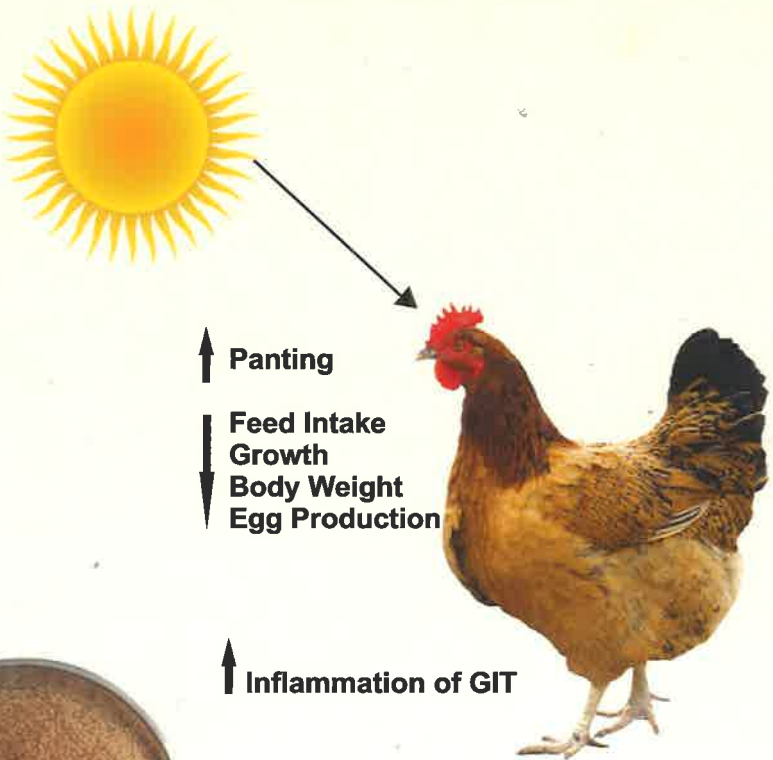
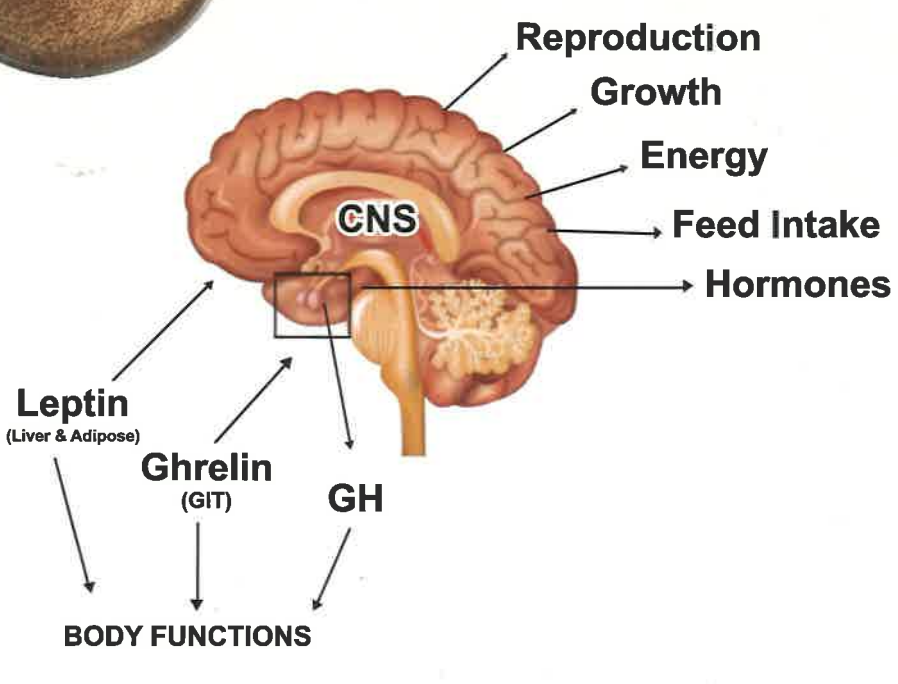
भाकृअनुप - कुक्कुट अनुसंधान निदेशालय
ICAR - DIRECTORATE OF POULTRY RESEARCH
राजेन्द्रनगर, हैदराबाद-५०० ०३०. -Rajendranagar, Hyderabad-500030.

