

**EFFECT OF HIGH ENVIRONMENTAL
TEMPERATURE ON PRODUCTION AND
HAEMATO-BIOCHEMICAL PARAMETERS OF
INTENSIVELY REARED DAIRY COWS**



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Roll No: 0122/03

Reg. No: 1071

Semester: 603

Session: January- June 2022

**A thesis submitted in the partial fulfillment of the requirements for the degree of
Masters of Science in Physiology**

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December 2023

Authorization

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December 2023

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This is to certify that we have examined the above Master's thesis and have found that is completed and satisfactory in all respects, and that all revisions required by the thesis examination committee have been made

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I dedicate

this small piece of work

to my beloved wife

Acknowledgements

All the praises and earnest sense of gratefulness belongs to the Almighty ALLAH (SWT), the Merciful, the Omnipotent and the Beneficent but the supreme Ruler of the Universe Who enabled me to complete my research work and thesis successfully for the degree of Master of Science (MS) in Physiology.

Cordial cooperation, friendly collaboration, fruitful advice and guidance were received from many persons throughout the experiment. The author is immensely grateful to all of them and regrets for inability to mention every one by name.

The author sincerely desires to express his deepest sense of gratitude to his teacher and research supervisor Professor Dr. Mohammad Rashedul Alam, Department of Physiology, Biochemistry and Pharmacology (DPBP). Chattogram Veterinary and Animal Sciences University (CVASU), Khulshi, Chattogram for his guidance and affectionate feelings during the entire period of research work and preparation of this thesis. The author deems it a proud privilege to acknowledge his gratefulness, heartfelt gratitude and best regards to his venerable research co-supervisor Dr. Md Ridoan Pasha, Assistant Professor, DVM, MS from CVASU, Khulshi, Chattogram for his continuous inspiration, valuable suggestions and instructions and preparation of this thesis.

The author finds his great pleasure to express heartiest appreciation and profound regards to Lieutenant Colonel Mohammad Mizanur Rahman, Commanding Officer, Military Farm Chattogram, Chattogram Cantonment for helping in sample collection by collaborative efforts. The author would like to thank MR. MD. Rafiqul Islam, Technical Officer, DPBP, CVASU, Khulshi, Chattogram, for his active cooperation and kind help.

Last but not least the author expresses his deepest sense of gratitude, cordial respect of feelings to his mother, beloved better half wife for spontaneous blessings, continuous encouragement and dedicated efforts to the author.

Author

December, 2023

Contents

Title	Page
Authorization	ii
Acknowledgements	v
Contents	vi-viii
List of Figures	ix
List of Tables	x
List of Abbreviations	xi
Abstract	xii-xiii
Chapter I: Introduction	1-3
Chapter II: Review of Literature	4-11
2.1. Dairy Production in Bangladesh	4
2.2. Problems of dairy industry	4
2.3. Stresses in dairy cattle	4-5
2.4. Heat stress and its causes	5
2.5. Effect of Heat stress on intensively reared dairy cows	5-6
2.6. Effect of heat stress on physiology and productivity of dairy cattle	6
2.6.1. Effect of heat stress on physiology productivity of dairy cattle	6-7
2.6.2. Effect of heat stress on productivity of dairy cattle	7
2.7. Effect of heat stress on milk production of dairy cattle	8
2.8. Effect of heat stress on milk parameters of dairy cattle	8-9
2.9. Heat stress and physiological changes of dairy cattle	9
2.10. Heat stress and hematological parameters	9-11
2.11. Heat stress and biochemical parameters	11
Chapter III: Materials and Methods	12-26
3.1. Study area	12
3.2. Study period	12
3.3. Selection of cow	12
3.4. Data collection	13
3.4.1. Shed and environmental temperature	13
3.4.2. Rectal temperature (RT)	13
3.4.3. Milk production and parameters	13
3.5. Milk analysis	13

