ARIZONA AND NEW MEXICO DAIRY NEWSLETTER

COOPERATIVE EXTENSION
The University of Arizona
New Mexico State University

November 2008

THIS MONTH'S ARTICLE:

Sweating Rates of Dairy and Feedlot Cows under Stressful Thermal Environments

Kifle G. Gebremedhin, Peter E. Hillman, C.N. Lee, Robert J. Collier, Scott T. Willard, John Arthington, and Tami M. Brown-Brandl

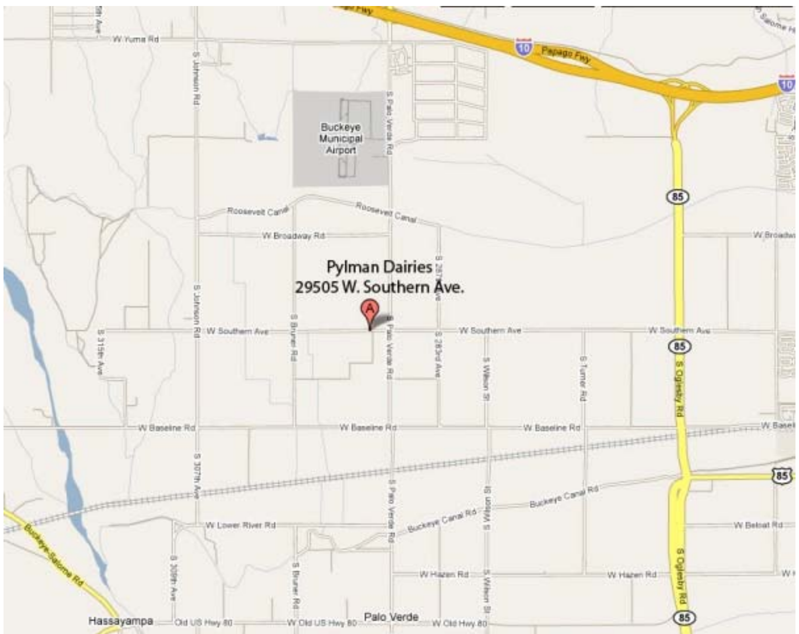
Upcoming Event
Arizona Dairy Day - April 2, 2009
Pylman Dairies - Buckeye, Arizona

Arizona Dairy Day Golf - April 3, 2009
Wigwam Golf Club - Litchfield Park, Arizona

ARIZONA DAIRY DAY

Make plans to be at

Pylman Dairies
29505 W. Southern Ave.
Buckeye, AZ 85326



April 2, 2009

10:00 AM - 2:00 PM

PYLMAN DAIRIES SOCIAL WILL FOLLOW AT 2:00 PM

Bring your family and enjoy the day with food and fun

Lunch provided by Farm Credit Services SOUTHWEST

For more information contact Julie at (520) 626-1754 ~ Stefanic@ag.arizona.edu ~ http://ag.arizona.edu/extension/dairy/index.html

DEPARTMENT OF ANIMAL SCIENCES

ARIZONA COOPERATIVE EXTENSION
THE UNIVERSITY OF ARIZONA • COLLEGE OF AGRICULTURE AND LIFE SCIENCES

April 2, 2009
Pylman Dairies
29505 W. Southern Ave.
Buckeye, AZ 85326

ARIZONA DAIRY DAY

Please indicate the booth space needed and number of pieces of equipment.
One table and two chairs are provided for each booth space. Two chairs are provided for each piece of equipment.

Booth Space __________ (# Booths) X $600.00 (per booth) = $______________
(Booth size – 10X10)
Equipment __________ (# of Pieces) X $600.00 (per piece of equipment) = $______________
(Tractors, Feed Trucks, etc.)
Power Type ____________ Water ___________

Power and water are available but **we must know requirements ahead of time** for generators, etc.

Company/Organization ____

Contact Person ____

Address ______________________________ City, State, Zip ________________________

Phone ______________________________ Fax ______________________________

Email Address ____

Payment Information – **Please make all checks payable to the University of Arizona** - Mail registration form to Julie Stefanic - The University of Arizona - Department of Animal Sciences - PO Box 210038 – Tucson, AZ 85721

Visa ______________ MasterCard ____________ American Express ________ Discover _____________

Credit Card Number __________________________ Exp. Date _______________ Security Code ________

For more information contact Julie at (520) 626-1754 ~ Stefanic@ag.arizona.edu
http://ag.arizona.edu/extension/dairy/index.html

DEPARTMENT OF ANIMAL SCIENCES

ARIZONA COOPERATIVE EXTENSION
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Dairy Day Golf Tournament Registration

Friday, April 3, 2009

Wigwam Golf Club
451 N. Old Litchfield Road
Litchfield Park, AZ 85340

Entry Fee: $100.00 per person
Shotgun Start: 1:00 p.m.
Contact Person: Julie Stefanic
1650 E. Limberlost Dr.
Dept. of Animal Sciences
Tucson, AZ 85721
(520) 626-1754 ~ stefanic@ag.arizona.edu

Registration form. Please detach and return to address above.

☐ **Individual** ☐ **Team**

Name(s)______________________________

Organization______________________________

Address______________________________

City/State/ZIP______________________________

Phone______________________________

Team Members:

____

____

____

Number of players __________

x $100.00

Total amount due **$**__________

Please make check payable to **UA Foundation**
Individuals will be assigned to a team.

Note: This is not a tax-deductible contribution to The University of Arizona Foundation per IRS regulations. (FEIN 86-6050388). Mulligans will be available the day of the tournament. Neither the tournament fee nor mulligans are considered a tax-deductible donation.

2009 Dairy Day Golf Tournament
Hole Sponsorship

Sponsorship is greatly appreciated and will be $350 per hole.

Sponsorship includes:
Sign with your company name (If received by March 14th, 2009)

If you would like to give golf balls, towels, pencils, etc., contact
Julie Stefanic at 520-626-1754 or stefanic@ag.arizona.edu
http://ag.arizona.edu/extension/dairy/index.html

✂- -

Return by March 14, 2009

Organization____

Address____

City/State/ZIP____

Contact Person____

Phone__________________ Fax________________________________

Email____

Article to give away____

Please make check for $350.00 payable to:

UA Foundation
Dairy Extension Program Coordinator
Dept. Animal Sciences
PO Box 210038
Tucson, AZ 85721-0038

Dairy Day Golf

The entire amount of hole sponsorship is considered a tax-deductible donation.