HEAT STRESS: EFFECTS AND MODULATION IN LAYER CHICKENS





- **PD 3 line is an improved variety of Dehlam Red at our institute .**
- **It comes under layer category.**
- **It lays brown coloured eggs with annual production of 180-200 eggs.**

- **Nicobari is an indigenous bird originated in Andaman and Lakshadeep islands.**
- **It comes under layer category.**
- **It lays white coloured eggs with annual production of 160-180 eggs.**

Heat stress decreases

- Body weight gain
- *Feed* intake
- *Laying rate*
- *Average egg mass*
- *Egg production Shell thickness and*
- Feed efficiency

Fermented Yeast culture: Saccharomyces *cerevisiae,* yeast grown on a media of ground yellow corn, hominy feed, corn gluten feed, wheat middlings, rye middlings, diastatic malt and corn syrup, and cane molasses.

Feed ingredient produced by fermenting selected liquid and cereal grain, raw ingredients with bakers yeast (Saccharomyces *cerevisiae*) and drying the entire culture-media without destroying the yeast factors, B-vitamins and other nutritional fermentation products.

Supplementation of a ***Saccharomyces cerevisiae* fermentation product** has also been shown **to improve feed efficiency, phosphorus utilization, and egg quality in poultry**. These products can be **beneficial for maintaining a stable intestinal environment, Improves intestinal immunity**

YC supplementation on broiler **performance** was more apparent during the grower period. In addition, significant **improved digestibility** was also observed during the grower period

METHODOLOGY

- Two groups of PD 3 line (DehlamRed) and Nicobari birds were maintained.
- Each group- 50 birds , Ten replicates with 5 birds in each replicate.
- Control Group was offered ad libitum devoid of FYC based on Maize & Soyabean
  Supplemented group ----- Fermented yeast culture(SC) 0.7g/kg feed
- Supplementation was initiated at 16 weeks itself till 32 weeks of age.
- Laying period – 26-32 weeks of age (Coincided with post summer period)
- Summer duration- eight weeks-21st April- 20 th June (Temp. inside the shed 29)
- Blood samples were collected at weekly intervals only during summer period. body weight was recorded at fortnight intervals during and post summer.
- In blood plasma : Hormones, leptin, Ghrelin and GH were estimated.
- Metabolites : Melandialdehyde, Cholesterol
- Enzyme – AMP Kinase (energy sensor)
- Gene expression studies : Expression of mentioned hormone receptors and genes

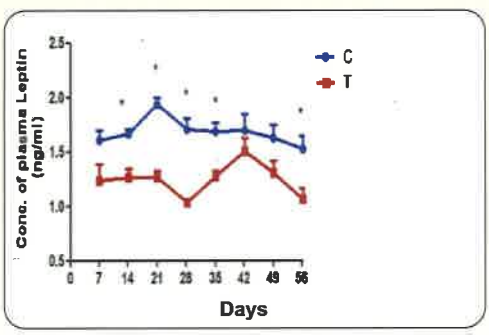


Fig-a

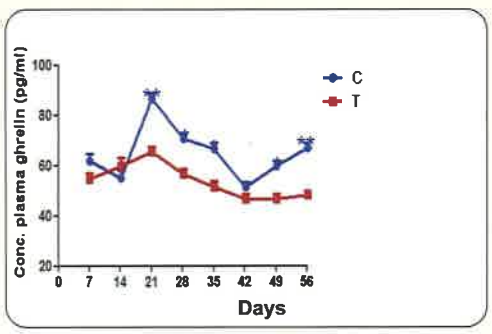


Fig-b

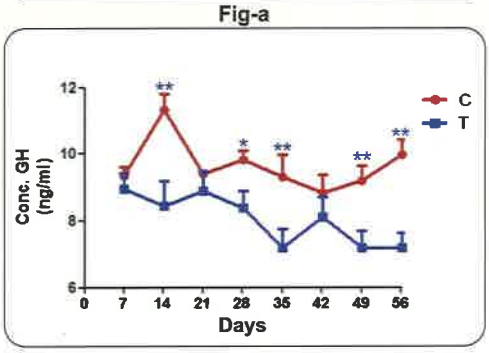


Fig-c

Profile of plasma a) Leptin, b) Ghrelin and c) GH during summer season (8 weeks). C-Control, T-Treatment, Age of the birds-16-23 weeks, *P<0.05. Supplementation of FYC , decreased higher level of plasma hormones in PD3 chickens

