups, group A served as control the mean of body weight was 510.0±54.0 Kg and group B with 491.52±43.22 Kg body weight were treated by adding biological additive (ZAD) product to concentrates. Climatic conditions were measured by recording air temperature (AT, °C), relative humidity (RH, %) around animals on weekly basis to calculate the temperature humidity index (THI). Value of THI index was 58.64±0.1 throughout January - Marsh where buffaloes were pregnant while it was 69.33±0.38 at time of delivery during April - June. Adaptive responses including rectal temperature (RT, °C) and respiration rate (RR, (r/min) before blood sampling, and recorded heat dissipation (HD, °C). Blood samples were collected in the morning before feeding. The measurements were taken on biweekly basis in addition to monthly weight of dams (WD, Kg), weight of calves at birth (BW, Kg) and monthly weight of calves and daily gain (DG, Kg). In addition nutrient digestibility and milk composition were estimated. Buffaloes of the treated group B had the ability to maintain their heat balance since values of RR and HD were significantly ($P \leq 0.05$) less than that of group A particularly after calving. Group B had higher ($P \leq 0.05$) concentrations of total protein, albumin and globulin than that of group A after calving and at time of milk peak. In positive response, ZAD treatment increased activity of the transaminases ALT and AST as well as level of total lipids. While urea and creatinine concentrations were increasing in blood of the control group A after calving up to the time of peak, it was decreasing in blood of ZAD treated buffaloes (group B). Concentrations of the thyroid hormones in group B at the time of peak production were relatively higher than the corresponding values before calving or values of group A. significant ($P \leq 0.05$) increase in daily milk yield and milk composition of group B was observed in comparison with the control group A. Estimates of feed conversion showed that group B was better than group A.

Key wards: Buffaloes – Biological additive - Cold waves stress - Fibrolytic enzymes - Performance.

INTRODUCTION

Extreme weather condition may cause substantial livestock production losses through increased animal mortality, reduced milk or meat production and inefficiency of reproductive performance. The dairy cow react with heat stress by several complicated physiological changes including increased respiration rate, body temperatures, water intake and evaporative water losses from the body, reduced feed intake and metabolic rate. However, the animal maintenance its nutritive requirements without altered levels (Pereira *et. al.,* 2008, Omran *et al.,* 2013). Beed and Collier (1986) reported that reducing of heat stress on animals need physical modification of the environment or improving the nutritional management via different ways such as increasing water consumption, shading and cooling facilities. During cold weather, animals appetite may be stimulated and feed intake increases to fulfill body requirement of energy, but efficiency of energetic feed utilization still under optimum level for milk production. Therefore, improving ruminal fermentation and digestibility of feedstuff using specific supplements to upgrade energy production at low cost of feeding will be beneficial to reduce cold stress on animals. Another helpful solution to reduce impact of cold waves is using artificial shades and windbreaks in animal housing. Omran and Fooda (2013) concluded that the best temperature humidity index (THI) for production is 68 for buffaloes and Friesian but buffaloes start to feel cold waves stress at this threshold under climatic conditions of mid Egypt. Friesian animals are more tolerant for cold and heat susceptible than buffalos under natural environmental Egyptian conditions. The process of metabolizing nutrients generates heat, which contributes to maintaining body temperature in cold environment, late pregnancy critical time for dairy cow (new calve and milk yields) micro environmental around dames with severe heat or cold waves need helped to lowers negative effects. In Egypt buffalo the first milk production, its importance and contribution in the agricultural economy increased year after year, its number about 3.9 million according to FAOSTAT (2014). Ruminal microorganisms, including bacteria and fungi secrete specific enzymes to digest fibrous fraction of feedstuffs, the host animal derives energy from the microbial cells and from various end products of fermentation. One potential method of improving utilization of fibrous feedstuffs is to increase their digestibility by increasing the quantity of fibrocystic enzymes that are available in the rumen (Zheng *et. al.,* 2000).