Improving Resistance to Thermal Stress in Dairy Cows with Protected Niacin
Presented at 2008 Southwest Nutrition Conference

R. Burgos Zimbelman, J. Collier, M.B. Abdallah, L.H. Baumgard, T.R. Bilby, and R.J. Collier
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Summary

- Heat stress continues to have major economic impacts on the U.S. Dairy Industry
- Presently, there are several management but few nutritional options to reduce heat stress effects on lactating dairy cows.
- During acute thermal stress supplementation with niacin increases evaporative heat loss while reducing body core temperatures
- In cell culture models, heat shock proteins 27 and 70 are elevated when cells are treated with niacin and prostaglandins
- Niacin may play an important role in protection of animals from heat shock.

Heat stress is a major source of economic distress to the U.S. dairy industry with average annual losses of over \$800 million associated with reduced performance and increased disease incidence (St. Pierre, 2003). In unusually warm summers these costs rapidly increase, for example, during the summer of 2006 a two week heat wave in California caused an estimated \$1 billion in production and animal losses.

When effective environmental temperature exceeds a cow's thermal zone of comfort, or thermo-neutral zone, cows experience heat stress (Armstrong, 1993). A cow's thermo-neutral zone is dependent upon an animal's physiological status and level of production. Since the 1950's, the average milk yield per cow in the U.S. has doubled and the cow's thermo-neutral zone has shifted downward becoming more heat sensitive and cold tolerant (Collier et al., 2004). Environmental factors which influence the effective environment around the animal include relative humidity, velocity of ambient air, degree of solar radiation, thermal radiation, and moisture loss (NRC, 1981; St. Pierre, 2003).

The Temperature Humidity Index (THI = t_{db} + .36t_{dp} + 41.5, where t_d = dry-bulb temperature, ^{0}C and t_{dp} = dew point temperature, ^{0}C) originally developed by Thom (1958) and extended to cattle by Berry and colleagues (1964) is used to estimate cooling requirements of dairy cattle. THI values were categorized into mild, moderate and severe stress levels for cattle by the Livestock Conservation Institute, (Whittier, 1993; Armstrong, 1994). However, as pointed out by Berman (2005) the supporting data for these designations are not clear. For example, the index is based on a retrospective analysis of studies carried out at The University of Missouri in the 1950's and early 1960's on a total of 56 cows averaging 15.5 kg/day, (range 2.7-31.8 kg/day). In contrast, average production per cow in the United States is presently over 30 kg/day with many cows producing above 50 kg/day at peak lactation. Escalating milk yield increases sensitivity of cattle to thermal stress and reduces the "threshold temperature" at which milk losses occur (Berman, 2005). This is because metabolic heat production increases as the production level of a cow enhances. For example, heat production from cows producing 18.5 and 31.6 kg/d of milk was 27.3 and 48.5% higher than non-lactating cows (Purwanto et al., 1990). In fact, Berman (2005) indicated that increasing milk production from 35 to 45 kg/d decreased threshold temperature for heat stress by 5^{0}C. Thus, THI predictions of environmental effects on milk yield presently underestimate the magnitude of thermal stress on current Holstein cattle. Furthermore, the work by Berry et al. (1964), did not take into account radiant heat load or convection effects. The vast majority of cattle today are housed under some type of shade structure during warm summer months and although this greatly reduces solar heat load there is still a radiant heat load on animals originating from the metal roof. Berman (2005) estimated that the typical shade structure in Israel adds an additional 3^{0}C to the effective ambient temperature surrounding animals. In addition, there are varying convection levels under shade structures depending on the use of fans as part of the cooling management system.

An additional factor in utilizing THI values is the management time interval. The time interval involved in the original THI predictions by Berry et al. (1964) was two weeks. In other words, the milk yield response to a given THI was the average yield in the second week at a given environmental heat load. However, this time lag is fiscally unacceptable and current dairy producers need to immediately know what level/extent of cooling needs to be in order to prevent present and future production losses. Collier and colleagues (1981) and Spiers and co-workers (2004) indicated that effects of a given temperature on milk yield were maximal between 24 and 48 hours following a stress. Additionally it has been reported that ambient weather conditions 2 days prior to milk yield measurement had the greatest correlation to reductions in production and dry matter intake (West et al., 2003). Furthermore, Linville and Pardue (1992) indicate that the total number of hours when THI exceeded 72 or 80 over a 4 day interval had the highest correlation with milk yield. Collectively, these results demonstrate that current THI values for lactating dairy cows underestimate the size of the thermal load as well as the impact of given thermal loads on animal productivity. In addition, there is an inappropriate time interval associated with cooling management decisions. Practically, if producers can avoid an acute (i.e. 48 hr) decline in production this will probably result in maintaining milk yield in the long run (i.e. two weeks later). Specifically, the time frame for utilizing THI values to reduce milk yield losses needs to be shortened. New studies need to be conducted utilizing high producing dairy cows and including radiant energy impacts on animal performance. Furthermore, impacts of a given THI on milk yield within 48 hours need to be identified. This will provide meaningful data to producers who need this information to make immediate cooling decisions to improve cow comfort, animal well-being and to maintain current and long-term production.

A final component of the current THI index is the pattern of stress application. In the original work by Berry et al. (1964), cows were exposed to given THI conditions continuously (no daily fluctuations) for the entire two week period. This is obviously not what occurs under natural/practical management conditions where temperatures cycle (rise and fall) during a normal day. As a consequence, we presently do not know how to assess the true THI value. For example, is it the average, the peak or the minimum which is important? Alternatively, is it a given number of hours above an arbitrary THI value which is most critical? Holter et al. (1996) reported that minimum THI was more closely correlated with reduced feed intake than maximum THI. Ravagnolo et al (2000) evaluated test day yields and found a decrease of 0.2 kg milk per unit increase in THI above 72 when THI was composed of maximum temperature and minimum humidity. A designed study where temperature and humidity are controlled in a circadian manner, similar to natural environmental conditions, has never been conducted. West et al. (2003) evaluated feed intake and milk yield under natural conditions and found that mean THI two days earlier had the greatest effect on both intake and yield. However, they were working under natural conditions and could not quantify the relationship between THI and milk yield.

