Print ISSN 0970-1524
Online ISSN 2350-0182
Volume 37, Number 04, October to December 2023

# INDIAN JOURNAL OF ANIMAL PRODUCTION AND MANAGEMENT

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THE INDIAN SOCIETY OF ANIMAL PRODUCTION AND MANAGEMENT
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# INDIAN JOURNAL OF
# ANIMAL PRODUCTION AND MANAGEMENT

## VOL. 37, ISSUE 04, OCTOBER TO DECEMBER, 2023

*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 270-277 https://doi.org/10.48165/ijapm.2023.37.4.1

# Oxidative Stress in Dairy Cattle: An Overview

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**Received: 03.05.2023; Accepted: 12.01.2024**

**ABSTRACT**

Throughout their productive lives, dairy cows experience numerous transitional phases that are associated with increased metabolic and infectious disease susceptibility. Redox equilibrium is crucial for guaranteeing a smooth transition. Nonetheless, oxidative stress (OS), a consequence of redox imbalance, has been linked to a higher disease risk in these animals. The periparturient and neonatal phases of the productive cycle of dairy cows are times of increased OS and disease susceptibility. This article reviews the relationship of redox status and OS with diseases of cows and calves, and how supplementation with various antioxidants can be used to prevent OS in these animals.

**Key words:** Oxidative stress, dairy cattle, antioxidant supplements

Stress can be defined as a process of altered biochemical homeostasis induced by psychological, physiological, or environmental stressors[1]. Oxidative stress is defined as an imbalance between free radicals and antioxidants [2]. A free radical is a highly reactive atom or molecule that contains one or more unpaired electrons in its outer orbit and extracts an electron from another compound to gain stability [3]. Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS) are the two main types of free radicals[4]. They are normally produced in the mitochondria and peroxisomes, as well as during inflammation and phagocytosis[5]. The uncontrolled production of ROS over the cells' antioxidant capacity leads to oxidative stress. Overproduction of ROS leads to oxidative damage to lipids, proteins, and DNA [6].

The transition period is also characterized by a depleted antioxidant status, often resulting in oxidative stress. Hence it is important for dairy cow health and following performance. It's key for ruminants to consume dietary antioxidants, not only does it aid in achieving great production results, but it also boosts their immune system and overall health. In order to combat free radicals, aerobic cells developed antioxidant defense mechanisms, which include enzymatic antioxidants (superoxide dismutase, catalase), non-enzymatic antioxidants (glutathione, selenium, tocopherol, beta-carotene), while dietary supplementation of vitamins A, D, and E as well as trace minerals Se, Cu, Zn, and Mn reveal as commanding antioxidant [7].

## Pre-disposing Factors for Oxidative Stress

High metabolic rate, excessive hormonal changes, labor, nutrients absorbed in colostrum and nutrient reserves for uterine involution all lead to depletion of stored nutrients such as energy, protein, minerals, vitamins and phytochemical antioxidants *i.e*., Polyphenolic Compounds. In addition, stress trigger factor that leads to lower feed intake after birth. All these factors combine to disrupt the pro-oxidant-antioxidant balance in the body, which favors the accumulation of pro-oxidants, leading to oxidative stress. Cows with high Body condition

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score (BCS) at calving result in high lipid mobilization, which in turn changes oxidative status and makes cows more sensitive to oxidative stress [8]. In dairy animals, subclinical and clinical ketosis leads to increases in beta-hydroxybutyrate (BHB), malondialdehyde (MDA), and Nitric oxide (NO). Mastitis in dairy cows altered the levels of TAC, GSH, GR, CAT, SOD, MDA, NO and the Oxidative Stress Index (OSI) [9]. The density and the content of immunoglobulin and lactoprotein of the colostrum of Holstein cows in the group with the highest BCS were highest ($p<0.05$). These animals not only had the highest ($p<0.05$) levels of serum unesterified fatty acids and beta-hydroxybutyrate, but also the highest ($p<0.05$) levels of malondialdehyde, superoxide dismutase, catalase, vitamin A, and vitamin E as well a greater ($p<0.05$) BCS loss was observed in the Highest BCS cows[8].