The objectives of the present work were to study the physiological performance, milk productivity, metabolic activity, heat dissipations with improving the efficiency of digestibility at late pregnancy, improve feed utilization and increased of pregnant buffaloes performance to tolerant weaves of cold under Middle Egypt condition.

MATERIALS AND METHODS

The experimental work was done at Sides Experimental Farm (Beni Suef Governorate), Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. The work was conducted to test role supplementation biological additive as diets to alleviate effect waves of cold stress during late gestation. Ten buffaloes at late gestation were available for experimental work, their production range between the 4th and 5th parity. Animals were divided into two groups, group A served as control the mean of body weight was 510.0±54.0 Kg and group B was 491.52±43.22 Kg were treated by adding ZAD product to concentrates (biotechnical product from natural source to elevate cellulytic enzymes aiming to improve ruminal fermentation, nitrogen balance, digestibility coefficients and feed conversion). ZAD product contains anaerobic bacteria and mixture of natural enzyme as cellulose (8.2 unit/g), hemi-cellulose (6.2 unit/g) Alpha amylase (64.4unit/g), Protease (12.3 unit/g). The recommended dosage of ZAD for dairy and beef cattle is 5 ml/animal/day.

Climatic conditions were measured by recording air temperature (AT, °C), relative humidity (RH, %) around animals on weekly basis to calculate the temperature humidity index (THI) during the experimental period. Using equation of Mader *et. al.,*(2006) as following:

$$THI= (0.8*T) + [(RH100) * (T- 14.4)] + 66.4$$

Where: T is air temperature (C), RH is the relative humidity%.

During pregnancy (January, February, Marsh) value of THI index was 58.64±0.1 and after calving (April, May, June) value of THI index was 69.33±0.38

The concentrate feed mixture (CFM) was consisting of 21% undecortecated cotton seed meal, 35% wheat bran, 5% molasses, 35% yellow corn, 2.5% limestone, 1% salt and 0.5% mineral mixture. Animals were fed individually according to requirements of Animal Production Research Institute for pregnant and lactating buffaloes. Feeding allowances were weekly adjusted according to changes in body weight and milk production. All experimental rations were formulated to contain 60 % CFM and 40 % rice straw. Rations were offered twice daily at 8 a.m. and 4 p.m., fresh and clean drinking water was offered three times daily, at 7 a.m. .3 p.m. and 8 p.m. The Approximate chemical composition of ingredients and the experimental rations are shown in Table (1).

Animal housing was open shed system, the roof from asbestos (3 meters high) above its three rows of straw bales, the ground from concrete. Feeding stalls and drinking basins were available from cement blocks.

Adaptive responses including rectal temperature (RT, °C) and respiration rate (RR, (r/min) before blood sampling, and recorded heat dissipation (HD, °C) from (head+ neck+ abdominal +back of the animal) by used scichemtech Infra-red thermometer was used to measure HD at assigned sites of animal body.

Blood samples were collected in the morning before feeding the animals. The samples were centrifuged for 30 min. at 3000 rpm to collect serum. Total protein (TP, g/dl), Albumin (Alb, g/dl), Globulin (Glo, g/dl), Total lipids (TL, mg/dl), Urea (U , . mg/dl), creatinine (CR, mg/dl) Kidney function, Alanine amino transfers (ALT., U/ml), Aspartate aminotransferase (AST., U/ml) Liver function, and the thyroid hormones triiodothyronine (T_3, ng/dl) , thyroxine (T_4, µg/dl).

The measurements were taken biweekly in addition to monthly weight of dams (W, Kg), weight of calves at birth (BW, Kg) and monthly weight of calves and daily gain (DG, Kg). Nutrient digestibility and nutritive values were determined using acid insoluble ash (AIA) technique of Van Keulen and Young (1977) on samples collected from three randomly chosen buffaloes from each group. Feeds and feces were sampled and the conventional analytical methods of AOAC (1995) were applied. Also, digestibility coefficient and feeding values of the tested rations were determined. Total digestible nutrients (TDN) and digestible crude protein (DCP) calculated according to classic formula of McDonald *et al.,* (1995). While digestible energy (DE Mcal/Kg DM) was calculated according to Nehring and Haenlien (1973). Buffaloes were hand milked twice daily (7 a.m. and 4 p.m.) during the experimental period and milk yields were recorded individually at each milking. Milk Samples were collected biweekly and analyzed for determination of fat, total solids, total protein and ash (Ling, 1963), Lactose content (Barett and Abd El-Tawab, 1957). Solids not fat (SNF) was calculated by difference.