The effects of radiant heat load can be evaluated using the Black Globe Humidity Index (BGHI = $t_{bg} + .36t_{dp} + 41.5$ where t_{bg} = black globe temperature ^{0}C and t_{dp} = dew point temperature, ^{0}C), developed by Buffington et al. (1981). These investigators demonstrated that BGHI had a higher correlation to rectal temperature increases and milk yield decreases than THI. They also pointed out that the correlation of BGHI to milk yield was greater ($r^2 = .36$) under conditions of high solar radiation (no shade) than under a shade structure ($r^2 = .23$). However, milk yields in this study were also low (average 15 kg/cow). Therefore, correlations of BGHI to milk yield under shade structures might be higher with higher producing dairy cows (which are more sensitive to increased heat loads).

During periods of heat stress the nutrient requirements of animals are altered resulting in the need to reformulate rations. For example, if dry matter intake decreases then an increase in nutrient density is required along with recalculating mineral and water requirements due to increased potassium loss in sweat (Collier et al., 2005). Reductions in dry matter intake are major contributors to decreased milk production. (Beede and Collier, 1985; Collier et al., 2005). When cows are heat stressed there are also reductions in rumination and nutrient reabsorption and an increase in maintenance requirements causing a net decrease in nutrient/energy availability for production (Beede and Collier, 1985; Collier et al., 2005). Recent studies by Baumgard et al. 2006 have shown the reduction in DMI may only be responsible for ~40-50% of the decrease in milk production when cows are heat stressed and ~50-60% can be explained by other changes induced by heat stress. This raises the possibility that some of the loss in milk yield during thermal stress might be recoverable through appropriate nutritional management. Other approaches to decrease the effect of heat stress nutritionally are to decrease fiber intake to levels where the rumen can function properly, adding fat supplementation because of its high energy content and low heat increment, implementing higher concentrate diets with caution, and more recently adding niacin supplementation (Beede and Collier, 1986; Knapp and Grummer, 1991; Morrison, 1983).

Niacin, nicotinic acid, is a possible supplement which induces vasodilation therefore transferring body heat to the peripheral (Di Constanza et al., 1997). Transferring body heat to the surface through peripheral or vasomotor function can perhaps alleviate some of the decrease in dry matter intake and thus milk production. Researchers have reported niacin to decrease skin temperatures during periods of mild to severe heat stress when supplementing cows with 12, 24, or 36 g of raw niacin for three consecutive 17 day periods (Di Constanza et al., 1997). When supplementing raw niacin, the amount of niacin degraded or absorbed in the rumen is much larger than the amount that reaches the small intestine (~17-30%; NRC, 2001). Past research observing the effects of niacin on heat stress have only looked at raw niacin, however encapsulated niacin was recently evaluated during two experiments at the University of Arizona, one in our environmental chambers, and one with a larger number of animals on a commercial dairy.

Environmental Chamber Study

Twelve multiparous Holstein cows producing an average of 25.4 kg/d and balanced for parity and stage of lactation were randomly assigned to either 0 g encapsulated niacin/d (C) or 12 g niacin/d (NIASHURE™®) (TRT) and were exposed to two environmental temperature patterns (Figure 1). Temperature patterns were period 1, thermoneutral (TN) and period 2, heat stress (HS). The temperature humidity index (THI) range of period 1 (TN) pattern never exceeded 72 while period 2 (HS) consisted of circadian temperature range where THI exceeded 72 for 12 hours per day. Milk yield was measured twice daily. Water readings were recorded once a day for daily water intake. Cows were fed twice a day and refusal was measured once a day. Respiration rates, surface temperatures (ST) of both shaved (-S) and unshaved (-U) areas were taken at the rump, (ST-R-S, ST-R-U) shoulder, (ST-S-S, ST-S-U), and tailhead (ST-T-S, ST-T-U), and sweating rates (SR) of the shoulder shaved (SR-S) and unshaved (SR-U) areas four times daily. Rectal temperatures (RT) were measured four times a day along with evaporative heat loss (EVHL).

Results

Dry matter intake was not affected by TRT however mean dry matter intake for both TRT and C was decreased during period 2 (HS) (38.9 vs. 37.7 kg/d, $P<0.05$, Table 1). Milk yields were not statistically different between TRT groups or periods ($P=0.17$, SEM= 0.34, Table 1). Water intakes had a tendency to be greater for cows in TRT group ($P=0.11$) regardless of period; however during period 2 (HS) C and TRT groups had higher water intakes, respectively (28.4 vs. 23.6 and 33.7 vs. 30.8 g/d; $P<0.01$, Table 1).