**Effect of Antioxidant Supplements on Serum Biochemistry**

Dietary nutrients consumed by animals undergo digestion and are broken down to simpler molecules and absorbed through the intestinal wall to enter into the blood stream. These absorbed nutrients are metabolized through complex biochemical pathways and exploited by the system for the production and maintenance of health. Thus, blood metabolites are supposed to be a good indicator of health and an alarm for any metabolic disturbances. Any change in the value of these attributes from their standard range could be suggestive of the effect of feeding strategy on health and productive performance.

AST and ALT are proposed to be the common parameters for the detection and diagnosis of liver damage. beta-hydroxybutyrate Increased AST level during the transition before 1 week of calving and postpartum till 21 days, increased transaminase enzyme activity indicates the stress and damage status that occur in the body. AST levels were higher in the parturient period as compared to the prepartum period [10]. The AST and ALT levels are higher in pregnant animals than in non-pregnant animals, while the AST and ALT levels were higher in the postpartum period as compared to the dry period[11]. An increase in the activity of transaminase enzymes may be associated with a reduction in DMI during the transition period, and a greater demand on the mammary gland for energy to produce milk resulting in NEB conditions in cows that may alter normal liver function. Changes in blood concentrations of AST enzyme activity may all reflect alterations in liver function associated with fat accumulation due to the increase in non-esterified fatty acids (NEFA) levels after calving [8]. Protein catabolism increases creatinine kinase (CK) activity and may lead to increased AST activity[12].

Mulberry leaves flavonoid supplement did not affect the serum biochemical parameters including TP, ALB, GLB, BUN, and glucose in lactating buffaloes. However, at a higher dose in rat it linearly increased ($p=0.002$) the insulin level as compared to the control [13]. The addition of chestnut tannin (CNT) led to lower BUN ($P=0.02$) and consequently higher serum glucose ($P=0.02$) and insulin ($P<0.01$) concentrations which were associated with lower circulating NEFA ($P<0.01$) and BHBA ($P<0.01$) in cows near parturition[14]**.** Vitamins (A, D, E) and trace elements (Cu, Mn, Se, Zn) were administered intramuscularly during the transition period lead to significant changes in the levels of NEFA, TBIL ($p<0.05$), T.CHOL, HDL, LDL ($p<0.01$), TG, GLU, P4, TAC and TOC ($p<0.001$) in clinically healthy Brown Swiss dairy cows[10]. It was emphasized that in cows receiving mineral solution, the ALT levels remained the same, while the AST tended to increase. It indicates that during postpartum this increase resulted from the deficiency in liver functions developed due to the NEB in that period. Se supplementation using organic sources slightly affected blood chemistry[15].

The change in the level of total serum protein during the transition period is attributed to lower feed intake before calving which causes metabolic and oxidative stress which results in oxidative stress conditions. Postpartum NEB

increases the utilization of protein as amino acids from muscle or different body tissues to complete the increased energy requirement of the mammary gland for growth and milk production in high-yielding dairy cows. The level could also be influenced by the partitioning of nutrients and protein towards fetal growth and the utilization of amino acids from the maternal circulation for protein synthesis in the fetal muscles. Ca concentration decreased during the gestation period because of its involvement in foetal survival and colostrum formation, leads to decrease in albumin concentration one week before calving and post-partum in CON cows compared to the cow supplemented with Vit-E and Se, Cu and Zn [16].

Significant decrease level of TP and ALB at prepartum calving was observed [16.]. Albumin (ALB) levels remained unchanged in cows receiving mineral solution. The intrapartum Total protein (TP) and ALB values were low in cows receiving trace elements. TP and ALB concentration remained unchanged in the treatment group. Trace minerals (Se, Zn, and Cu) actively participate in mitigation of oxidative stress and minimize the protein catabolism from muscles [9].

**Effect of Antioxidant Supplements on Redox Status**

Oxidative stress can be access by Markers like antioxidants, Total antioxidant capacity (TAC), advanced oxidation protein products (AOPP), Malondialdehyde (MDA), Thiobarbituric acid reactive substances (TBARS).