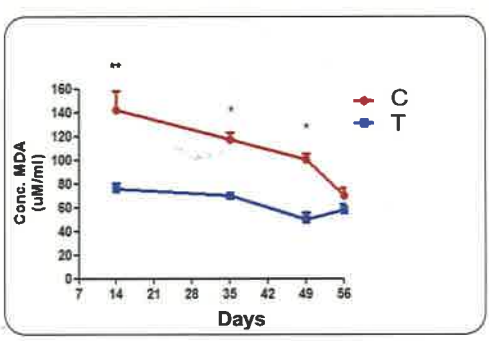


Fig-d

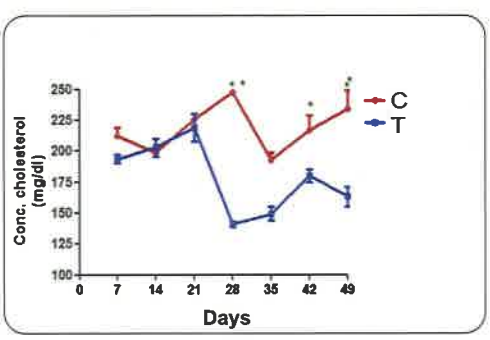


Fig-e

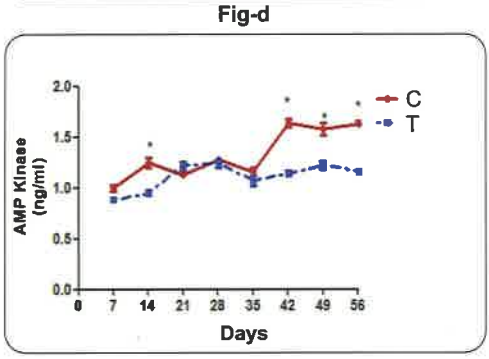


Fig-f

Supplementation of FYC decreased higher level of plasma d) MDA, e) Cholesterol and f) AMP kinase in PD3 chickens during summer season. Age- 16 - 23 weeks, C-Control, T-Treatment *P<0.05,**P<0.01.

EFFECT OF SUPPLEMENTATION OF FYC ON PHYSIOLOGICAL PARAMETERS IN NICOBARI CHICKENS DURING SUMMER SEASION

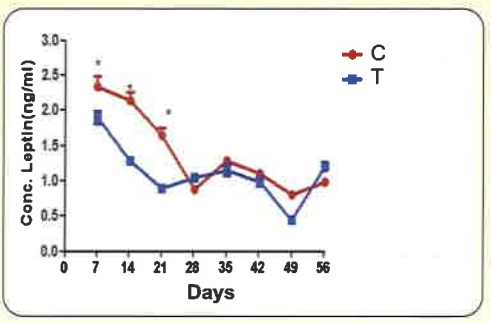


Fig-a

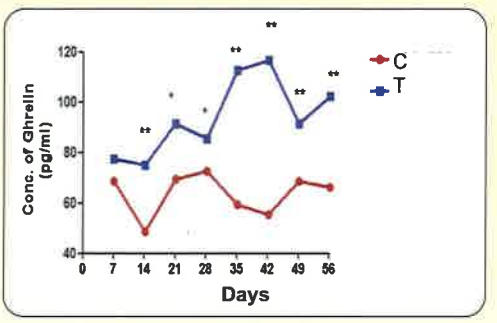


Fig-b

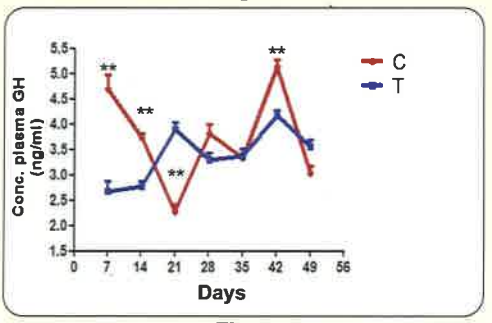


Fig-c

Fig Profile of plasma a) Leptin, b) Ghrelin and c) GH during summer season (8 weeks). C-Control, T-Treatment, Age of the birds-16-23 weeks, *P<0.05, **P<0.01. Supplementation of FYC , decreased higher level of plasma hormones in Nicobari chickens.