3.5.1. Fat test	13
3.5.1.1. Assay principle	13
3.5.1.2. Materials and reagents	14
3.5.1.3. Procedure	14
3.5.2. SNF test	14
3.5.2.1. Assay principle	14
3.5.2.2. Materials and reagents	14
3.5.2.3. Procedure	15
3.6. Hematobiochemical analysis	15
3.6.1. Collection and preservation of blood sample	15
3.6.2. Hematological test of blood sample	15
3.6.3. Preservation of serum samples	16
3.6.4. Biochemical assay of serum samples	16
3.6.4.1. Carbohydrate assay	16
3.6.4.1.1. Assay Principle	16
3.6.4.1.2. Materials and reagents	17
3.6.4.2. Total protein assay	17
3.6.4.2.1. Assay Principle	17
3.6.4.2.2. Materials and reagents	17
3.6.4.2.3. Procedure	18
3.6.4.3. Albumin assay	18
3.6.4.3.1. Assay Principle	18
3.6.4.3.2. Materials and reagents	18
3.6.4.3.3. Procedure	19
3.6.4.4. Mineral assay	19
3.6.4.4.1. Calcium assay	19
3.6.4.4.1.1. Assay Principle	19
3.6.4.4.1.2. Materials and reagents	19
3.6.4.4.1.3. Procedure	20
3.6.4.4.2. Sodium (Na)	20
3.6.4.4.2.1. Assay Principle	20
3.6.4.4.2.2. Materials and reagents	20
3.6.4.4.2.3. Procedure	21

3.6.4.4.3. Phosphorus assay	21
3.6.4.4.3.1. Assay Principle	21
3.6.4.4.3.2. Materials and reagents	21
3.6.4.4.3.3. Procedure	21
3.6.4.4.4. Chloride (Cl)	22
3.6.4.4.4.1. Assay Principle	22
3.6.4.4.4.2. Procedure	22
3.6.4.4.5. Alanine aminotransferase (ALT)	23
3.6.4.4.5.1. Assay Principle	23
3.6.4.4.5.2. Procedure	23
3.6.4.4.6. Aspartate aminotransferase (AST)	23
3.6.4.4.6.1. Assay Principle	23
3.6.4.4.6.2. Procedure	24
3.7. Statistical analysis	24
Chapter IV: Results	27-32
4.1. Variation in rectal temperature of lactating cows concerning environmental temperature	27-28
4.2. Effect of heat stress on milk production and content	28-29
4.3. Effect of heat stress on Hematological parameters of lactating cows	29-30
4.4. Effect of Heat Stress on Biochemical Parameters	31-32
Chapter V: Discussion	33-37
5.1 Effect of environmental temperature on cow physiology	33
5.1.1 Effect on body temperature	33-34
5.2 Effect of environmental temperature and heat stress on milk	34
5.2.1. Association between milk production and heat stress	34
5.2.2. Effect of heat stress on milk parameters	34-35
5.2.3. Correlation between milk production and milk parameters	35
5.3 Effect of heat stress on Hematological parameters	35-36
5.4 Effect of heat stress on Biochemical parameters	36-37
Chapter VI: Conclusion	38
Chapter VII: Recommendations	39
Chapter VIII: References	40-47
Appendices	48-52
Biography	53

LIST OF FIGURES

Serial No.	Title	Page
Figure 1	Activities performed during the study	26
Figure 2	Schematic layout of the study	27
Figure 3	Map of Chattogram	57

List of Tables

Serial No	Title	Page
Table 1	Rectal temperature (°F) of lactating cows (N=90)	27
Table 2	Average rectal temperature (°F) and environmental temperature in the studied farm (N=90)	28
Table 3	Effect of heat stress on milk production	28
Table 4	Effect of heat stress on milk composition	29
Table 5	Hematological parameters of lactating cows (N= 72)	29
Table 6	Frequency of hematological parameters of lactating cows (N= 72)	30
Table 7	Blood biochemical parameters in lactating cows (N=72)	31
Table 8	Comparison of blood biochemical parameters in lactating cows (N=72)	32

List of Abbreviations

Alb	Albumin
a.m.	Ante meridian
ANOVA	Analysis of variance
Ca	Calcium
CVASU	Chittagong Veterinary and Animal Sciences University
DMI	Dry Matter Intake
DPBP	Department of Physiology, Biochemistry and Pharmacology
DLS	District Livestock Service
dl	Deci liter
gm	Gram
HF	Holstein-Friesian
HDL	High-density lipoprotein
i/v	Intravenous
MS	Master of Science
L	Liter
L-C	LDL cholesterol
LDL	Low-density lipoprotein
Mg	Magnesium
mg	Mili gram
NEFA	Non-Esterified Fatty Acid
NRC	National Research Council
P	Phosphorus
p.m.	Post meridian
Rpm	Rotation per minute
Tg	Triglyceride
TP	Total protein
VLDL	Very low-density lipoprotein
ul	Microliter
°F	Degree Fahrenheit
%	Percentage