Average surface temperatures obtained from the shoulder, rump and tail head were unaffected by TRT but were affected by shaving (32.5 shaved vs. 31.4 °C unshaved, Table 2). During period 2 all ST were higher in both groups compared to period 1, (Table 2). Cows provided TRT had higher average EVHL (66.3 vs 57.8 g/M/hr, P=0.11, EVHL-S) and (57.4 vs 52.7 g/M/hr, P<0.05, EVHL-U) over the entire 24 hour period and these differences grew larger during periods of peak thermal stress. Between 11:00AM to 4:00 PM average EVHL for the TRT group were higher than C (81.1 vs. 68.2 g/M/hr). Cows in TRT had lower average RT during period 2 (HS) compared to C (38.2 vs. 38.3 °C, Table 1) and lower mean vaginal temperatures for the 72 hour period, from d 4 thru d 7, (38.0 vs. 38.4; $P<0.001$, Figure 2). Respiration rates tended to be greater for cows in the TRT group compared to cows in C during both periods ($P=0.14$, Table 1). Control and TRT groups had significantly higher respiration rates during period 2 (HS), (30.6 vs. 50.8 and 32.5 vs. 54.5 bpm; $P<0.0001$, Table 1). Average rectal temperatures tended ($P = 0.07$, Table 1) to be lower for cows in the TRT group compared to C during period 2 (HS). However, during period 1, TRT group had higher rectal temperatures than C ($P = 0.05$). Total metabolic and milk heat storage was greater during period 1 (TN; 31388 kcal) than period 2 (HS; 30669 kcal) for cows in the TRT group, (Table 3), whereas cows in the C group had less total metabolic and milk heat during period 1 (28895 kcal) compared to period 2 (28974 kcal). The reduction in heat storage in TRT cows is in agreement with increased heat dissipation in this group. Heat storage was significantly less throughout the entire study when cows were supplemented with encapsulated niacin (30.49 vs. 30.54 kcal/kg of body weight; $P<0.05$). Overall, all cows had significantly greater heat storage during period 2 (HS) compared to period 1 (TN) regardless of treatment, as expected when cows are heat stressed (30.59 vs. 30.44 kcal/kg of body weight; $P<0.0001$, Table 3). Although cows in the TRT group did not have significantly less heat storage than cows in the control group there was a numerical difference in that cows on TRT had less heat storage during period 2 than cows in the control group (30.53 vs. 30.66 kcal/kg of body weight; $P<0.06$)

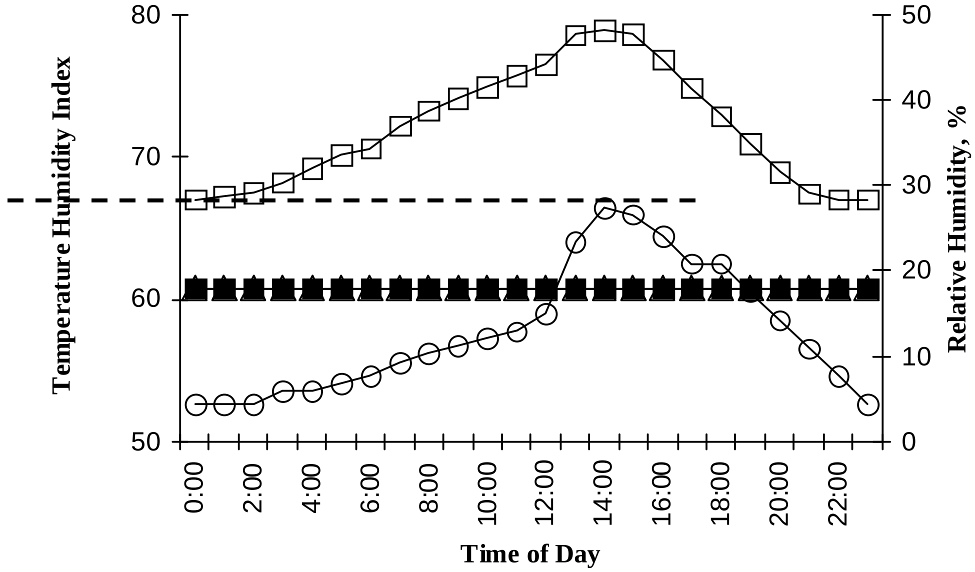


Figure 1. 24 hour circadian patterns for thermoneutral (TN, Period 1) and heat stressed (HS, Period 2) periods.

Key: ○ = THI-TN (Period 1), □ = THI- HS (Period 2), ■ = Relative Humidity-TN (Period 1), Δ = Relative Humidity-HS (Period 2).

----- Line represents 72 THI.

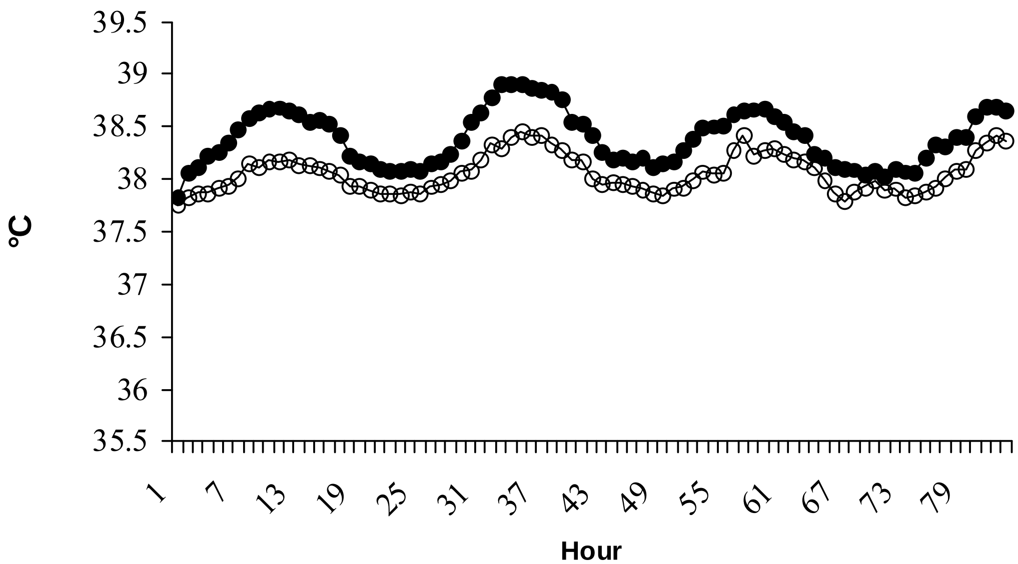


Figure 2. Body core temperatures during period 2 (HS) from day 4 to day 7 period.
Treatment [○]; Control [●]