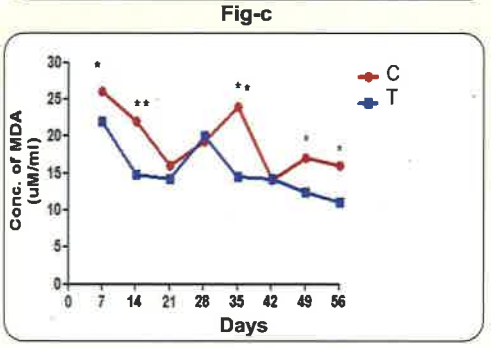


Fig-d

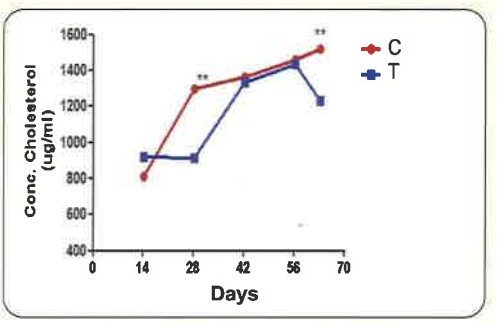


Fig-e

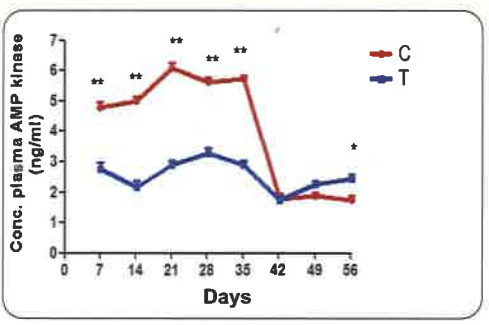


Fig-f

Supplementation of FYC decreased higher level of plasma d) MDA, e) Cholesterol and f) AMP kinase in Nicobari chickens during summer season. C-Control, T-Treatment. Age- 17 - 24 weeks, *P<0.05, **P<0.01

EFFECT OF SUPPLEMENTATION OF FYC ON BODY WEIGHT AND FEED INTAKE IN PD3 & NICOBARI CHICKENS DURING & POST SUMMER SEASION

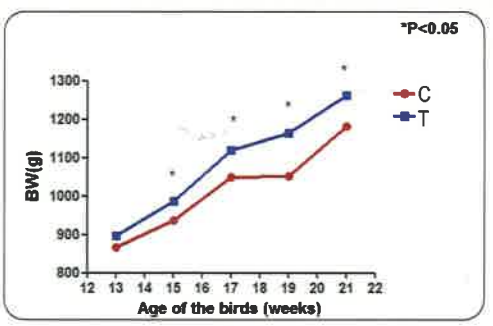


Fig-a

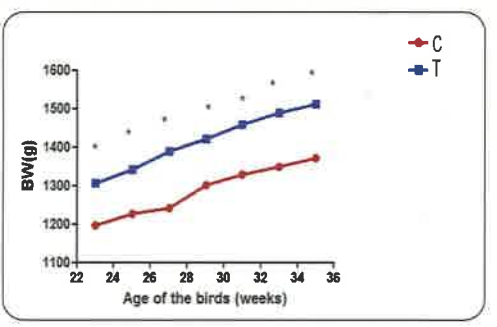
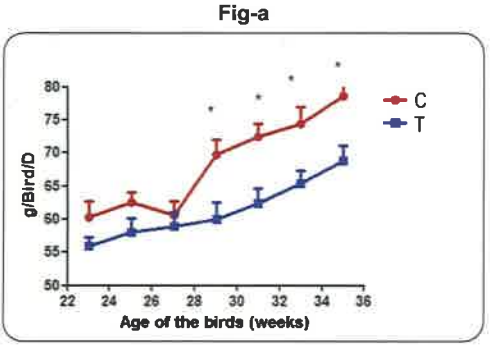


Fig-b



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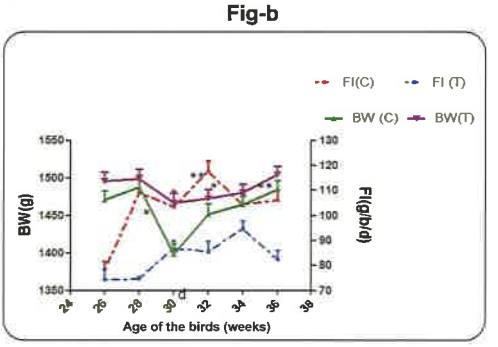


