

RPF-II

**(PROFORMA FOR SUBMISSION OF ANNUAL PROGRESS REPORT OF
RESEARCH PROJECTS)**

PART - I General Information

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RESEARCH PROJECTS**

Part - I General Information

600 Project Code

6001 Institute Project Code No. : XI/PRSM 2.2

6002 ICAR Project Code No. :

601 Name of the Institute and Division

6011 Name and address of Institute: CIRG, Makhdoom, P.O Farah-281122 Distt:
Mathura, U.P.

6012 Name of Division/Section: Physiology, Reproduction and Shelter Management
Division

6013 Location of the Project: C.I.R.G., Makhdoom

**602 Project Title: "Adaptability of Goats and Environmental Aspects Under
Different Production Systems"**

603 Research Approach:

Applied Res./Basic Res./Process or Tech. Devel. / Transfer of Tech.

01

02

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04

604 Specific Area: Environmental Physiology of Goat

605 Duration of Project:

6051 Date of Start of the Project : 2007

6052 Likely date for completion of Project : 2012

6053 Period for which report submitted : 2009-2010

606 Total cost of the project

6061 Expenditure to date Rs (lakhs) : 44.76

607 Summary Achievements

Recording and Analysis of meteorological data

- Data collected on these various meteorological observations during the last 21 years (1987-2007) was analyzed to study the climatic changes at this institute. The overall increase of 1.9 °C in mean temperature has been observed during the last decade (1998-2007) from that of 1987-1997 periods.
- The increase in maximum temperature and minimum temperature during that period was 0.92 °C and 2.84 °C respectively.
- The maximum temperature of June month was highest in 2009 since 1987. The rain fall during June month was nil.

Adaptability of Barbari does under Intensive and Semi-intensive system of management

- Adaptability study on 28 adult female Barbari goats was conducted in intensive and semi-intensive system of management round the year in different seasons of the year.
- Animals were randomly divided in two groups having 14 animals in each group. Cardinal physiological responses were recorded at 15 days interval for 03 consecutive days two times a day, in the morning as well in the afternoon.
- There appeared no difference in the cardinal physiological responses of both the groups except during the evening of the hot dry period.

Safe disposal of goat waste:

- To minimize the health hazards of the workers at commercial goat farms, few types of equipment have been developed for the collection of faecal materials and cleaning of livestock shed.
- A goat cart has been developed for the transportation of the feed and faecal materials, in and around livestock farm.

Effect of solar eclipse on certain serum hormones, enzymes, and minerals of Indian goats under intensive and extensive housing systems

- Four groups (six animals in each group) of adult male and female Barbari goats (weight range 22.0-32.0 kg) were distributed as, Group I (Male Extensive), Group II (Female Extensive), Group III (Male Intensive), and Group IV (Female Intensive).
- On the next day of solar eclipse, TSH level was significantly ($p < 0.05$) increased in group III as compared to others days. However, ALT activity was significantly low on solar eclipse and last day in group I, whereas decreased activity of ALT was recorded in group III and IV at the end of experiment.
- Significantly ($p < 0.05$) high level of Ca in group III and ALP in group I and III was recorded on solar eclipse day and was persistent at the end of experiment.

- We did not observed any changes in level of TSH, T₃, T₄, ALP, Ca, and P in group II and IV. Similarly, there was no variation in TSH, T₄, Ca, P level in group I and P, T₄ in group III due to solar eclipse.

608 key words: Commercial goat farming.

PART -II Investigator Profile

(Please identify clearly changes, if any in project personnel)

610 Principal Investigator

6101 Name: **Dr Puneet Kumar (Up to 9th April 2010)**

Dr R.P. Misra (From 10th April)

6102 Designation: Principal Scientist

6103 Division/Section: PRSM

6104 Location: CIRG, Makhdoom

6105 Institute Address: CIRG, Makhdoom, P.O. Farah - 281 122, Mathura (UP)

611 Co-investigator

6111 Name: **R.P. Misra**

6112 Designation: Principal Scientist

6113 Division/Section: PRSM

6114 Location: CIRG, Makhdoom

6115 Institute Address: CIRG, Makhdoom, P.O. Farah - 281 122 , Mathura (UP)

612 Co-investigator

6121 Name: **Dr S.P. Singh**

6122 Designation: Scientist

6123 Division/Section: PRSM

6124 Location: CIRG, Makhdoom

6125 Institute Address: CIRG, Makhdoom, P.O. Farah - 281 122, Mathura (UP)

PART-III: Technical Details

PART-III: Technical Details

620 Introduction and objectives

6201 Immediate objectives:

1. To study the thermoregulatory characteristics of goats under intensive and semi-intensive production systems.
2. To study the metabolic profile of goats under intensive and semi-intensive production systems.
3. To study the emission of green house gases from goats under the semi-intensive and intensive production systems.
4. To study the safe disposal of goat waste.