Table 1. Approximate chemical composition of feed ingredients and the experimental rations on DM basis.

Items	Chemical composition (%), as DM basis						
	DM	OM	CP	EE	CF	NFE	Ash
Feedstuffs							
CFM	90.55	91.34	16.23	3.89	15.67	55.55	8.66
CFM+ZAD	88.60	90.60	17.22	4.02	15.22	54.14	9.40
Rice straw	91.22	85.32	3.82	1.67	39.22	40.61	14.68
Rations							
Group A	90.82	88.93	11.27	3.00	25.09	49.57	11.07
Group B	89.65	88.49	11.86	3.08	24.82	48.73	11.51

CFM: Concentrate feed mixture

Statistical analysis of data was carried out applying the Statistical Analysis System (SAS, 2002) according to the following model:

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

Where:

Y_{ij} = observation on the j^{th} animals of the i^{th} treatment,

μ = overall mean,

T_i= fixed effect due to the treatment (i= A (control) and B (with zad)) and

e_{ij}= random error assumed N.I.D (0, $\sigma^2 e$).

RESULTS AND DISCUSSION

As shown in table (2), means of the adaptive responses of buffaloes before calving differed than its corresponding values after calving. Values of rectal temperature (RT, °C) and respiration rate (RR, r/min) were relatively higher after calving while, heat dissipation (HD, °C) values were relatively less than that before calving.

Despite similar values of RT were observed for both groups A and B, values of RR and HD were significantly ($P \leq 0.05$) less in ZAD treated group B particularly after calving. This finding indicate that buffaloes have the ability to maintain their heat balance. It is worth mentioning that under the experimental condition, THI value was 58.64±0.1 before calving indicating that dams were under cold stress whereas, THI was 69.33± 0.38 after calving, this value is ideal for buffalo production under middle Egypt condition as reported by Omran and Fooda (2013). In agreement with these results, Hahn *et .al.*(2003) and Omran and Fooda (2013) stated that any improvement in animal index will ideally be useful for continued development of biological functions and representative of consequences resulting from primary factors influencing energy exchange between the animal and its surrounding,

Table 2. Means ± SE for rectal temperature, respiration rate and heat dissipation for buffaloes fed on diet supplemented with ZAD (group B) before and after calving.

Items	Group	Before calving	After calving
Rectal temperature (RT, °C)	A	36.91±0.03[b]	37.88±0.05[a]
	B	37.16±0.05[a]	37.34±0.04[b]
Respiration rate (RR, r/min)	A	14.13±0.48[b]	29.13±0.53[a]
	B	16.19±0.60[a]	20.27±0.44[b]
Heat dissipation (HD,°C)	A	33.71±0.20[a]	32.43 ±0.25[a]
	B	32.78±0.49[b]	30.47 ±0.14[b]

Mean values of groups for each item with different superscripts in the same column are significantly different ($P \leq 0.05$).

Table (3) display averages of some blood serum constituents in the experimental buffaloes. Concentrations of blood total protein (TP) in both control and treated groups were relatively reduced after calving then resumed its level again at time of peak. The treated group B had higher ($P < 0.05$) concentrations of TP than that of group A after calving and at time of peak. Similar trend was observed for blood protein fractions but no significant differences were noticed between groups A and B except that globulin concentration of group B at time of peak was higher ($P \leq 0.05$) as compared with group A.

The higher concentration of TP before calving may refer to increased protein synthesis needed for fetal growth and preparatory function of the mammary gland.

Total lipids in blood tended to increase in both groups A and B after calving but its concentrations were significantly ($P \leq 0.05$) higher in group B than that of group A. This finding reflex the role of ZAD treatment in energy production in the ruminant animal particularly to combat the influence of cold weaves.