Fig-d

The difference in the BWs (Body Weight g) between the two groups of PD3 line birds was not significant (figure not given) either during or post summer (a,b). In the Nicobari birds the BW of the treatment group was significantly more both during and post summer. FI (Feed intake, g /bird/day) was significantly less during post summer (c,d). C-Control, T-Treatment *P<0.05,**P<0.01

Changes In Expression Fold Level Of Leptin, Ghrelin & GH receptors, Matrixmetalloproteinase (MMP3), genes In PD3 And Nikobari Chickens

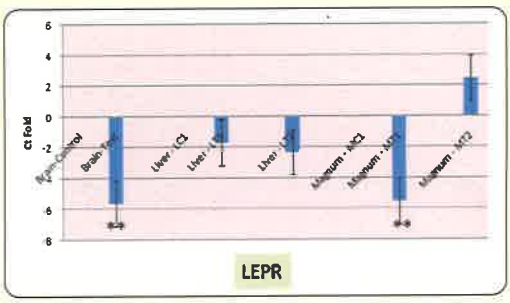
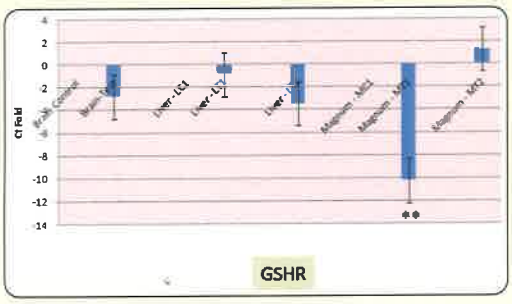


Fig-a



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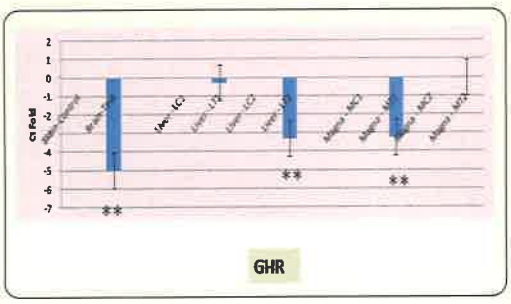


Fig-c

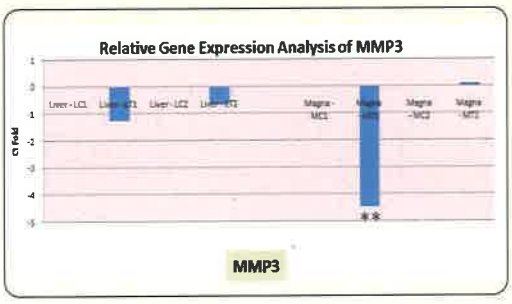


Fig-d

Gene expression of a) Leptin, b) ghrelin, c) GH receptors, d) Matrixmetalloproteinase (MMP3), genes in brain, liver & magnum tissues in PD3 chickens during summer season