Abstract

The dairy sector is one of the most important components of the livestock sector in Bangladesh. The demand of milk for the growing large population in Bangladesh is increasing day by day. The number of dairy farms is increasing gradually as well. Bangladesh is a country situated in sub-tropics and has a hot and humid environment. The seasons of this country vary in the temperature and humidity. The high temperature and humidity of the dairy cow shed and also cow itself can impact on the milk production and blood parameters. However, there is very limited information on the effect of heat stress on the production and blood profile of intensively reared dairy cattle. Therefore, this study was conducted in the intensively reared Chattogram military dairy farm to reveal the effect of heat stress on the production and to know the effect of heat stress on the haemato-biochemical parameters of dairy cattle. For this, a three-month-long study was conducted in Military Farm Chattogram, at Chattogram Cantonment, in Chattogram district. A total of 90 cows were selected based on the lactation at the end the month of February. Lactation-wise production data, the temperature of the ambient, shed, and rectal temperature of each cow were recorded by digital thermometer for three months, from March 2022 to May 2022. The average milk production of each cow as per lactation was calculated in Excel sheets. Milk parameters like fat, solid non-fat (SNF), and total solids (TS) were analyzed weekly in the experimental area. Blood samples were collected from 72 cows for hematological and biochemical assays after the end of the study on May, 2022. Routine hematological parameters were analyzed and a few selected serum biochemical parameters were assayed.

The study revealed that the rectal temperature of cows at 3rd ($101.90 \pm 0.3^{\circ}\text{F}$) and 5th ($101.99 \pm 0.4^{\circ}\text{F}$) lactation increased in the month of April, whereas, increased rectal temperature of 4th lactation ($101.91 \pm 0.4^{\circ}\text{F}$) was observed in cows at May. There was significant difference of rectal temperature between different months of 4th and 5th lactating cows. Results showed that the increased average environmental ($100.21 \pm 0.4^{\circ}\text{F}$) and rectal temperatures ($101.82 \pm 0.4^{\circ}\text{F}$) were observed in May. There was no significant difference between the average rectal temperatures and environmental temperatures of cows at different months recorded during the study period. It was found that, the highest milk production was achieved in all cows of 3rd (12.12 ± 3.53 liter), 4th (12.83 ± 3.26 liter), and 5th (11.71 ± 2.86 liter) lactation during March. However,

average milk production decreased in April and May in all lactation groups and the variation was significant. Milk analysis data showed that the fat% significantly increased in April (3.82 ± 0.19 %) and May (3.99 ± 0.19 %) than March (3.69 ± 0.39 %). Whereas, SNF% significantly decreased in April (8.71 ± 1.53 %) and May (8.58 ± 0.19 %) than March (9.46 ± 0.25 %). Total Solids% insignificantly decreased in April (12.59 ± 1.60 %) and May (12.57 ± 0.27 %).

The hematological analysis revealed that, there was significant variations of white blood cells (WBC) among different lactations with higher number of WBC was found during 5th lactation ($11.50 \pm 3.03 \times 10^3/\mu\text{L}$). Irrespective to months, across the blood samples, all of the hematological parameters were found to be within normal value range; except in case of mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentrations (MCHC) where majority of the cows showed higher than normal (49% and 57% samples, respectively). Blood serum biochemical analysis revealed that glucose, sodium and calcium were found to be higher in the 3rd lactation animals whereas albumin and chloride were higher in the 4th lactation. Total Protein (TP), Phosphorus, ALT (Alanine Transaminase) and AST (Aspartate Transaminase) were higher in 5th lactation animals where AST was significantly higher than other lactation. Phosphorus was found to be higher across all blood samples with 60% samples had higher than normal reference range.

The study can conclude from the findings that the ambient temperature directly affects the body physiology of cows—reflected by the increased rectal temperature and decreased milk production—and the milk components especially SNF and Total solids. It also affects the older cows (5th lactation) than the younger animals (3rd lactation) which is reflected through the changes of hematological parameters (especially WBC) and biochemical parameters (especially AST). Therefore, there could be possible effect of the ambient temperature on the heat stress of dairy cows and optimum environmental temperature is necessary for the better production and body physiology of intensively reared dairy cows.

Keywords: Heat stress, dairy cow, hemato-biochemical analysis, milk production, milk parameters