There was a significant increase in plasma GPX activity and a decrease in plasma MDA concentration following a single intramuscular injection of 20mg sodium selenite and 800mg tocopherol acetate three weeks prior to parturition[15]. Consequently, the incidence of retained placenta in supplemented animals was reduced half compared to non-supplemented animals**.** Redox balance was improved by Yerba Mate (*Ilex paraguariensis*) supplementation, as reflected in the lower OSI values observed in the YM group[17]. Yerba Mate is known to possess a strong antioxidant capacity due to its high concentration of polyphenols such as chlorogenic acid[18] and caffeoyl derivatives such as caffeic acid[19]

The increased concentration of malonaldehyde (MDA) seen during transition period in dairy cattle indicates the intensity of oxidative stress and cell membrane damage. Supplementation of antioxidants as vitamins A, D, E and micro minerals Se Cu, Zn and Mn were effectively reduced levels of serum TOS and SCC and increased levels of serum TAS, however, it did not affect Individual bacteria count (IBC) and Colony formation unit (CFU) in HF cattle [20]. Micromineral supplementation (Cu, Zn, Mn, and Co) significantly ($P<0.05$) lowered mean MDA level on the day of calving (day 0) and 28 days post-parturition in animals**.** Similarly, a substantial ($P<0.05$) decrease in ROS levels following minerals supplementation on days 15 and 30 post-calving [21] .

A significant ($p<0.05$) decrease in the mean LPO level in the vitamin-E and selenium supplemented group of cows [22]. Vitamin E and Se supplement significantly lower MDA while significantly improved the Hb, SOD and catalase in cattle [23]. Oral supplementation of Vitamin E, Se, Cu, Zn improve anti-oxidant status and while it reduced the milk MDA[16]. Vitamin E supplementation decreased the plasma MDA level [24]. These findings depict the role of chelated trace mineral supplementation in combating the oxidative stress of dairy cows during the transition period.

Dietary supplementation of Mulberry leaf flavonoids significantly decreased the oxidative stress marker (MDA) while increasing the serum heat shock proteins, GHS-Px, and insulin contents. However, the treatment decreased T-AOC and CAT while no effect on serum SOD contents was observed owing to reduced oxidative stress in buffaloes [13] Single (i/m) administration of Vitamins (A, D and E) and trace

elements (Cu, Mn, Se and Zn) improved TAC, TOC in Brown Swiss dairy cows[10]. A similar finding was reported by [20] on the supplementation of Vit-A, D and E and trace minerals (Cu, Zn, Se and Mn) that improved the total antioxidant status (TAS) and total oxidant status (TOS) in Holstein-Friesian cows. Oral supplementation of Micro Mineral Mixture (MMM) @ 7g/head/day decreased the plasma MDA and increased the activity of GPx, GST and SOD in dairy cattle [25].

Supplementation of Vit-E and selenium @ 0.3 ppm/kg DM started at 220 days of pregnancy and continued till 30 days post-partum reduced MDA and improved the GSH-Px and serum catalase activity in dairy cattle[26]Single (i/m) injection of selenium 21 days prepartum increased the level of blood Se (ng/mL) and GPx (µkat/L) and decreased the plasma MDA and cortisol level in HF cows [15]. Supplementation of yerba mate @ 250 ad 500 g/cow/day reduced the OSI and improved milk yield periodically in pregnant Holstein–Friesian[17]

Copper is involved in the antioxidant system via its involvement in the enzymes Cu–Zn superoxide dismutase (SOD) and ceruloplasmin. Copper–Zn SOD is responsible for dismutation of superoxide radicals to hydrogen peroxide in the cytosol. Ceruloplasmin is a Cu transport protein that also exhibits oxidase activity. It oxidizes ferric iron ($Fe^{+3}$) to ferrous iron ($Fe^{+2}$) without the production of free $Fe^{+3}$ that can cause oxidation and peroxidation to tissues. Ceruloplasmin is an acute phase protein that increases during disease and may be important in scavenging superoxide radicals. Copper deficiency in cattle is generally due to the presence of dietary antagonists, such as sulphur, molybdenum and iron (Fe) that reduce Cu bioavailability. Dietary requirements for Cu are greatly increased by high concentrations of molybdenum and sulphur. [27]

**Effect of Antioxidant Supplements on milk quality and quantity**

In dairy animals, milk yield is directly affected by animal health status, health of the mammary gland, environmental condition, and DMI[28]. Reactive oxygen species (ROS) induce cell damage and alter immune cell function, resulting in an increased risk of mastitis[29]. Trace mineral and vitamin supplements keep the udder healthy and protect against mastitis and other mammary illnesses. Biochemical actions that enhance the function of the antioxidant defense system are influenced by Cu, Zn, Se, and vitamin E. The enzyme superoxide dismutase contains Copper protects against harmful superoxide and dismutase it into regular oxygen or $H_2O_2$ via the glutathione peroxidase enzyme. Zn has a crucial function in mammary cell division and protein synthesis, while Se maintains the intracellular redox status, preserves the sulfhydryl group of proteins that play a vital part in muscle protein, and increases the membrane integrity of udder and teat epithelial tissue[30]. Vit E act as natural antioxidant, they all prevent from oxidative damage and maintain the health of the mammary gland and increase the milk production.