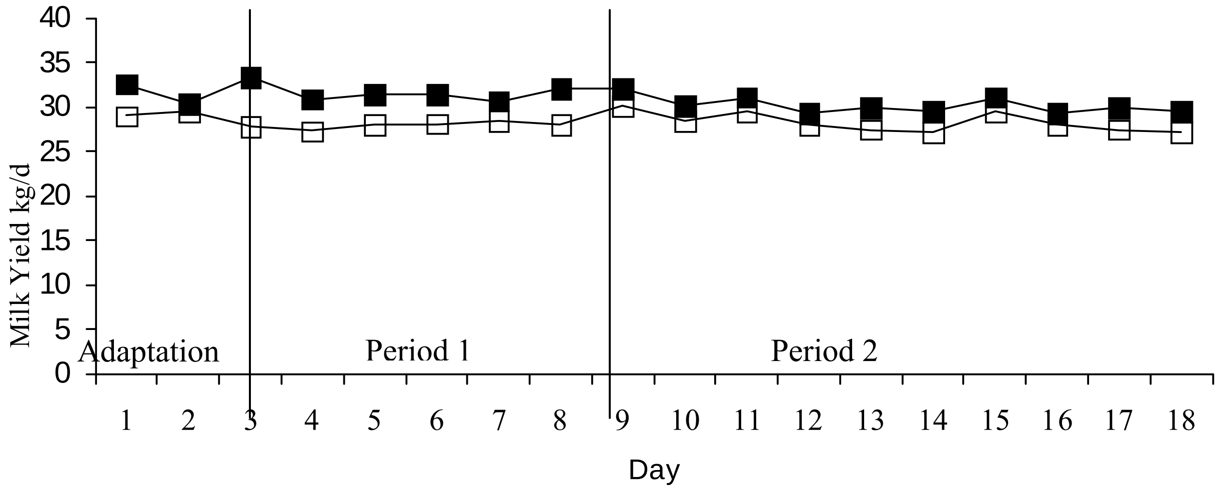


Figure 3. Temporal pattern of milk yield during adaptation, period 1 and 2.

Key: □ = C, ■ = Trt

Table 1. Summary of the dry matter intake, water intake, respiration rate, rectal temperatures, and milk yield.

	Period 1		Period 2		Trt		Period	
Item	**C**	**Trt**	**C**	**Trt**	**SEM**	***P***	**SEM**	***P***
Dry Matter Intake, kg/d	39.1	38.7	38.8	36.7	1.69	0.69	1.74	0.05
Water intake, L/d	89.2	116.4	107.3	127.4	2.24	0.11	1.50	<0.01
Respiration Rate, bpm	30.6	32.5	50.8	54.5	1.78	0.14	2.12	<0.001
Rectal Temperatures, °C	38.01	38.06	38.34	38.17	0.06	0.05	0.07	<0.001
Milk Yield, kg/d	28.4	31.4	28.5	30.4	0.54	0.17	0.32	0.35

C= Control (0g Niashure™)
Trt = Treatment (12g Niashure™)

Table 2. Surface temperatures and evaporative heat loss (EVHL) for shaved and unshaved areas.

	Period 1		Period 2		Trt		Period	
Variable	C[2]	Trt[3]	C	Trt	SEM	P	SEM	*P*
Surface Temperature, °C								
Shoulder, shaved	31.3	30.9	34.3	34.1	0.18	0.62	0.18	<0.01
Shoulder, non-shaved	29.9	29.6	33.4	33.6	0.21	0.32	0.20	<0.001
Rump, shaved	31.4	31.3	34.5	34.5	0.16	0.85	0.17	0.51
Rump, non-shaved	30.4	30.3	33.8	33.7	0.24	0.92	0.21	<0.01
Tail head, shaved	30.5	30.7	33.4	33.7	0.19	0.18	0.19	<0.05
Tail head, non-shaved	28.4	28.5	32.8	32.6	0.28	0.93	0.26	<0.001
EVHL								
Shaved	23.2	18.3	92.4	114.4	5.30	0.11	5.80	<0.001
Non-shaved[4]	18.2	13.1	87.2	101.7	4.93	<0.05	4.79	<0.001

1. Closed chamber evapometer
2. C= Control (0g Niashure™)
3. Trt = Treatment (12g Niashure™)
4. EVHL average for all 4 measurement times

Table 3. Effects of encapsulated niacin on physiological and metabolic parameters.

	Period 1		Period 2		Trt		Period		Trt*Period	
Variable	C[1]	Trt[2]	C	Trt	SEM	*P*	SEM	*P*	SEM	*P*
Average Weight[3], kg	594	603	---------	---------	---------	---------	-------	---------	---------	---------
Average Surface Area[3], m^2	5.54	5.58	---------	---------	---------	---------	-------	---------	---------	---------
Average Total Heat[4], kcal/d	28895	31388	28974	30669	969.40	0.14	730.33	<0.05	1032.84	0.81
Total Stored Heat[5], kcal/d	18073	18361	18223	18405	507.47	0.92	359.24	<0.0001	507.88	<0.10
Mean Body Temperature[6], °C	35.7	35.7	36.9	36.8	0.07	0.45	0.07	<0.0001	0.09	0.43
EVHL kcal/d										
Shaved	74931	60216	297170	370975	19843	0.11	20037	<0.001	26298	<0.10
Non-shaved[7]	58843	42965	279974	330847	20728	0.05	18106	<0.001	24375	<0.10