6202 Long term objectives:

1. To generate the knowledge on the impact of environment on different goat production systems for commercial goat farmers.
2. To examine the effect of intensive goat production on environment.

6203 Specific objectives for the year as detailed in RPF-I

2009-10 (3rd Year)

- Recording of macro and micro-environmental data.
- Recording of data on thermoregulatory characteristics in pregnant does and kids.
- Blood biochemical studies in pregnant does and kids.
- Studies on green house gases.
- Studies on waste management.
- Report writing.

621 Project Technical Profile

6211 Technical programme

(Indicate briefly plan of procedure, techniques, instruments and special materials, organisms, special environment etc.)

Please refer annexure I enclosed herewith.

6212 Man-months involvement of component project workers for the specified year

Sl. No	Staff	Man-months
1.	Scientific	7.5
2.	Technical	5.0
3.	Supporting	5.0

622 Progress of work

6221 Achievement in terms of targets fixed for each Activity
Kindly refer enclosed annexure 1

6222 Questions- Answered

Adaptability of different goat breeds under different production systems and environments.

6223 Process/Product/Technology developed during the year:

Different mechanisms utilized by different breeds of goats to ameliorate extra body heat during different seasons of the year.

6224 Utility of results obtained so far:

Adaptability of goats to variable type of climate. The data will be helpful in climate change studies on goats.

621 Project Technical Profile

6211 Technical programme

(Indicate briefly plan of procedure, techniques, instruments and special materials, organisms, special environment etc.)

- Daily maximum-minimum temperature, mean daily temperature, sun-shine, rainfall, wind direction, relative humidity vapor pressure, Dry bulb and wet bulb temperature has been recorded three times in a day.
- Micro-environmental climatic variables like temperature, RH, vapour pressure etc. has been recorded daily in different seasons for various shed (convertible shed with thatch panel and asbestos roof shed) three times in a day.
- Adaptability study on 16 Barbari and 12 Sirohi bucks was conducted in intensive and semi-intensive system of management round the year in different seasons of the year.
- 08 Barbari and 06 Sirohi bucks were taken in each system of management.
- Cardinal physiological responses were recorded at 15 days interval for three consecutive days two times a day (morning and afternoon). Body weights of all the animals were recorded monthly.

623 Publications and Material Development

(One copy each to be supplied with this proforma)

6231 Research Papers:

- I. Bhooshan Neeru, Kumar Puneet, and Yadav, M. C. (2010). Micro- minerals status in goats of different age in semi arid region of India. *Indian Journal of Animal Sciences* **80(3)**: 258-261.

- II. Bhooshan Neeru, Kumar Puneet, and Yadav, M. C. (2010). Effect of age and reproductive state on phosphatase enzymes and steroid hormones profile in Indian goats. *Indian Journal of Animal Sciences* 80(4): 321-325.
- III. Bhooshan Neeru, Kumar Puneet, and Yadav, M. C. (2010). Changes in plasma metabolites, enzymes and minerals from birth to sexual maturity in goats. *Indian Journal of Animal Sciences* 80(5): 422-427.
- IV. Bhooshan Neeru, Kumar Puneet, Singh, S.K. and Yadav, M. C. (2010). Status of thyroid hormones in blood plasma of goats at different ages and their correlation with other biochemical parameters. *Indian Journal of Animal Sciences* (Accepted).
- V. Bharti, V. K.; Singh, S.P.; Kumar Puneet; Misra R.P. and Bhavna N. (2009). Effect of solar eclipse on certain serum hormones, enzymes and minerals of India goats under intensive and extensive housing systems. (Submitted for publication in foreign Journal)