Cytokines are soluble mediators and assist in the regulation of the immune response, and are generally produced by macrophages, with TNF and IL-1 being the first to appear in an inflammatory response, as well as the main indicators of infection in the udder of cows. According to researchers, TNF participates in neutrophil chemotactic activity[31] and IL-1 during an inflammatory process regulates the expression of adhesion molecules and chemotaxis of neutrophils, as occurred in E. coli infection. [32]

It is found that prepartum micromineral treatment lowers postpartum oxidative stress in dairy cows accompanying a decrease in the incidence of postpartum subclinical mastitis (SCM) and a significant ($P<0.05$) increase in milk production. Dairy cows treated with organic trace minerals produced significantly more milk [33]. Oral

supplementation of Vitamin E, Se, Cu, Zn improved milk production, milk vitamin E, and milk somatic cell count in dairy cows [16]. A significant increase in milk yield ($p<0.05$) was observed on supplementing (Vitamin E + Zn) [34], [35] vitamin-E and selenium [36],[35] However, authors reported no significant difference on milk production in Vit E supplemented group [37]

Antioxidant minerals Selenium and copper supplements have been shown to increase immunological response, which leads to a decrease in SCC in both primiparous and multiparous cows. A supplement of 45 grams of mulberry leaf per day can improve lactation performance and reduce heat-induced oxidative stress throughout the summer season [13].

**Effect on Animal Reproduction**

Oxidative stress leads to the degradation of reproductive, physiological and metabolic functions causing an increase in reactive oxygen species (ROS) and reduction in antioxidant protection mechanisms[38]. the adverse effects of oxidative stress to reproduction system involve damage to oocyte DNA, ovary, and endometrium with consequent impacts on fertility outputs. [39.] Defence mechanisms against free radical-induced oxidative stress involve preventative mechanisms, repair mechanisms, physical defenses, and antioxidant defences [6]. Several researchers have determined the effects of various exogenous vitamins (A, D, E) and trace elements (Cu, Mn, Se, Zn) on metabolic and reproductive profile in transition dairy cows.

There was a significant reduction retained placenta following a single intramuscular injection of Supplemented 10 mg Sodium Selenite + 400mg Tac or 20mg sodium selenite and 800mg tocopherol acetate three weeks prior to parturition (Jovanović et al., 2013). Proposed pathway of RP development starting with an imbalance of the antioxidant capacity, followed by a decrease in estrogen production, resulting in decreased PGF2$\alpha$ and accumulation of arachidonic and linoleic acids in the placental tissue.[40]. Single injection of 3000 mg of vitamin C and Inj. 3000 IU vitamin E improved the pregnancy rate in Holstein dairy cows. Cattle require vitamin C and E to maintain normal fertility [41] [42] and to develop follicles and corpus luteum (CL)[43]. The reduced fertility of dairy cattle may be attributed to a smaller preovulatory follicle and CL compared with animals that are not stressed by heat(A.S. Lopes, 2007). Administration of β-carotene and tocopherol @ of 800 mg & 500 mg and 1200 mg & 750 mg improved Embryo Quality Index (EQI) and number of viable embryos in heifer[45]. supplementation of -carotene and tocopherol promoted equilibrium between oxidative agents and the antioxidative system which may have improved embryo quality. Addition of bovine serum albumin (BSA), GSSG and GSH as anti-oxidant bull semen increases the sperm motility, reduced acrosome abnormality, total abnormalities and improved the MDA, SOD, GSH-PX, CAT, GHS and Pregnancy rate in frozen-thawed bull semen [46].

