*The Indian Journal of Animal Reproduction; 29(2):133- 137; December 2008* **Research Article**

# Effect of Plane of Nutrition on Blood Biochemical Profile and Reproductive Efficiency in Nili Ravi Buffalo Heifers

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## ABSTRACT

Fifteen Nili Ravi heifers aged 13 months were randomly divided into three groups of 5 each. Group-I was fed 100%, Group-II 115% and Group-III 130% of nutrients as per the Kearl (1982) feeding standards. Blood samples were collected at fortnightly intervals. Haemoglobin and haematocrit did not differ significantly in the three groups. Blood glucose levels in Groups I, II and III were 70.15±1.67, 67.15±1.67 and 65.25±1.67 mg %, respectively. The differences were significant (P<0.05) in Groups I and III. Protein values did not differ significantly among the groups. Plasma urea (mmol/l) was higher in Group-I (7.38±0.34) followed by Group-II (6.85±0.34) and Group-III (6.18±0.34). The differences in Group-I and Group-III were significant (P<0.05). Similarly, cholesterol (mg%) was higher (P<0.05) in Group-I (64.64±3.01) followed by Group-II (61.38±3.01) and Group-III (52.88±3.01). Plasma triglycerides and thyroxine did not differ significantly among the groups. Plasma triiodothyronine (ng/ml) was highest in Group-I (1.67±0.07) followed by Group-II (1.54±0.07) and Group-III (1.39±0.07). The differences were significant (P<0.05) in Group-I and Group-III.Age at puberty (days) was lowest in Group-III (801.80±46.70) followed by Group-I (828.00±46.70) and Group-II (834.80±46.70). Significantly lower age at sexual maturity (days) was recorded in Group-II (840.40±54.24) followed by Group-I (828.00±46.70) and Group-III (1067.00±54.24). Number of services per conception was lowest in Group-II (1.20±0.50) followed by Group-I (2.70±0.50) and Group-III (3.00±0.50). It can be concluded that feeding the Nili Ravi heifers at 115 and 130% depressed circulating plasma levels of glucose, urea, cholesterol and $T_3$. Reproductive efficiency in terms of age at sexual maturity and services per conception was highest at 115% plane of nutrition.

**Key Words:** Heifers, Feeding level, Puberty and conception.

Buffalo, the backbone of dairy industry in India still suffers from a host of reproductive problems like delayed puberty, higher age at sexual maturity and poor conception rate. The reasons may be physiological / nutritional or genetic. Increased nutrition level in young heifers may help to improve physiological process, thus leading to early maturation of hypothalamic hypophyseal axis thus leading to early initiation of ovarian activity and reproductive function (Armstrong et al 2001, Reksen and Ropstad, 2002). Various workers have tried to improve reproductive efficiency of heifers by increasing the dietary energy level (Tuna-Pinto and Cronje 2000, Reksen and Ropstad 2002). Haematobiochemical profile is an index of homeostasis and is influenced by many factors including nutritional level. Not much work has been done in buffaloes on the level of nutrition, reproductive efficiency and blood composition. The present investigation was undertaken to study the influence of feeding levels on blood chemistry and reproductive efficiency in buffalo heifers.

## MATERIALS AND METHODS

Fifteen prepubertal buffalo heifers aged 13 months and weighing 207± 6.7 Kg were randomly divided into three groups of 5 each and kept at 100% (Group-I), 115% (Group-II) and 130% (Group-III) as per Kearl (1982) feeding standards on a ration containing 3.3% DCP and 44.5 % TDN. The intakes of digestible crude protein and total digestible nutrients (kg/day) were 0.55 and 3.28 in Group-I, 0.68 and 3.96 in Group-II and 0.66 and 3.95 in Group-III. The blood samples were collected in heparinized vials at

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fortnightly intervals from 13 months of age till the expected age at puberty i.e. 27 months. The protein free filtrate was prepared from the heparinized whole blood on the spot for blood glucose estimation (Folin and Wu, 1920). Haemoglobin (Hb) was estimated in the blood by cyanmethaemoglobin method (Dacie and Lewis, 1975) and the packed cell volume (PCV) by the meterohaematocrit method (Benjamin, 1985). The plasma was separated from rest of the blood in a refrigerated centrifuge at 2000 rpm for 20 min. and stored at –20°C in different aliquots till analyzed for the biochemical constituents. The total plasma proteins and urea were estimated by the methods of Reinhold (1953) and Wootton (1964), respectively. Total cholesterol concentration was determined according to Henley (1957) and triglycerides (TG) as per Varley *et al* (1984). The plasma concentration of triiodothyronine ($T_3$) and thyroxine ($T_4$) was determined using the iodinated RIA kits obtained from BARC, India. The data obtained were analyzed statistically as per Snedecor and Cochran (1989).