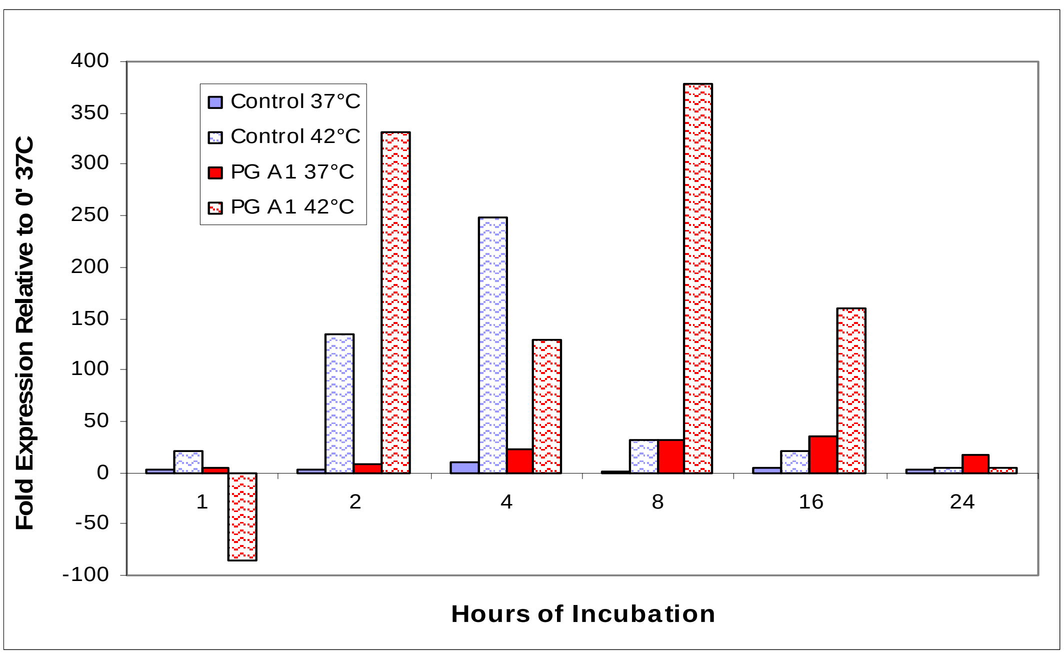
1. C= Control (0g Niashure™)
2. Trt = Treatment (12g Niashure™)
3. over entire trial, not separated by period
4. $=70.5(BW)^{0.734} *1000 + (MY*750 cal/kg)$
5. =Body temperature*Specific heat of tissue(0.8)*Body weight
6. =0.33*Temperature of skin+0.67*rectal temperature
7. EVHL average for all 4 measurement times

Effect of Niacin and Prostaglandins D and E on Heat Shock Protein Gene Expression in Bovine Mammary Epithelial Cells In Vitro

Based on the data evaluating effects of feeding Niashure in the environmental chambers at the University of Arizona, niacin decreased vaginal core temperatures via increasing mechanisms regulating heat dissipation. Niacin, nicotinic acid, is known to induce vasodilatation, therefore transferring the body heat to the peripheral (Di Constanza et al., 1997) and this flushing has been shown to act through prostaglandin D (**PGD**) and the prostaglandin D2 receptor, (Cheng et al. 2006). Researchers have reported niacin decreases skin temperatures during periods of mild to severe heat stress when supplementing cows with 12, 24, or 36 g of raw niacin for three consecutive 17 day periods (Di Constanza et al., 1997).

Another possible protective mechanism of niacin may occur at the cellular level due to an increase in heat shock protein (**Hsp**) production. A cellular stress response is initiated with the onset of thermal stress; more specifically certain heat shock proteins become elevated. These proteins protect cells against heat stress by refolding proteins in the cytoplasm which have been denatured by high temperatures. The expression of Hsp 70 is increased up to 20 fold when subjected to chronic thermal stress. The protective roles of Hsp's during thermal stress are well established (Collier et al. 2007). Kozawa et al. (2001) demonstrated that prostaglandin D_2 increased Hsp 27 production in osteoblasts, however, the Hsp response of other cell types to PGD has not been studied. As stated earlier, PGD is increased by niacin, (Cheng et al. 2006) and could therefore increase Hsp production in other cells as well. Bryantsev et al. (2007) reviewed the role of Hsp 27 in heat shock and reported that this protein acts synergistically with Hsp 70 to refold proteins denatured by heat shock thereby increasing performance and viability of cells. Collier et al. (2007) reported that prostaglandins of the A increased Hsp 70 production in bovine mammary epithelial cells after 8 hrs at 42 ºC in vitro as shown in Figure 4. Furthermore, the increase in Hsp production in response to Prostaglandin A was associated with improved viability of bovine mammary cells in culture

Figure 4. Effect of Heat Shock (42ºC) and Prostaglandin A1 on Heat Shock Protein 70 Production in Bovine Mammary Epithelial Cells In Vitro.



Our next objective was to determine if niacin alone or in combination with PGD and PGE alters gene expression of heat shock proteins 27 and 70 in bovine mammary epithelial cells in vitro. Bovine mammary epithelial cells (BMEC) were cast in collagen in 24-well plates containing growth media (GM) composed of DMEM/F-12, insulin, EGF, IGF-I, BSA and antibiotics at 37°C, 5% CO_2. Cultures grew into ductal structures with media changes at 48 hr intervals. On day 8 cultures were divided into Controls (C) receiving GM, GM with niacin (0.5, 1.0, or 10.0 mM), PGD_2 (10 or 24 uM), PGD_2 with PGE_1 (both at 24uM) alone or in combination with niacin. Half were placed into incubators at 37°C (TN) and the remainder at 42°C (HS) for 8 h. At 0h and 8h, replicates were pooled, placed in TRIzol and stored at -80°C until extracted for RNA. Isolated RNA was reverse transcribed into cDNA. Expression of Hsp's-27 and 70 was measured by q-PCR. Addition of PGD increased HSP-27 and 70 gene expression in HS cultures, (Figures 5 and 6, P<.0001). Peak fold increases in Hsp-70 expression at 8 hr over time zero differed between C and PGD, (-2.4 vs. 9.3, P<.0001) and were greater for Hsp-27 (-115 vs +10, P<.0001). Addition of PGE increased Hsp-27 and 70 expression compared to C and PGD alone (P<.05). We conclude that niacin with PGD or PGD+PGE alters HSP-27 and Hsp-70 gene expression in BMEC during HS.

Figure 5. Effect of Heat Shock (42º) and Prostaglandin A1 and E2 on Heat Shock Protein 70 Gene Expression in Bovine Mammary Epithelial Cells In Vitro.