**Effect on Animal Health**

Administration of vitamin E and selenium along with Buparvaquone and Marbofloxacin in tropical Theileriosis potentiated the efficacy of the anti-theilerial drug by elevating the antioxidant level of the affected animal (Nayak et al., 2018). BCS from 2.6 to 3.0 reduced post-calving oxidative stress. Supplementation of Vit-E and Se reduced oxidative stress in cattle, naturally affected by bovine tropical theileriosis[23]. Vit-E + Se and Vitamin-C reduced bovine mastitis-related oxidative stress when given with suitable antibiotics [22]. The dry cow program reduced metabolic diseases. Supplementation of trace minerals (Cu, Zn, Mn & Se) and Vit- A, D, & E from 30-day Pre-calving to 30-day post-calving reduced the oxidative stress (up to 25.84 %), improve the total antioxidant capacity (18.85 to 98 %), reducing SCC (36.6 to 67.7 %), increase milk (7 to 11 %), Increases the recovery rate of mastitis (up to 50 %) pregnancy rate (up to 50 %) and decreased ROP (up to 53.82 %) in dairy

animals.

Immune function and oxidative stress are closely associated. Reactive oxygen species (ROS) such as oxygen ions, free radicals, and peroxides produced through normal cellular activity can destroy cellular membranes, cellular proteins, and nucleic acids. Immune cells are particularly susceptible to oxidative damage not only because of the oxidative respiratory burst during phagocytosis and pathogen kill that generates large amount of ROS, but also because immune cells have a high percentage of polyunsaturated fatty acids in their plasma membrane, which makes them more sensitive to oxidative stress. In addition, the immune system uses ROS to maintain signal transduction pathways [6]. As a result, the immune system is dependent particularly on high level of antioxidants to protect them from ROS.

## CONCLUSION

Oxidative stress and free radicals are generally known to be detrimental to animal health. Antioxidants, as class of compounds able to counteract oxidative stress and mitigate its effects on animal health. As the antioxidants can be very useful in preventing, managing, or treating animal pathologies, they are not immune to generating adverse effects. Oxidative stress, as phenomenon, although being one of the major harms to animal's' wellness and health, it can also be exploited as a treatment tool.

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*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 278-284 https://doi.org/10.48165/ijapm.2023.37.4.2

# Pre-Partum Feeding and Elimination Behaviour of Kankrej Cows at an Organized Farm

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**Received: 03.09.2023; Accepted: 12.01.2024**

**ABSTRACT**

Present study was carried out to assess the effect of parturition on feeding behaviour on before calving. 21 Kankrej cows were equally grouped into 3 treatments, first parity (T1), second parity (T2) and 3 or more parity (T3) cows. The behaviour of cows was recorded with two CCTV cameras and 24 hours' observations were made from recorded video for four days −1, −2, −3 and −7 prior to the calving. The feeding behaviour was assessed in terms of feeding frequency, feeding duration and watering frequency. The mean feeding frequency was the highest on the day of calving (30.33±2.07) followed by day-3 (26.62±1.43), day-2 (25.33±1.46) and Day-7 (24.43±1.40) in a day and the difference found was significant (P<0.05). The mean feeding duration (min) was the minimum on the day of calving (273.19±14.45) followed by day-7 (315.00±11.17), day-2 (315.57±9.84) and day-3 (318.10.95±1.40) in a day and the difference found was significant (P<0.05). Mean water drinking frequencies was maximum on the day of calving 4.14±0.55 compared to 3.95±0.51, 3.67±0.40 and 3.81±0.48 on −2, −3 and −7 prior to the calving, respectively, but the difference found was not significant. Hence, it may be concluded from the study that cows have higher feeding frequency, less feeding duration and higher watering frequency on the day of calving than 2-7 days before the calving. The decrease in feeding duration on the day of calving is directly related to lesser feed intake and reason might be due to increase restlessness and discomfort associated with the parturition process.

**Key words:** Kankrej cow, parity, feeding behaviour, elimination behaviour, pre-partum behaviour

The event of giving birth is an essential part of animal production. There are substantial economical and welfare-related challenges arising around the time of parturition, and commercial animal production have developed an extensive body of recommendations for managing parturient females. In dairy production, successful management of the calving cow aims to ensure a viable calf with no detrimental effects for the cow[16]. In a similar manner to some of the physical changes, the behaviour of cows shows gradual changes throughout gestation and then more obvious, short-term changes in the last few days before parturition. One change in behaviour that is directly related to physical change is the gradual reduction in feeding duration during the dry period as the increasing volume of the uterus limits the space available for food [8 &11]. The decrease in feed intake is also accompanied by a decrease in time spent ruminating. Kankrej is a breed of dual-purpose zebu cattle. Total estimated population of Kankrej cattle in the country is 3028.3 thousand and the share of Kankrej cattle in total Indigenous cattle population is 2.0 per cent[20]. They are well adapted to the geo-climatic conditions of Saurashtra and Kutch, have immense draught power and are known for yielding good quantity of milk with high fat content even in stress