6232 Popular articles:

- I. Puneet Kumar, Deepti Paliwal and Mahesh Chandra Sharma (2009). Pashuon mein Methane Gas Ka Utsarjan va Uske Kam Karne ke Upay (Emission of Methane gas in Animals and means of its reduction). *Ajamukh*, A Hindi quarterly publication of CIRG. Makhdoom.
- II. Singh, S.P.; Vijay K. Bharti. Puneet Kumar, R.P. Mishra and M.C. Sharma (2009). Effect of solar eclipse on behavior of goats. *ICAR News Vol 15(3)* July-September 2009 pp.19.
- III. Puneet Kumar (2009). Jalvau Parivartan ka Bakrion per prabhav. In: a six monthly magazine *Pashu Chikitsa Vigyan* (Vol. no.1(2), July -December, 2009). Published by the Joint Directorate of Extension Education, IVRI Izatnagar-243 122, India. Pp.13-15.
- IV. Puneet Kumar, S.P. Singh, V.K. Bharti, Bhawna Nimbarc, R.P. Misra and M.C. Sharma (2009). Effect of Solar Eclipse on goats. Wide coverage in *Amar Ujala* and *Dainink Jagran* of July 22, 2009

6233 Reports:

- 1- Singh S.P.; Vijay K. Bharti; Puneet Kumar, R.P.Misra and M.C. Sharma (2009). Effect of solar eclipse on behavior of goats. *ICAR NEWS Vol 15(3)* July-September.

6234 Seminars and workshops (relevant to the project) in which the scientists have participated

- 1- R.P. Misra, S.P. Singh and Puneet Kumar. 2009. Construction of houses for improving the productivity of small ruminants. In a National Seminar on importance of post harvest processing of agricultural products in rural

- development. Central Institute of Post Harvesting Engineering and Technology Institute, Ludhiana, November 13-14, 2009.
- 2- Bharti, Vijay K.; Singh S.P.; Kumar Puneet, Misra R.P. and Bhawana, N. (2009). Effect of solar eclipse on behavioral changes in kids and adult goats. National Seminar on "Dimension of Climate Change Affecting Education and Research Agenda for Livestock Health and Production" and Colloquy on "Quality Deliverance of New Under-Graduate Veterinary Course Curriculum" on September 24th 2009 at Pandit Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Gau Anusandhan Sansthan (DUVASU), Mathura. pp 68.
 - 3- Paliwal, D.; Kumar Puneet and Singh S.P. 2009. Mining, classification, distribution of the heat shock proteins and variation in the amino acid frequency and their different isoforms among goats, sheep and cow. National Seminar on "Dimension of Climate Change Affecting Education and Research Agenda for Livestock Health and Production" and Colloquy on "Quality Deliverance of New Under-Graduate Veterinary Course Curriculum" on September 24th 2009 at Pandit Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Gau Anusandhan Sansthan (DUVASU). Mathura. pp 23.
 - 4- R.P. Misra, S.P. Singh and Puneet Kumar. 2009. Construction of houses for improving the productivity of small ruminants. In a National Seminar on importance of post harvest processing of agricultural products in rural development. Central Institute of Post Harvesting Engineering and Technology Institute, Ludhiana, November 13-14, 2009.
 - 5- R.P. Misra, Singh. S.P., Kumar Puneet and N Ramachandran. 2010. Issues related to livestock housing. Interaction meeting between scientists of CIAE, Animal Science and Fishery Institutes of ICAR, January 11-12, 2010 at CIAE Bhopal.
 - 6- Misra R.P., Singh S. P. and Ramachandran N. 2010. Shelter management for sheep and goats for mitigating climatic stress. National Seminar on Stress management in small ruminant production and product processing. Indian society of Sheep and Goat Production and Utilization, Jaipur, January 29-31, 2010.

625 Infrastructural facilities developed

Installation and standardization of psychometric chamber.

Renovation of meteorological observatory and replacement of old equipments with new one.

Renovated the convertible shed module to conduct experiments of goat shelters.

Various equipments, glass ware and plastic wares purchased.

PART-IV Project Expenditure
(Summary)
Year: 2009-10

630 Recurring Expenditure

6301 Salaries (Designation with pay scale)

Designation	Pay scale	Man-months	Amount (Rs. in Lacs)
Scientific			
Principal Scientist	Pay band IV	6+ 6	10.50
Scientist	Pay band III	6	2.34
Technical and Supporting			
T,II-3		12	2.50
Supporting		12	1.88
wages		12	1.46
Sub Total			18.68

6302 Consumable (Rs in Lakh)

(i) Chemical		
(ii) Glassware		
(iii) Others		2.25
Sub Total		2.25

6303 Travel		0.15
6304 Miscellaneous (Other costs)		2.60
6305 Sub total (Recurring)		23.68

631 Non recurring expenditure :

0.02

632 Total
(630 and 631)

23.70

Rpmisza
31.5.10.
Signature of Project Investigator

Co-investigators: ~~*[Signature]*~~
31.5.10.