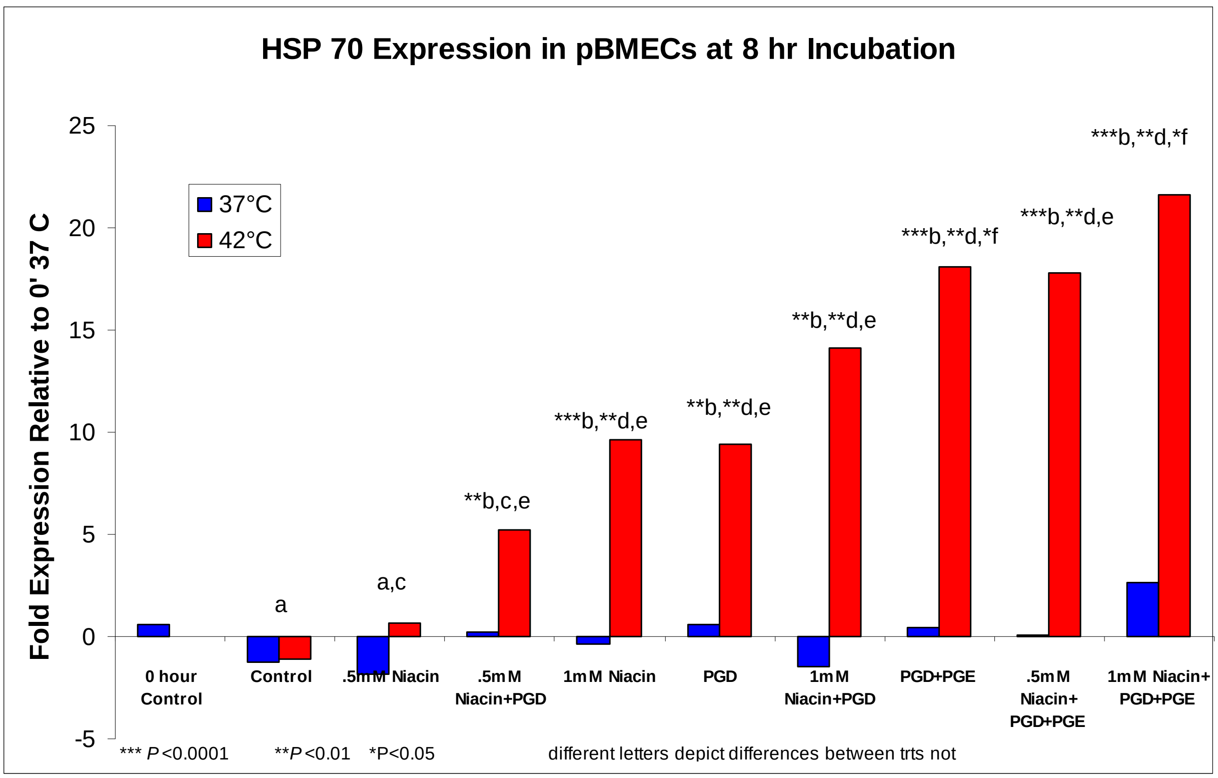
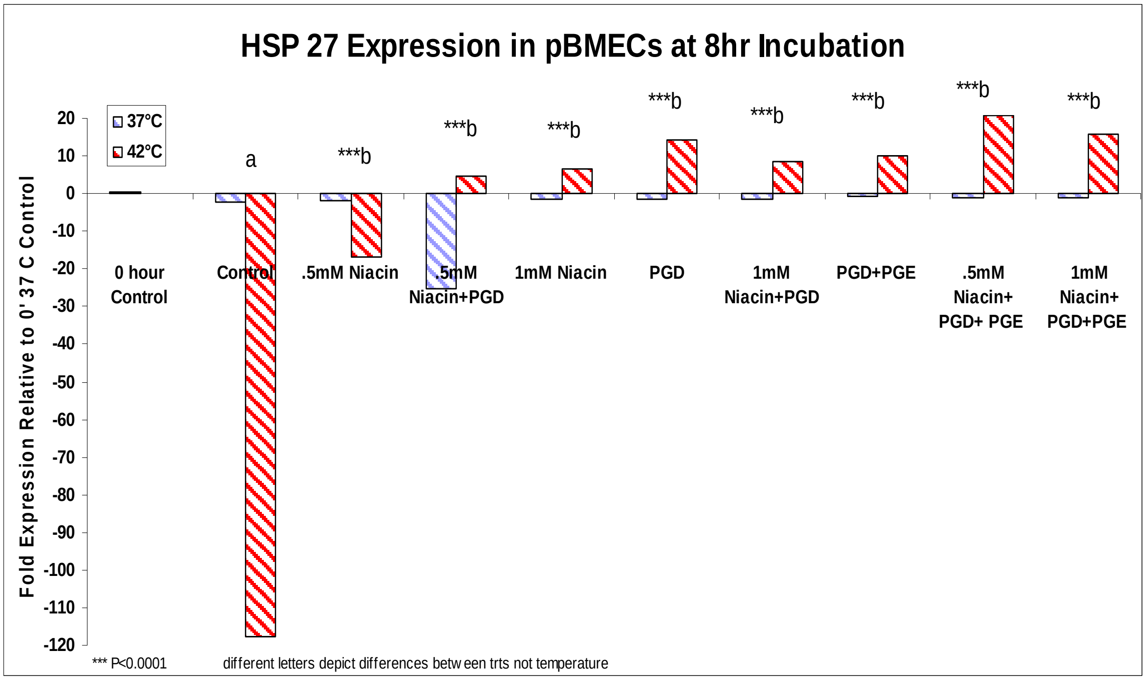


Figure 6. Effect of Heat Shock (42º) and Prostaglandin A1 and E2 on Heat Shock Protein 27 Gene Expression in Bovine Mammary Epithelial Cells In Vitro.



Conclusion

The supplementation of encapsulated niacin increased sweating rates, decreased rectal and vaginal temperatures concluding that increasing vasodilation and shifting blood flow to the periphery alleviates some of the impact of heat stress during acute periods. Collectively, these results support further on-farm studies to examine the role of niacin in protection against thermal stress.