Both transaminases activity of ALT and AST of the treated group B increased steadily after calving to reach higher values ($P \leq 0.05$) than group A at the time of peak. This result may point to accelerated liver function in positive response to ZAD treatment. While urea concentrations were increasing in blood of the control group A after calving up to the time of peak, it were decreasing in blood of ZAD treated buffaloes (group B). Also, concentrations of creatinine were significantly ($P \leq 0.05$) lower in blood of group B than that in group A. In agreement with our findings, Bedrek (1965) reported that blood enzymes are often influenced by the external environmental conditions including feeding practices, type of shelter and other aspects of herd management, since they are intimately related to metabolism accordingly, seasonally change of the enzymes must be considered. It seems likely that ZAD treatment improved ruminal fermentation through function of cellulytic enzymes so that the host animal could efficiently utilized N for biosynthesis of microbial protein. Conclusively, ZAD treatment may ameliorate protein metabolism and improved energy production in treated animals.

As shown in Table (4), the maximum values of thyroid hormones T_3 (603.6 ± 12.1) and T_4 (18.73 ± 0.21) were attained by group B at the time of peak. These values were considerably greater than the corresponding values of both hormones before calving or the interval between calving until peak of production. Generally, concentrations of T_3 and T4 were relatively higher in group B than that in group A all over the experimental period. Greater T_3 / T_4 ratios for group B were noticed after calving as compared with group A. The higher ratio of T_3 / T_4 that noticed for group A before calving may be related to higher metabolic body weight of that group. Many investigators reported that thyroid hormone play an important role in the animal adaptation to environmental changes (Thompson, 1973, El-Masry and Habeeb, 1989, Omran *et al*, 2011 a, b and Omran *et. al.,* 2013). However, T_3 is more concerned with thermo genesis under cold stress to match the increase of animal appetite and its feed intake. In consequence, elevation of metabolic rate may be expected in the treated group B in response to increased secretion of thyroid hormones. This finding denotes indirect relationship between amelioration of rumen function in response to ZAD treatment and increased activity of the thyroid gland during waves of cold stress.

Table 3. Mean ± SE of some blood and urine constituents in buffaloes fed on diet supplemented with ZAD (group B) before and after calving and at time of peak production.

Items	Group	Before calving	After calving	Time of peak
Total protein (TP, g/dl)	A	9.5±0.1[a]	7.86±0.21[a]	9.14±0.13[b]
	B	9.16±0.2[a]	8.27±0.16[a]	9.66±0.11[a]
Albumin (Alb, g/dl)	A	4.3±0.1[a]	3.93±0.13[a]	4.53±0.05[a]
	B	4.25±0.1[a]	4.12±0.10[a]	4.47±0.05[a]
Globulin (Glo, g/dl)	A	5.20±0.1[a]	4.02±0.21[a]	4.61±0.14[b]
	B	4.91±0.2[a]	4.18±0.12[a]	5.19±0.12[a]
Total lipids (TL, mg/dl)	A	552.9±4.2[a]	577.77±2.03[b]	580.96±4.49[b]
	B	592.99±12.9[a]	594.22±5.00[a]	622.13±7.11[a]
Transaminases activity:				
Alanine aminotransferase (ALT, U/ml)	A	13.5±0.4[a]	14.33±0.47[a]	10.67±0.31[b]
	B	10.50±0.93[b]	11.08±0.34[b]	13.83±0.81[a]
Aspartateaminotransferase (AST, U/ml)	A	21.3±0.4[a]	20.58±0.87[b]	27.92±1.18[a]
	B	18.67±1.2[a]	23.17±1.15[a]	28.00±0.48[a]
Urea (mg/dl)	A	137.5±0.1[b]	153.1±0.4[a]	184.1±0.1[a]
	B	177.3±0.2[a]	121.6±0.3[b]	111.35±0.12[b]
Creatinine (mg/dl)	A	2.14±0.2[a]	2.90±0.04[a]	2.09±0.01[a]
	B	1.97±0.03[b]	2.08±0.04[a]	1.82±0.08[b]

Mean values of groups for each item with different superscripts in the same column are significantly different ($P \leq 0.05$).