## RESULTS AND DISCUSSION

Blood composition and reproductive efficiency parameters have been depicted in Table 1. Haemoglobin and packed cell volume did not differ significantly in the three groups. Blood glucose value was highest in Group-I followed by Group-II and Group-III. The differences between Group-I and Group-III were significant ($P<0.05$). Plasma protein did not differ significantly among the three groups. Plasma urea concentration was highest in Group-I followed by Group-II and Group-III, the differences in Group-I and Group-III were significant ($P<0.05$). Similarly, cholesterol level was highest ($P<0.05$) in Group-I compared to Group-II and Group-III. Triglycerides and thyroxine did not differ significantly but the value of thyroxine was highest in Group-III. $T_3$ was highest ($P<0.05$) in Group-I followed by Group-II and Group-III.

Lowest age at puberty was obtained in Group-III followed by Group-I and Group-II. Age at sexual maturity was significantly lower in Group-II and Group-I compared to Group-III. Number of services per conception was lowest in Group-II and higher in Group-I and Group-III, the differences in Group-I and Group-III were significant.

Haemoglobin and haematocrit values did not differ significantly in the three groups. Slightly higher value of hemoglobin in Group-III agrees with Bhat (1999) for cows and buffaloes. Lower level of glucose in Group-II and III compared to Group-I is an indicator of lower conversion of glycogen to glucose as positive energy balance which increased circulating insulin levels (Amstalden *et al.* 2000, Armstrong *et al.* 2001). Elevated level of blood urea is an indicator of imbalance between energy and protein in high yielding dairy cows with decreased fertility (Ward 2000). Elevated plasma urea in Group-I might be due to catabolism of body proteins for energy purposes. (Toharmat *et al.* 1998, Pontler *et al.* 2000). Higher cholesterol level in Group-I indicates that the animals were under stress as stress elevates synthesis of cholesterol for production of stress hormones (Hafez 1980, Bahga *et al.* 1988).

Not much work has been reported on the level of feeding on thyroid hormones in bovines. Lowest $T_3$ and $T_4$ were observed in animals showing ketonuria i.e. deficient energy levels (Nikolic *et al.* 2001). In early lactation in cattle when the demand of nutrients is higher, lower values of $T_4$ and $T_3$ were reported than those in mid lactation in cows (Gueorguier 1999). Lower plasma $T_3$ but unaltered $T_4$ was observed in feed restricted lambs (Fkpe and Christopherson 2000).

Delayed ovarian activity was detected in cattle with negative energy balance (Reksen *et al.* 2001). Butler *et al.* (2000) reported that negative energy balance in cattle delays first ovulation through inhibition of LH frequency. Tuna-Pinto and Cronje (2000) reported that normal fed heifers (growth rate 0.6 kg/d) compared to restricted fed ones (growth rate 0.3 kg/d) reached puberty four week earlier. The favorable action of high energy diet on ovarian function has been reported by Armstrong *et al.* (2001) and is due to increased peripheral concentrations of insulin and IGF-I which may increase growth rate of dominant follicle and sensitivity of follicles to FSH. Reksen and Ropstad (2002) also reported delayed ovarian activity in energy deficient dairy cows, which may be due to lower estradiol and progesterone production.