Part of the PhD Thesis of the first author

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conditions[4]. Commercialisation and realisation of Kankrej cattle as a quality milk producer has increased in recent time. The knowledge of prepartum feeding behaviour can help to reduce the frequency and intensity of abnormal behaviour and survival of the offspring. The prepartum feeding behaviour have been studied by the various researchers on dairy as well as for beef cattle abroad, but literature regarding indigenous cows is scanty. Hence, there is need to study various aspects of the prepartum feeding and elimination behaviour of indigenous cattle. Considering the above facts, the present investigation was proposed to study the prepartum feeding and elimination behaviour of indigenous Kankrej cows at organized herd.

## MATERIALS AND METHODS

Present study was conducted on 21 Kankrej cows maintained at Livestock Research Station (L.R.S.) under Sardarkrushinagar Dantiwada Agricultural University (S.D.A.U.), Sardarkrushinagar, Gujarat. Animals were allotted to each treatment group namely Treatment -1 ($T_1$) seven heifers (I parity; which had not calved); Treatment - 2 ($T_2$) seven cows in second lactation (II parity) and Treatment -3 ($T_3$) seven cows in third or higher lactation (III or more parity).

**Housing and feeding management:** The animals were maintained under loose housing system. The housing space for the animals was specified as per BIS. Experimental shed was measuring 16.5 × 7.5 m (L x W) which include 3.7 x 7.5 m (L x W) covered area and remaining as open paddock area. Covered area could accommodate three cows at a time. Covered area was further divided by a six feet wall, so as to provide two separate pens to accommodate one (2.5 x 3.7 m) and two cows (5.0 x 3.7 m), respectively. Animals were free to move from one pen to other, when they were not chained. Cows were tied with metallic chain around the neck and it was reaching about 1.0 meters above the ground when animals were standing and feeding. This 1.0 m length of chain provided little movement and change of place of animal while standing. Animals were chained in morning at 8.00 hr and free at 14.00 hr. for rest of the period. The floor of the covered area was made up of concrete whereas; open paddock was made up of sandy soil and no bedding was provided to the animals. There was separate manger for three animals under covered area whereas; common water trough was present on at the end of open paddock.

Experimental cows were transferred to experimental pen approximately 8-10 days prior to their expected date of calving. Daily routine of the advanced pregnant shed was followed for the experimental animals. They were offered concentrate in morning 8.00 hrs, dry fodder at 11.00 hrs and green fodder at 15.00 hrs daily as per the availability of fodder. They were allowed to feed in continuous feeding manger, inside the shed. Pregnant cows and heifers were fed concentrate mixture (*Banasdan*) individually for maintenance at the rate of 1.50 kg per animal. The green fodders fed to entire herd in general were Maize (*Zee mays*), Sorghum (*Sorghum bicolor*), Cowpea (*Vigna sinensis*), Sunflower (*Helianthus annus*), Lucerne (*Medicago sativa*) and Hybrid napier grass (*Pennisetum purpureum*). The feeds and fodders were supplied uniformly throughout the year. The dry fodders fed to animals were Jowar and Bajara straw, *Dicanthium annulatum* and Gotars. Both green and dry fodders were fed after chaffing. The animals had free access to fresh and clean drinking water all the time. Cleaning of shed was done twice daily in morning and evening. All animals were vaccinated against Foot and Mouth Disease and Haemorrhagic Septicemia and routinely dewormed. They were also tested annually for positive reactors of Brucellosis, Johne's disease and Tuberculosis.

**Behavioural observations and CCTV camera:** The behaviour of the animals was recorded in the farm and confined condition

with the help of two CCTV cameras CPLUS® which were installed in the experimental animal shed. The first Dome (Non IP- CP-USC-DA13L2) type camera was installed above the manger wall whereas, another one **(**Bullet Non IP- CP-VCG-ST24L2) was placed opposite of the first camera on the periphery wall of the open paddock. The cameras were installed in the experimental shed in such a way that gave the best possible view of activity across the whole shed. The signal from the cameras went through a video multiplexer DVR (8 Channel x 4 HDCVI with Remote CPPLUS-UVR-804E2) to record 24 hours of video in 2TB HDD surveillance. From HDD the data were transferred through USB (Pen drive) and finally stored in the 2 TB (Trillion bytes) Seagate® Expansion portable drive and further observations were made with desktop computer.