Table (5) display means values of monthly weight of dams and newborn calves in the experimental groups a (control) and B (ZAD treated group). Differences in body weight of dams between groups were insignificant. However, it was observed that group B increased in body weight by 7.35% while, no abundant change in dam weight was noticed in group A. Similarly, differences in body weight of newborn calves between groups were insignificant until weaning. Body weight of calves in group B became significantly ($P \leq 0.05$) higher at post-weaning period. The improvement in body weight of dams and calves of group B compared with that of group A may be attributed to augmented digestibility of nutrients as affected by ZAD treatment.

Table 4. Mean ± SE of thyroid hormones concentrations in buffaloes fed on diet supplemented with ZAD (group B) before and after calving and at time of peak production.

Items	Group	Before calving	After calving	Time of peak
Triiodothyronine (T_3, ng/dl)	A	431.4 ± 0.87^b	412.4 ± 3.48^b	470.5 ± 16.18^b
	B	512.5 ± 6.43^a	515.6 ± 5.62^a	603.6 ± 12.1^a
Thyroxine (T_4, µg/dl)	A	13.05 ± 0.31^b	15.60 ± 0.40^b	16.73 ± 0.25^b
	B	16.65 ± 0.20^a	17.74 ± 0.12^a	18.73 ± 0.21^a

Mean values of groups for each item with different superscripts in the same column are significantly different ($P \leq 0.05$).

Results of Table (6) indicate a significant ($P \leq 0.05$) increase in daily milk yield and milk composition of group B in comparison with the control group A. The rate of increase in milk total solids of group B by 25.43% over that of group A is mainly referring to abundant increase of fat percent in milk of group B. This finding may demonstrate superiority of energy production in ZAD treated groups of buffaloes. The supplement of fed fibrolytic enzymes may improve the process of metabolizing nutrients to generate heat that contributed in maintaining body temperature during exposure to cold waves so that the energy content of undigested fibrous fraction became available and provided considerable benefit to the dairy animal. In this context, Zheng *et.al.* (2000) reported that ruminal microorganisms, including bacteria and fungi, secrete specific enzymes to digest the fibrous fraction of feed stuffs. The host animal derives energy from the microbial cells and from various end products of fermentation hence, improving utilization of fibrous feedstuffs by increasing the quantity of fibrolytic enzymes that are available in rumen. Also, some investigators found that the direct–fed enzymes produced no significant on feed intake (Lewis *et. al.*, 1999; Yang *et. al*, 2000 and Phipps *et. al.*, 2002). However, those authors indicated that fibrolytic enzymes have the potential to increase digestibility and milk production in dairy cows because digestion is low relative to potential digestibility.

Estimates of feed intake, digestibility coefficients of nutrients and nutritive values are shown in Table (7). There was no significant difference in feed intake between the two studied groups. However, estimates of feed conversion showed that group B required 3.14 kg DM /h/d to produce one kg of milk while, group A required 4.21 kg DM /h/d for 1 kg of milk. On the other hand, no significant differences were observed in digestibility coefficients (%) between the two groups except digestibility of crude fiber that was relatively ($P \leq 0.05$) higher in group B. This finding may attributed to direct supplementation of the fibrolytic enzymes to concentrate feed mixture before feeding. Yang *et al.,* (1999 and 2000) noticed a significant changes in milk yield when enzymes were mixed at the time of manufacturing with alfalfa hay cubes or the concentrated ration. These results may be due to fibrolytic enzymes supplementation to concentrate feed mixture before feeding. The decline of heat dissipation (HD) in group B may be an indicator to increased metabolic energy utilized for fetal growth during cold stress and initiation of milk yield. The nutritive values % was almost similar in both groups.

Table 5. Mean ± SE of monthly body weight (W, kg) for dames and newborn calves as affected by ZAD treatment.