The mechanism by which low dietary energy inhibits reproduction as explained by Pinos-Rodriguez and Sanchez-Tones (2001) may be due to reduced hypothalamic release of LH, diminished frequency at which pulses are generated by the hypothalamus to induce

**Table 1. Effect of feeding level on blood biochemical profiles in Nili-Ravi buffalo heifers.**

| Parameter | No. of Observations. | Feeding levels | | |
|---|---|---|---|---|
| | | 100% | 115% | 130% |
| **A. Haematological parameters** | | | | |
| Hb ($gdl^{-1}$) | 150 | $12.28\pm0.28^{a}$ | $12.24\pm0.28^{a}$ | $12.35\pm0.28^{a}$ |
| PCV (%) | 150 | $35.7\pm0.77^{a}$ | $34.42\pm0.77^{a}$ | $35.34\pm0.77^{a}$ |
| **B. BLOOD BIOCHEMICAL CONSTITUENTS** | | | | |
| Glucose ($mgdl^{-1}$) | 150 | $70.15\pm1.67^{a}$ | $67.15\pm1.67^{ab}$ | $65.25\pm1.67^{b}$ |
| Protein ($gdl^{-1}$) | 150 | $7.10\pm0.16^{a}$ | $7.26\pm0.16^{a}$ | $7.12\pm0.16^{a}$ |
| Urea ($mmol^{-1}$) | 150 | $7.38\pm0.34^{a}$ | $6.85\pm0.34^{b}$ | $6.18\pm0.34^{b}$ |
| Cholesterol ($mgdl^{-1}$) | 150 | $64.64\pm3.01^{a}$ | $61.38\pm3.01^{b}$ | $52.88\pm3.01^{b}$ |
| Triglycerides ($mmol^{-1}$) | 150 | $0.13\pm0.01^{a}$ | $0.12\pm0.01^{a}$ | $0.12\pm0.01^{a}$ |
| $T_3$ (ng/ml) | 90 | $1.67\pm0.07^{a}$ | $1.54\pm0.07^{ab}$ | $1.39\pm0.07^{b}$ |
| $T_4$ (ng/ml) | 90 | $59.73\pm9.14^{a}$ | $57.83\pm9.14^{a}$ | $67.36\pm9.14^{a}$ |
| **C. REPRODUCTIVE PARAMETERS** | | | | |
| Age at puberty (days) | 15 | $828.0\pm46.7^{a}$ | $843.8\pm46.7^{a}$ | $801.8\pm46.7^{a}$ |
| Age at sexual maturity (days) | 15 | $883.2\pm54.24^{a}$ | $840.4\pm54.24^{a}$ | $1067.0\pm54.24^{b}$ |
| Services per conception | 15 | $2.2\pm0.5^{a}$ | $1.2\pm0.5^{ab}$ | $3.0\pm0.5^{b}$ |

Similar superscripts indicate statistical at par values.

the liberation of GnRH and hypersensitivity of the hypothalamus pituitary axis to low concentrations of estradiol produced by the ovaries in prepubertal heifers or in the adult females in anoestrus postpartum period.

It is concluded that feeding at 115% and 130% of Kearl feeding standards depressed plasma glucose, urea, cholesterol and $T_3$ levels. Reproductive efficiency in terms of age at sexual maturity and services per conception was highest at 115% level.

## REFERENCES


Amstalden, M., Garcia, M. R., Williams, S. W., Stanko, R. L., Nizielski, S. F., Morrison, C. D., Keisler, D. H. and Williams, G. L. (2000). Leptin gene expression, circulating leptin and luteinizing hormone pulsatility are acutely responsible to short-term fasting in prepubertal heifers, relationship to circulating insulin and insulin like growth factor 1. Biol. Reprod. **63** (1): 127-33.

Armstrong, D. G., McEvoy, T. G., Baxter, G., Robinson, J. J., Hogg, C. O., Wood, K. I., Webb, R. and Sinclair, K. D.( 2001). Effect of dietary energy and protein on bovine follicular dynamics and embryo production in vitro, association with the ovarian insulin-like growth factor system. Biol. Reprod. **64** (6) : 1624-32.

Bahga, C. S., Gangwar, P. C. and Capitan, S. S (1988). Seasonal variations in plasma cholesterol levels in relation to reproductive efficiency in postpartum buffaloes (Bubalus bubalis). Indian Vet. J. **65** : 585-88.

Benjamin, M. M. (1985). Outlines of Veterinary Clinical Pathology. Kalyani Publishers, 3rd Edn., p 70.

Bhat, A. S. (1999). Effect of special feeding on blood profile of cows and buffaloes. Indian Vet. J. **76** : 501-05.