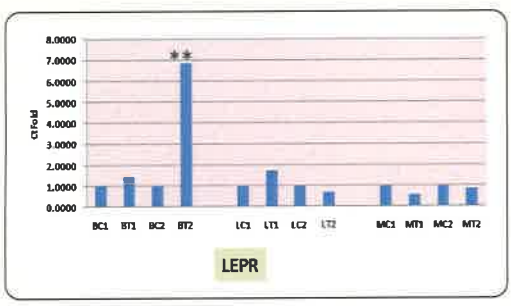


Fig-e

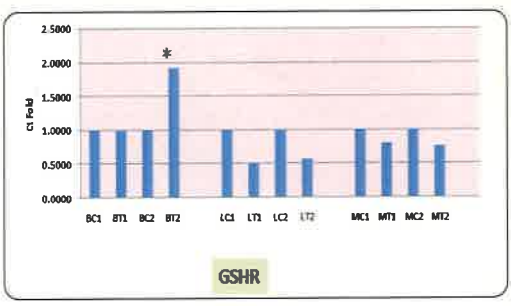


Fig-f

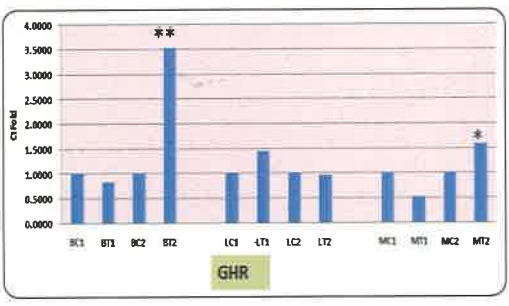


Fig-g

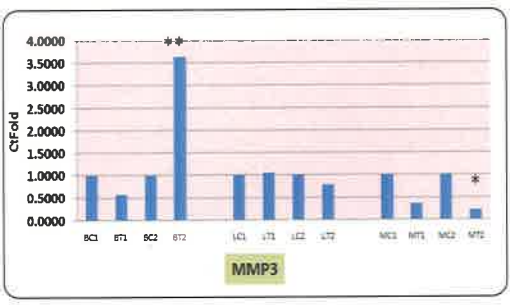


Fig-h

Gene expression of e) Leptin, f)ghrelin, g) GH receptors, h) Matrixmetalloproteinase (MMP3),genes in brain, liver & magnum tissues in Nicobari chickens during summer season

C-control, T-treatment C1,T1- At 20d interval, C2,T2- At 30d interval from the beginning of experiment

*P<0.05, **P<0.01

CONCLUSIONS

- **During summer season supplementation of fermented yeast culture @0.7g/kg of feed to PD3 line and Nicobari chickens decreased plasma level of leptin, Ghrelin and GH without any significant effect on body weight and feed intake in PD3 birds.**
- **Supplementation of FYC increased the body weight of Nicobari birds during and post summer period.**
- **The receptors for the mentioned hormones were down regulated in brain, liver and magnum of the treatment group post 30d of expt. Where as in nicobari chickens the expression of the receptors was upregulated. But in the magnum it was upregulated after 30d in PD3 Chickens .**
- **Supplementation continued in the post summer season, decreased feed intake but without any significant effect on weight of the egg. The percentage production of the eggs , fertility and hatchability of the eggs was also observed to be more .**
- **Hence supplementation of FYC during and post summer increased production parameters in both PD3 line and Nicobari chickens.**

Experiments Under Controlled Conditions

Another experiment was conducted to observe the effect of exposure to constant high temperature (39°C for 4h) in manually controlled chamber

I.Three groups of Nicobari hens were maintained (twenty / group).

Two groups (CH and SH) were subjected to a temperature of 39° C for 4 h in an environmentally controlled chamber, RH - 49% for 21d. (21-23 weeks of age)

1. CH group positive control
2. SH group was supplemented with yeast culture @ 700mg/kg.
3. Negative Control (CR) was maintained at room temperature (26-28°C, RH-46-59%). From 24 week onwards all the groups were maintained at ambient temperature (26-28°C) till 31 weeks of age.

Plasma hormones, Leptin, Ghrelin and GH were estimated.

Plasma Cholesterol, Melandialdehyde and enzyme AMP kinase were estimated.

Q PCR studies on hormone receptor genes were conducted.

II. After 21d (20-23 weeks of age) of heat exposure , they were transferred to poultry shed under normal ambient temperature which coincided with the laying period.

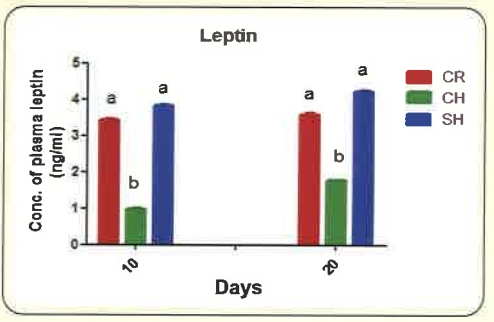
Weeks	Control 1 (CR)	Control 2 (CH)	Treatment (SH)
20	$1156.63^{a}\pm9.23$	$1159.75^{a}\pm8.45$	$1179.88^{a}\pm10.25$
21	$1198.14^{a}\pm10.23$	$1225.75^{b}\pm10.52$	$1269.63^{b}\pm11.23$
23	$1245.98^{a}\pm11.23$	$1257.07^{a}\pm10.23$	$1291.95^{b}\pm11.64$