Items	Group (A)	Group (B)
Dams		
W1 (kg)	520.0±54.12[a]	510.0±45.41[a]
W2 (kg)	522.5±55.32[a]	513.8±49.85[a]
W3 (kg)	520.0±57.19[a]	517.5±50.60[a]
W4 (kg)	525.0±56.79[a]	525.0±49.16[a]
W5 (kg)	525.0±50.00[a]	547.5±46.39[a]
Calves		
BW (kg)	31.67±0.88[a]	34.75±0.63[a]
W1 (kg)	43.00±1.15[a]	46.00±0.82[a]
W2 (kg)	55.67±1.20[a]	59.25±1.10[a]
WW (kg)	71.67±1.86[a]	75.75±0.85[a]
W4 (kg)	86.33±2.96[b]	96.75±0.75[a]
DG (kg)	0.46±0.03[b]	0.52±0.01[a]

Mean values in the same row with different superscripts are significantly different ($P \leq 0.05$).

Table 6. Mean ± SE of milk yield (kg/day) and chemical analysis of buffalo milk during time of peak production for animals fed on diets supplemented with ZAD (group B).

Items	Experimental groups	
	Group (A)	Group (B)
Milk yield (kg/day)	4.20±0.00 [b]	5.79±0.00 [a]
Fat (F, %)	4.25±0.10[b]	6.73±0.09[a]
Protein (P, %)	3.59±0.08[b]	3.98±0.06[a]
Lactose (L, %)	4.31±0.07[b]	5.09±0.07[a]
Total solids (TS, %)	13.33±0.25[b]	16.72±0.11[a]
Solid not fat (SNF, %)	9.08±0.16[b]	9.99±0.06[a]

Mean values in the same row with different superscripts are significantly different ($P \leq 0.05$).

Table 7. Feed intake, digestibility coefficients of nutrients and nutritive values as affected by ZAD supplemented ration.

Items	Group (A)	Group (B)
Feed intake (Kg/h/d)		
Total dry matter intake	17.68±1.21[a]	18.18±1.21[a]
Concentrate feed mixture	10.61±0.72[a]	10.91±0.72[a]
Rice Straw	7.07±0.48[a]	7.27±0.48[a]
Digestibility coefficient (%):		
DM	76.65±0.95[a]	79.96±0.12[a]
OM	73.11±1.42[a]	75.94±0.71[a]
CP	64.62±3.11[a]	64.43±2.00[a]
EE	74.34±1.98[a]	76.05±4.08[a]
CF	49.95±2.95[b]	59.94±0.63[a]
NFE	83.07±1.34[a]	85.48±0.96[a]
Nutritive value (%):		
TDN	57.54±1.14[a]	61.41±0.21[a]
DCP	4.80±0.20[a]	4.50±0.11[a]
DE	2.84±0.07[a]	3.00±0.03[a]

Mean values in the same row with different superscripts are significantly different ($P \leq 0.05$).

CONCLUSION

Results of the present study revealed that exposure of pregnant buffaloes to stress of cold waves during winter effects on physiological functions as increased rate of RR and HD. Incorporating the fibrolytic enzymes of ZAD 5 g/h/day into diet of buffaloes have the ability to maintain their heat balance evidenced by reduced values of RR and HD particularly after calving, reduces sensitivity of buffaloes to waves of cooled from January – Marsh under middle Egypt condition.

Moreover, ZAD treated group was increased thyroid concomitant with enhanced metabolic activity and increased milk production with greater fat percentage. It can be concluded that use of supplementing diets with ZAD reduced the harmful effects of cold waves, help to improve physiological status at postpartum and reduces sensitivity of buffaloes to cooled with climatic change.