Signature & Comments of the Head
of the Division/Section

*The progress of the project is
Very Good and as per the
technical programme of the project.*

Rpmisza
1.6.10.

Signature & Comments of the
Joint Director (Research)

Signature & Comments of the
Director.

ANNEXURE-I

Project No. XI/PRSM 2.2

Title: **Adaptability of Goats and Environmental Aspects under Different Production Systems**Principal Investigator: Dr Puneet Kumar (Up to 9th April 2010)
Dr R.P. Misra (From 10th April)Co-investigators: Dr. R.P. Misra
Dr. S.P. Singh**A. Meteorological Observations at C.I.R.G. Makhdoom:**

The meteorological observations recorded during 2008-09 at C.I.R.G. Makhdoom have been given in Table 1. It was revealed that the in contrary to month of June 2008 which experienced the lowest maximum temperature (37°C), June 2009 experienced highest maximum temperature (44.08°C) during the last 21 years. The rain fall during June 2009 was nil which has not been observed since 1992. During last year it was 58.00 mm.

Table 1: Meteorological Observations at C.I.R.G. Makhdoom from April 2009 to March 2010

Months	Mean Max Temp. (°C)	Mean Min. Temp. (°C)	Mean Daily Temp. (°C)	Mean Vapor Pressure (mmHg)	Mean RH (%)	Mean Rain Fall (mm) /Wet Days	Sun Shine (hrs)
April 2009	41.95	21.10	31.53	9.37	24.18	9.6/1	293.2
May 2009	43.25	24.33	33.79	15.91	35.75	21.4/6	294.3
June 2009	44.08	27.27	35.68	14.96	28.97	Nil	288.8
July 2009	38.31	26.32	32.31	24.63	65.59	82/8	230.8
August 2009	37.52	26.11	31.81	24.53	67.28	114/8	218.3
September 2009	36.98	23.73	30.36	22.53	64.17	49/6	253
October 2009	35.63	17.92	26.77	14.85	39.53	24/1	254.3
November 2009	29.98	12.93	21.46	12.76	62.11	24/2	201.1
December 2009	26.26	7.97	17.11	10.26	65.65	Nil	201.4
January 2010	19.95	6.76	13.35	10.00	85.03	12/1	131.8
February 2010	27.43	10.71	19.07	12.00	61.46	6/2	232.4
March 2010	42.00	22.00	32.00	11.00	27.00	Nil	295

Maximum temperature: 47.5 °C on 25.6.2009

Minimum temperature: 2°C on 12.01.2010

Annual Rain Fall: 342.00 mm

The average annual rainfall has decreased to 342.00 mm in 35 wet days during the last decade from 487.81 mm in 38.18 wet days during 1999. The maximum rainfall of 796.2 mm in 39 days was recorded at this place in 1992 and minimum rainfall of 252.7 mm in 39 days was recorded in 2001.

Table 2: Temperature and rainfall pattern in the month of June since 1987 to 2009.

Year	Max. temp. (°C)	Min. temp. (°C)	Mean daily temp. (°C)	Rainfall (mm)
1987	42.96	26.00	34.50	20.2
1988	39.75	24.28	32.02	49.0
1989	39.77	24.67	32.20	29.0
1990	41.41	25.68	33.60	0.0
1991	41.20	25.30	33.30	0.0
1992	42.50	25.83	34.20	22.6
1993	41.27	25.30	33.30	7.4
1994	41.25	27.07	34.20	7.4
1995	42.50	27.02	34.80	47.2
1996	37.39	25.13	30.20	164.0
1998	41.00	29.08	35.00	53.0
1999	40.75	27.61	34.20	23.6
2000	39.58	27.35	33.50	55.4
2001	37.05	27.73	32.40	56.0
2002	41.47	28.87	35.20	5.8
2003	42.37	29.87	36.10	52.0
2004	39.57	27.88	33.70	32.0
2005	42.77	29.52	36.10	3.8
2006	39.75	27.38	33.60	45.0
2007	42.92	28.43	35.70	71.0
2008	37.00	25.37	31.20	58.0
2009	44.08	27.27	35.68	0.00

C. Adaptability of Barbari does under Intensive and Semi-intensive system of management

Adaptability study on 28 adult female Barbari goats was conducted in intensive and semi-intensive system of management round the year in different seasons of the year. Animals were randomly divided in two groups having 14 animals in each group. Cardinal physiological responses were recorded at 15 days interval for 03 consecutive days two times a day, in the morning as well in the afternoon. There appeared no difference in the cardinal physiological responses of both the groups except during the evening of the hot dry period.