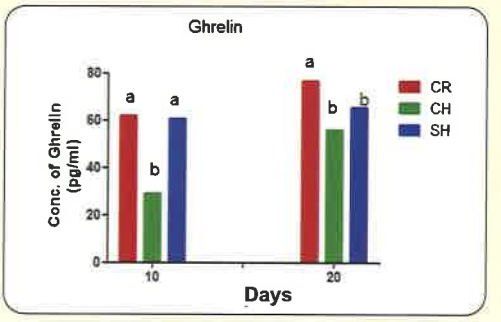
Values are represented as Mean ± SEM at 15d interval . Values with different superscripts are significantly different P<0.05. Weeks- Age of the birds-20-23weeks (subjected to Heat stress)

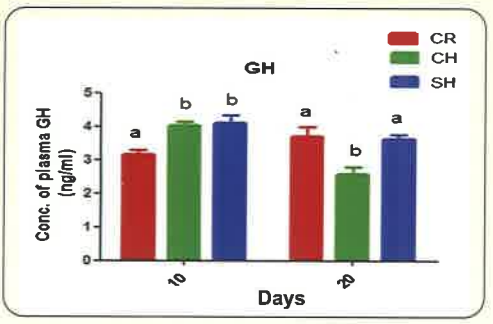
24	$1278.22^{a}\pm14.23$	$1286.05^{a}\pm11.32$	$1363.82^{b}\pm12.32$
26	$1360.66^{a}\pm10.68$	$1326.07^{a}\pm9.58$	$1445.93^{b}\pm10.89$
28	$1436.25^{a}\pm13.25$	$1422.34^{a}\pm12.56$	$1507.22^{b}\pm11.57$
30	$1466.67^{a}\pm9.06$	$1454.70^{a}\pm7.54$	$1556.89^{b}\pm7.91$

Values are represented as Mean ± SEM at 15d interval from 24-30 weeks of age. Values with different superscripts are significantly different P<0.05, Post heatstress

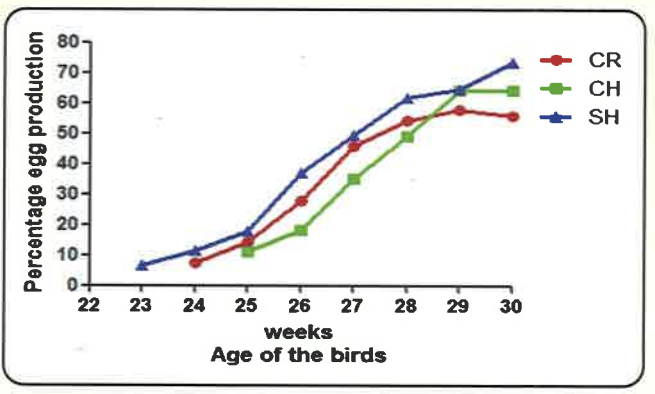
Supplemented group with FYC had higher body weight when compared to the control (CR) and heat stressed group (CH) of birds.







Mean± SEM values with different superscripts are significantly (P<0.01) different from each other. Continuous exposure to 39°C for 4h decreased plasma hormone levels in heat stressed group of birds and supplementation of FYC (SH group) increased the plasma levels of hormones at 20d of the experiment.



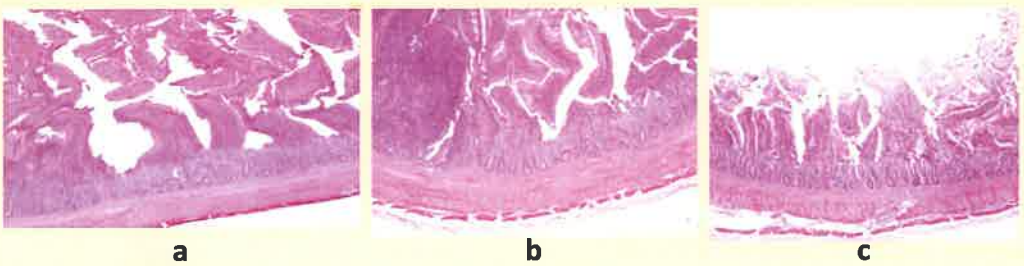
ASM (age at sexual maturity)
161 days -SH
168 days -CR
175 days -CH

Percentage of egg production of different groups post exposure during laying period