Butler, W. R., Forsberg, M. (ed.), Greve, T. (ed.), Gustafsson, H. (ed.), Katila, T. (ed.), Kindahl, H. (ed.) and Ropstad, F. (2000). Nutritional interactions with reproductive performance in dairy cattle. Annual Reproduction: Research and Practice II. Proc. 14th Int. Cong. Anim. Reprod., Stockholm, Sweden, 2-6 July, 2000. Anim. Reprod. Sci. 2000. **60-61** : 447-57.

Dacie, J. Y. and Lewis, S. M. (1975). Practical Haematology. Churchill Leviagrtene, 5th Edn., p 32.

Fkpe, F. D. and Christopherson, R. J. (2000). Metabolic and endocrine responses to cold and feed restriction in ruminants. Canadian J. Anim. Sci. **80** (1) : 87-95.

Folin, O. and Wu, H.(1920). A system of blood analysis: Supplement I. A., Simplified and improved method for determination of sugar. Journal of Biol. Chem. **41** : 367-74.

Gueorguier, I. P. (1999). Thyroxine and triiodothyronine concentrations during lactation in dairy cows. Annals de Zootechnia **48** (6): 477-80.

Hafez, E. S. E. (1980). In: Reproduction in Farm Animals, 4th edn. Lea and Febiger, Philadelphia.

Henley, A. A. (1957). Determination of serum cholesterol. Analyst **82** : 286-87.

Nikolic, J. A., Samane, H., Kovacevic, M., Bugarki, D. and Masniposa, R. (2001). Serum concentrations of insulin like growth factors and thyroid hormones inhealthy and petotic dairy cows during the purperium. Acta Vet. Beorgrad **51** (2-3) : 73-88.

Kearl, L. C. (1982). Nutrient requirements of ruminants in developing countries. Utah Univ. Pub., Logan, Utah., U.S.A., pp. 109-13.

Pinos-Rodriguez, J. M. and Sanchez-Torres, M. T. (2001). Effect of energy intake on reproductive processes of the female cattle – A review. Revista Cientifica Facultad de Cierncias Veterinarians, Universidad del Zulice **11** (3) : 256-63.

Pontler, A. A., Douar, C., Mialot, J. P., Benat-Valiergue, H. and Grimard, B. (2000). Effect of underfeeding postpartum Charolais beef cones on composition of plasma non-esterified fatty acids. Science **71** (2) : 243-52.

Reinhold, J. G. (1953). Total protein, albumin and globulin. In: Standard Methods of Clinical Chemistry (Ed. M. Reiner) Vol. I, Academic Press, New York, p 88.

Reksen, O., Grohn, Y. T., Havrevoll, O. S., Bolstad, T., Waldmann, A. and Ropstad, F. (2001). Influence of concentrate allocation and energy balance on postpartum ovarian activity in Morwegian cattle.

Reksen, O. and Ropstad, F. (2002). Influence of dietary energy and protein on reproductive performance in dairy cattle. Norsk Veterinaer tidsskrift **114** (1) : 21-25.

Snedecor, G. W. and Cochran, W. C. (1989). Statistical Methods. 8th Edn. Iowa State University Press, Iowa.

Toharmat, T, Nonaka, I., Shimizu, M., Batajoo, K. K. and Kume, S. (1998). Effects of prepartum energy intake and calving season on blood

composition of periparturient cows. Asian Aust. J. Anim. Sci. **11** (6) : 739-45.

Tuna-Pinto, G. and Cronje, P. B. (2000). The roles of the insuline-like growth factor system and leptin as possible mediators of the effects of nutritional restriction on age at puberty and compensatory growth in dairy heifers. South African J. Anim. Sci. **30** (2) : 155-63.

Varley, H., Gowenlock, A.H. and Bell, M. (1984). Lipids and Lipoproteins. In : Prectical Clinical Biochemistry. Vol. I, 5th Edn. Heinemann Professional Publishing Ltd., London.

Ward, W. R. (2000). Fertility and dietary energy and protein in dairy cows. Cattle Practice. **8**:4,383-389.

Wootton, I. D. P. (1964). Microanalysis in Medical Chemistry. 4th Edn., J & A Churchill Ltd. London, p 112.

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