Comfortable period

Physiological Responses	Morning		Evening	
	Intensive	Semi-intensive	Intensive	Semi-intensive
HR	92.31 ^A ±2.38	91.29 ^A ±1.63	106.28 ^B ±1.84	107.13 ^B ±0.99
RR	26.13 ^A ±1.87	23.68 ^A ±1.25	43.53 ^B ±2.47	39.62 ^B ±1.82
RT	37.95 ^A ±0.11	37.90 ^A ±0.11	38.82 ^B ±0.11	38.92 ^B ±9.11

Hot dry period

Physiological Responses	Morning		Evening	
	Intensive	Semi-intensive	Intensive	Semi-intensive
RT	38.49 ^A ±7.33	38.25 ^A ±0.13	39.45 ^B ±0.18	38.99 ^C ±0.09
RR	30.42 ^A ±0.75	26.80 ^A ±1.74	54.57 ^B ±4.23	39.34 ^A ±5.82
HR	85.09 ^A ±4.42	86.33 ^A ±1.19	102.03 ^B ±3.34	94.97 ^A ±2.03

Cool Period

Physiological Responses	Morning		Evening	
	Intensive	Semi-intensive	Intensive	Semi-intensive
RT	37.38 ^A ±4.99	37.33 ^A ±8.33	39.00 ^B ±9.74	39.04 ^B ±0.11
RR	19.06 ^A ±0.38	19.10 ^A ±0.48	49.83 ^B ±7.42	39.63 ^B ±4.01
HR	84.42 ^A ±1.60	86.72 ^A ±1.67	106.71 ^B ±1.76	107.28 ^B ±1.27

Effect of solar eclipse on certain serum hormones, enzymes, and minerals of Indian goats under intensive and extensive housing systems

Four groups (six animals in each group) of adult male and female Barbari goats (weight range 22.0-32.0 kg) were distributed as, Group I (Male Extensive), Group II (Female Extensive), Group III (Male Intensive), and Group IV (Female Intensive). On the next day of solar eclipse, TSH level was significantly ($p < 0.05$) increased in group III as compared to others days. However, ALT activity was significantly low on solar eclipse and last day in group I, whereas decreased activity of ALT was recorded in group III and IV at the end of experiment. Significantly ($p < 0.05$) high level of Ca in group III and ALP in group I and III was recorded on solar eclipse day and was persistent at the end of experiment. We did not observed any changes in level of TSH, T₃, T₄, ALP, Ca, and P in

group II and IV. Similarly, there was no variation in TSH, T₄, Ca, P level in group I and P, T₄ in group III due to solar eclipse. Interestingly, T₃ was significantly decreased on solar eclipse day and on last day of experiment in group III. However, T₃ was significantly increased on before the solar eclipse and decreased on solar eclipse day and again significantly increased in group I.

Table: change in serum thyroid stimulating hormone (TSH), T₃, T₄ of goats in Different Groups.

Group	Days				
	1	2	3	4	5
TSH (μIU/ml)					
I	0.37 ±0.18	0.42 ±0.33	0.51 ±0.34	1.22 ±0.43	1.04 ±0.35
II	0.10 ±0.05	0.11 ±0.03	0.11 ±0.06	0.40 ±0.19	0.19 ±0.06
III	0.15 ^a ±0.20	0.16 ^a ±0.10	0.22 ^a ±0.13	0.17 ^a ±0.14	0.46 ^b ±0.07
IV	0.44 ^{a,b} ±0.08	0.64 ^b ±0.20	0.17 ^a ±0.20	0.57 ^{a,b} ±0.25	0.16 ^{a,b} ±0.08
T₃ (ng/ml)					
I	1.64 ^a ±0.17	1.49 ^a ±0.39	2.14 ^b ±0.13	1.58 ^a ±0.22	2.59 ^b ±0.28
II	1.80 ±0.27	1.82 ±0.79	1.78 ±0.24	1.98 ±0.21	1.70 ±0.22
III	1.11 ^{a,b} ±0.16	0.84 ^a ±0.25	1.46 ^b ±0.18	0.83 ^a ±0.08	0.78 ^a ±0.17
IV	1.92 ^b ±0.27	1.51 ^{a,b} ±0.16	1.69 ^{a,b} ±0.09	1.29 ^a ±0.12	1.43 ^{a,b} ±0.09
T₄ (ng/ml)					
I	153.50 ^c ±10.37	144.00 ^c ±15.47	108.80 ^b ±18.06	148.40 ^c ±9.87	69.50 ^a ±7.72
II	146.00 ^b ±13.64	90.00 ^c ±6.58	136.40 ^b ±7.65	120.00 ^b ±8.00	79.00 ^a ±16.46
III	135.00 ^c ±13.50	122.00 ^c ±14.07	72.80 ^b ±5.08	126.40 ^c ±13.26	54.00 ^a ±5.35
IV	125.00 ^b ±6.61	85.75 ^a ±12.92	102.40 ^a ±5.23	121.60 ^{a,b} ±9.89	101.50 ^{a,b} ±19.80