References Upon Request

HIGH COW REPORT
October 2008

MILK

Arizona Owner	Barn#	Age	Milk	New Mexico Owner	Barn #	Age	Milk
*Stotz Dairy	22216	04-00	42,370	*Providence Dairy	5743	6-03	41,590
*Stotz Dairy	20147	05-10	39,950	*Providence Dairy	8341	3-10	39,960
*Stotz Dairy	23023	03-03	39,240	*Opportunity Dairy	4399	4-11	36,960
*Stotz Dairy	23270	03-01	37,810	*Opportunity Dairy	1601	3-11	35,890
*Zimmerman Dairy	1123	06-00	37,710	*Wayne Palla Dairy	------	5-03	35,880
*Shamrock Farms	12003	05-04	37,460	*Providence Dairy	7811	4-03	35,780
*D & I Holstein	4428	04-03	36,130	*Wayne Palla Dairy	-----	5-09	35,740
*Stotz Dairy	21991	04-02	35,990	*Providence Dairy	7269	4-08	35,460
*Stotz Dairy	18668	06-01	35,240	*Providence Dairy	7913	4-01	35,380
*Shamrock Farms	21835	03-01	35,050	Pareo Dairy	6427	4-01	35,328

FAT

*Stotz Dairy	23023	03-03	1,572	*Providence Dairy	5743	6-03	1525
*Stotz Dairy	23270	03-01	1,517	*Wayne Palla Dairy	-----	5-09	1333
*Stotz Dairy	20147	05-10	1,510	*Providence Dairy	7269	4-08	1319
*Stotz Dairy	22216	04-00	1,510	*Tee Vee Dairy	1776	5-06	1303
*Stotz Dairy	18915	05-10	1,496	*Vaz Dairy	4245	4-05	1293
*Stotz Dairy	21991	04-02	1,488	Arrowhead Dairy	4165	2-07	1293
*Stotz Dairy	23330	03-01	1,464	*Vaz Dairy	1024	3-03	1282
*D & I Holstein	4907	03-09	1,460	Tres Hermanos Dairy Llc	1202	7-04	1275
*Stotz Dairy	21992	04-02	1,415	*Vaz Dairy	512	3-01	1272
*Stotz Dairy	18979	05-11	1,399	Pareo Dairy	5804	5-02	1270

PROTEIN

*Stotz Dairy	22216	04-00	1,258	*Providence Dairy	5743	6-03	1312
*Stotz Dairy	20147	05-10	1,160	*Providence Dairy	1205	6-05	1090
*Stotz Dairy	23023	03-03	1,102	*Providence Dairy	8341	3-10	1087
*Stotz Dairy	23270	03-01	1,097	*Wayne Palla Dairy	-----	5-03	1087
*Stotz Dairy	21991	04-02	1,072	*Opportunity Dairy	1601	3-11	1083
*Stotz Dairy	18915	05-10	1,068	*Providence Dairy	7269	4-08	1071
*Shamrock Farms	21835	03-01	1,054	*North Star Dairy, Llc	10505	3-04	1067
*Shamrock Farms	12003	05-04	1,042	Caballo Dairy	7829	6-03	1058
*Shamrock Farms	10737	05-10	1,018	*Wayne Palla Dairy	-----	5-09	1057
*Stotz Dairy	21349	04-10	1,011	*Providence Dairy	7913	4-01	1074

*all or part of lactation is 3X or 4X milking

ARIZONA - TOP 50% FOR F.C.M.[b]
October 2008

OWNERS NAME	Number of Cows	MILK	FAT	3.5 FCM	DIM
*Stotz Dairy West	2,312	28,239	1,031	28,931	231
*Danzeisen Dairy, Inc.	1,775	25,884	932	26,307	204
*Stotz Dairy East	1,151	24,987	911	25,578	243
*Goldman Dairy	2,404	24,836	846	24,458	207
*Zimmerman Dairy	1,260	23,420	833	23,636	206
*Arizona Dairy Company	5,772	22,651	803	23,636	208
*Butler Dairy	622	23,733	820	23,554	
*Shamrock Farms	8,202	24,171	804	23,489	214
*Mike Pylman	7,266	23,301	801	23,065	256
*Withrow Dairy	5,231	22,865	800	22,860	201

NEW MEXICO - TOP 50% FOR F.C.M.[b]
October 2008

OWNERS NAME	Number of Cows	MILK	FAT	3.5 FCM	CI
*Pareo 2	1,701	24,950	914	25,610	13.60
*SAS	2,091	24,513	902	25,226	13.10
*Butterfield	2,199	25,308	873	25,100	13.56
*Milagro	3,481	23,801	874	24,464	13.82
McCatharn	1,129	24,364	849	24,302	13.40
*Vaz	2,130	23,164	859	23,946	14.70
*Clover Knolls	3,433	24,495	823	23,937	12.60
Vaz 2	1,969	22,942	857	23,817	14.00
*Do-Rene	2,344	24,425	809	23,680	11.70
*Providence	3,313	23,348	824	23,458	13.30
*Tallmon	539	21,911	830	22,934	13.70
*Tee Vee	1,113	21,946	812	22,657	14.11
Cross Country	3,490	22,225	803	22,632	13.20
Stark Everett	3,295	22,167	795	22,477	13.60
*Pareo	3,196	22,162	784	22,296	13.50

* all or part of lactation is 3X or 4X milking

[b] average milk and fat figure may be different from monthly herd summary; figures used are last day/month

ARIZONA AND NEW MEXICO HERD IMPROVEMENT SUMMARY FOR OFFICIAL HERDS TESTED October 2008

		ARIZONA	NEW MEXICO
1.	Number of Herds	30	26
2.	Total Cows in Herd	69,109	64,857
3.	Average Herd Size	2,304	2,495
4.	Percent in Milk	86	87
5.	Average Days in Milk	212	203
6.	Average Milk – All Cows Per Day	54.2	63
7.	Average Percent Fat – All Cows	3.6	3.6
8.	Total Cows in Milk	58,535	56,426
9.	Average Daily Milk for Milking Cows	63.9	69.2
10.	Average Days in Milk 1st Breeding	88	76
11.	Average Days Open	173	146
12.	Average Calving Interval	14.6	14.1
13.	Percent Somatic Cell – Low	83	81
14.	Percent Somatic Cell – Medium	12	15
15.	Percent Somatic Cell – High	5	4
16.	Average Previous Days Dry	52	63
17.	Percent Cows Leaving Herd	33	34
	Milk	22,000	20,518
	Percent butterfat	3.60	3.61
	Percent protein	2.98	3.12
	Pounds butterfat	789	838
	Pounds protein	654	691

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Upcoming Event
Arizona Dairy Day - April 2, 2009
Pylman Dairies - Buckeye, Arizona

Arizona Dairy Day Golf - April 3, 2009
Wigwam Golf Club - Litchfield Park, Arizona