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تأثير الإضافة البيولوجية علي الآداء الفسيولوجي والإنتاجي للجاموس آثناء التعرض لإجهاد الموجات البارده فى مصرالوسطى

فايزة إبراهيم محمد عمران، عبد المنعم علي سيد محجوب ، طارق عبد العزيز فودة

معهد بحوث الإنتاج الحيواني – مركز البحوث الزراعية – الدقي – جيزة – مصر

اجريت هذه الدراسه بمحطه سدس (بمحافظة بني سويف)، والتابعه لمعهد بحوث الإنتاج الحيواني، مركز البحوث الزراعية، مصر. لدراسه دور الاضافة البيولوجية للتخفيف من آثار موجات الإجهاد البارد خلال الفترة الاخيره من الحمل خاصه مع التغيرات المناخيه . استخدم ١٠ امهات عشار في الفتره الاخيره من الحمل كانت متاحة لاجزاء التجربه، بين الموسمين الرابع والخامس. تم تقسيم الحيوانات إلى مجموعتين. المجموعه الاولى A كنترول متوسط وزن الجسم ٥١٠,٠ ± ٥٤,٠كم والمجموعه الثانيه B المعامله بمنتج الزاد بمعدل ٥جم/رأس/يوم، متوسط وزن الجسم ٤٩١,٥٢ ± ٤٣,٢٢ كجم. منتج الزاد كان يضاف الى العلف المركز. تم قياس الظروف المناخية عن طريق تسجيل درجة حرارة الهواء والرطوبة النسبية حول الحيوانات أسبوعيا لحساب دليل الحرارة والرطوبه. كانت القيمه ٥٨,٦٤ ±٠،١ فى فتره الحمل من يناير الى مارس و٦٩,٣٣±٠،٣٨ بعد الولاده فى الفتره من ابريل الى يونيه والاستجابه الفسيولوجيه، درجة حرارة المستقيم (درجة مئوية) ومعدل التنفس (فى دقيقة) وكذالك الانبعاث الحرارى من الحيوان (درجه مئويه) . تم جمع عينات الدم في الصباح قبل اطعام الحيوانات. وزن الامهات شهريا. وزن العجول عند الميلاد ثم الوزن الشهرى لها حتى الفطام لحساب الزياده اليوميه. تحليل مكونات اللبن. جميع القياسات السابقه كانت تقدر كل١٥ يوم.

أظهرت نتائج الدراسة : أن تعرض الجاموس العشار للموجات البارده تحت ظروف مصر الوسطى له آثار ضارة على قدرة الحيوان على الحفاظ على وظائفه الفسيولوجية وانخفاض كفاءة الاستفاده من الغذاء و النشاط التمثيلى وزياده معدل التنفس. وان المجموعه المعامله (ب) كانت لها القدره على الحفاظ على التوازن الحرارى عند معنويه ($P \le 0.05$) واضح فى قيم وزياده التنفس والانبعاث الحرارى بعد الولاده. زياده تركيز البروتينات الكليه والالبيومين والجلوبيولين بعد الولاده وفتره زياده الانتاج عند معنويه ($P \le 0.05$) وزياده نشاط انزيمات الكبد والدهون الكليه لزياده الطاقه المنتجه. وزياده تركيز هرمونات الغده الدرقيه وانتاج اللبن اليومي . بينما المجموعه الغير معامله (أ) اظهرت زياده فى تركيز الكريتينين واليوريا بعد الولاده وفتره زياده الانتاج . واضافه الإنزيمات المحلله للسليلوز الى الغذاء خلال فترة الجفاف يحسن الحفاظ على التوازن الحرارى وانخفاض معدل التنفس بعد الولاده وتقليل حساسيه الجاموس للموجات البارده فى الفتره من يناير الى مارس مع دليل حراره ورطوبه ٥٨ او عندما يقل دليل الحراره والرطوبه عن ٦٨ تحت ظروف مصر الوسطى. بالاضافه الى تحسين وظائف الغده الدرقيه والنشاط التمثيلى وزياده انتاج اللبن ونسبه الدهن. عند تقدير التحول الغذائى.

والخلاصه أن استخدام الاضافة البيولوجية لها تاثير فعال فى تخفيف الاثر السيئه للموجات البارده وكذالك تساعد فى تحسين الحاله الفسيولوجيه بعد الولاد ه وتقليل من حساسيه الجاموس للاجواء البارده فى ظل التغيرات المناخيه .