Values (n=6; Means ±S.E) in the same row bearing no superscript (^{a, b, c}) common vary significantly (p<0.05).

Table: Changes in serum alkaline phosphatase (ALP) and alanine aminotransferase (ALT) activity of goats in different groups.

Group	Days				
	1	2	3	4	5
ALP (KA)					
I	2.92 ^a ±0.41	4.21 ^a ±0.66	7.72 ^b ±0.45	7.34 ^b ±0.42	10.80 ^c ±0.33
II	6.84 ^a ±0.62	8.32 ^b ±0.43	10.13 ^{b,c} ±0.92	10.55 ^c ±0.28	9.74 ^{b,c} ±0.87
III	5.22 ^a ±0.63	7.63 ^b ±0.41	6.67 ^b ±0.65	12.72 ^d ±0.23	10.77 ^c ±0.42

IV	4.92 ^a ±0.42	8.78 ^b ±0.65	9.10 ^b ±0.41	10.36 ^b ±0.48	8.92 ^b ±0.55
ALT (IU/L)	154.24 ^c ±5.46	102.03 ^b ±4.69	65.99 ^a ±2.35	74.43 ^a ±3.67	73.39 ^a ±3.86
I					
II	113.91 ^d ±3.13	98.10 ^c ±6.98	71.02 ^b ±4.26	59.84 ^a ±1.85	52.35 ^a ±5.12
III	87.07 ^b ±3.34	76.93 ^b ±4.84	63.66 ^a ±1.59	75.32 ^b ±2.90	63.25 ^a ±4.31
IV	86.44 ^b ±6.12	89.89 ^b ±5.94	68.18 ^a ±3.17	76.70 ^{a,b} ±5.95	67.40 ^a ±4.10

Values (n=6; Means ±S.E) in the same row bearing no superscript (^{a, b, c, d}) common vary significantly (p<0.05).

Table: Changes in serum calcium (Ca) and phosphorus (P) level of goats in different groups.

Group	Days				
	1	2	3	4	5
Ca (mg/dL)	4.31 ^a ±0.58	6.95 ^b 10.29	6.41 ^b ±0.45	6.66 ^b ±0.52	6.25 ^b ±0.55
I					
II	6.25 ^a ±0.49	5.94 ^a ±0.35	6.25 ^a ±0.31	6.88 ^a ±0.42	5.69 ^a ±0.32
III	5.79 ^a ±0.65	6.13 ^a ±0.56	5.99 ^a ±0.36	7.40 ^b ±0.48	7.28 ^{a,b} ±0.30
IV	5.64 ^a ±0.40	6.36 ^{a,b,c} ±0.37	6.11 ^{a,b} ±0.28	6.74 ^{b,c} ±0.28	7.05 ^c ±0.27
P (mg/dL)	2.44 ^a ±0.16	2.36 ^a ±0.18	2.74 ^{a,b} ±0.20	2.77 ^{a,b} ±0.21	3.10 ^b ±0.26
I					
II	3.59 ^a ±0.41	2.96 ^a ±0.30	3.35 ^a ±0.19	3.20 ^a ±0.31	2.72 ^a ±0.17
III	3.34 ^a ±0.18	4.01 ^b ±0.24	3.19 ^a ±0.30	3.15 ^a ±0.36	3.10 ^a ±0.35
IV	3.77 ^b ±0.24	3.72 ^b ±0.27	3.00 ^{a,b} ±0.28	2.58 ^a ±0.19	3.32 ^{a,b} ±0.36

Values (n=6; Means ±S.E) in the same row bearing no superscript (^{a, b, c}) common vary significantly (p<0.05).