Weeks	CR	CH	SH
23			6.6
24	7.5		11.42
25	14.16	11.10	17.77
26	27.85	18.24	36.96
27	45.71	34.91	49.52
28	54.28	49.20	61.90
29	57.85	64.21	64.75
30	55.71	64.28	73.31
31	65.25	55.55	72.01

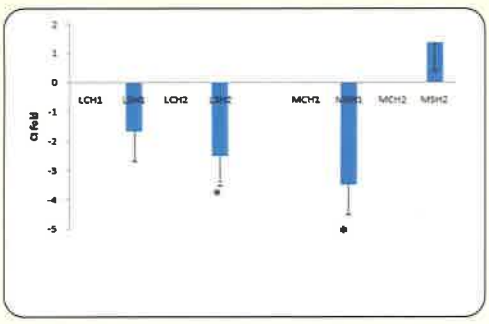
Egg production was more for SH group compared to CR & CH. From 29-31 weeks the egg production of CH group was comparable or more with respect to CR Group.

- **Plasma hormones Leptin, Ghrelin and GH decreased significantly on exposure to heat stress under controlled conditions,upon supplementation (SH) the level of the hormones were restored to the room temperature maintained birds.**
- **Concentration of Plasma Cholesterol , MDA and AMP kinase were significantly greater in heat stressed birds which decreased upon supplementation of FYC (SH) and control group of birds.**
- **Bodyweight (g) of supplemented (SH) group was significantly more**
- **Age at sexual maturity was less for –SH when compared with the other two groups.**
- **50% egg production was attained earlier (27 weeks) for SH and CR groups while for CH group it was attained at 28 weeks of age.**
- **Percentage of Fertile and hatchable eggs was more in SH group when compared to CR and CH groups from 28-32 weeks**

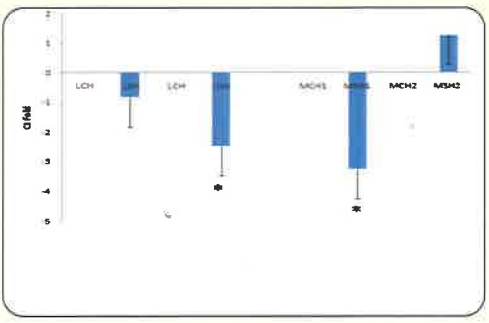


a b c

➢ **Histomorphology of the jejunum revealed that the severity of the necrosis was mild to medium (b-c) in all the three groups of hens, severity being more in the positive Control group (CH) of birds. a) represents normal villi.**



a



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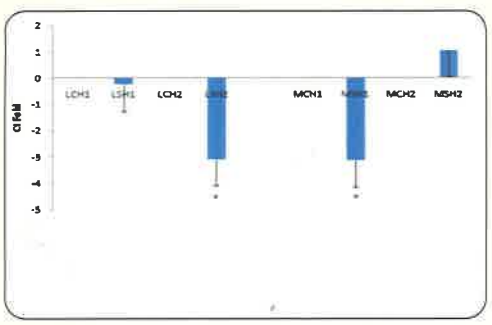

c

Relative fold change in the gene expression of a) Leptin b) Ghrelin and c) GH receptor in L- Liver and M-magnum tissue of Nicobari chicken post 10d (CH1 and SH1) and 20d (CH2 and SH2) of the experiment.

C(CH)- Control, S(SH)-Supplemented with FYC@700mg/kg. *P<0.05, expression was down regulated.

CONCLUSIONS

- **During summer high ambient temperature prevails and this has negative effect on endocrine, metabolic and reproductive functions.**
- **From the present studies it can be concluded that feeding supplement like fermented yeast culture during and post summer can have beneficial effect on production performance in chickens and can negate the negative effects of heat stress.**
- **Supplementation of FYC proved beneficial in both PD3 line and native Nicobari chicken.**
- **If we can produce our own product with yeast culture with still more Beneficial factors we may still get better results.**

भाकृअनुप – कुक्कुट अनुसंधान निदेशालय
ICAR - DIRECTORATE OF POULTRY RESEARCH
राजेन्द्रनगर, हैदराबाद-५०० ०३०. -Rajendranagar, Hyderabad-500030.

Ph: +914024017000 / 24015651, Fax: +91 40 24017002
Email: pdpoult@nic.in, Website: www.pdonpoultry.org
An ISO 9001:2015 Certified Organization