The prepartum feeding and elimination behaviour was observed seven days before the expected date of parturition. The exact calving time (defined as the time where the calf was fully expelled) was obtained from video recordings. The final 24 hr prior to calving was assigned as day −1. Days −2, −3 and −7 comprised hours −25 to −48, hours −49 to −72, and hours −145 to −168, respectively. Day 1 comprised hours 1–24 and day 2 comprised 25–48 hr after the parturition[10].

**Recording of observations**: Feeding state of cow was defined as cow places head through feed barrier and eats, with muzzle no more than 10 cm away from the feed manger[14]. Drinking state was defined as cow moves muzzle within 10 cm of water in trough. Ends when muzzle is more than 10 cm away from water. The number of times the cow opted for feeding state, during 24-hour period was recorded and referred as feeding frequency. The duration of more than 2 minutes was considered as feeding frequency. The time duration between two successive feeding events was recorded as feeding duration and this period was sum up for the 24-hour period and referred as feeding duration. The number of times the cow opted for water drinking state, during 24-hour period was recorded and referred as watering frequency. The number of times the cow passes the urine, during 24-hour period was recorded and referred as urination frequency. The number of times the cow defaecated, during 24-hour period was recorded and referred as defaecation frequency.

**Statistical Analysis**: Two-way ANOVA test were performed for pre-parturient behavioural parameters such as feeding, watering, defecating and urination behaviour of pre-parturient cows. Partitioning of variance for comparing means of all other traits were done using *aov* function of 'R' Software and means were compared using Tukey HSD[21].

## RESULTS AND DISCUSSION

**Feeding duration:** Cows of all the treatments have spent less time for feeding on the day of calving (-1 day) as compared to 2–7 days before calving (Table1). The mean feeding duration was 13.27 % less on the day of calving (315.00 vs. 273.19) as compared to 7 days before calving and difference was significant ($P<0.05$) among the days. Duration of feeding was not significant among the treatment groups; however, the effect was more pronounced in $T_2$ cows than $T_1$ heifers and $T_3$ cows. The decrease feeding duration on the day of calving (Day-1) is directly related to lesser feed intake. The reason for this might be due to increase restlessness and discomfort associated with the parturition process.

Reduction in feed intake was commonly seen in cows before parturition and the results are in agreement with the work of researchers [1, 2, 3, 8, 9, 10, 12, 17, 19]. Authors[13] reviewed that cows decrease their DMI by approximately 30% on the day of calving compared to the previous day and time spent at the feed bunk on the day of calving follows a similar pattern as dry matter intake, with a larger variation between individual cows.

**Table 1: Feeding duration of pre-parturient Kankrej cows before parturition**

| Day/Treatment | Day -7 | Day -3 | Day -2 | Day -1 | Overall |
|---|---|---|---|---|---|
| **$T_1$** | 298.57±15.19$^{ab}$ | 316.29±22.70$^{a}$ | 336.57±19.28$^{a}$ | 277.86±22.70$^{b}$ | 307.32±14.21 |
| **$T_2$** | 335.86±25.79$^{ab}$ | 310.57±15.50$^{a}$ | 309.00±20.37$^{a}$ | 241.71±26.87$^{b}$ | 299.29±16.53 |
| **$T_3$** | 310.57±15.18$^{ab}$ | 328.14±20.39$^{a}$ | 301.14±8.14$^{a}$ | 300.00±23.69$^{b}$ | 309.96±11.89 |
| **Overall** | 315.00±11.17 | 318.33±10.95 | 315.57±9.84 | 273.19±14.45 | 305.52±7.92 |

N.B. Means with different superscripts (row wise a,b) differs significantly.

**Table 2: Feeding frequency of pre-parturient Kankrej cow before parturition**

| Day / Treatment | Day -7 | Day -3 | Day -2 | Day -1 | Overall |
|---|---|---|---|---|---|
| **$T_1$** | 25.00±1.40$^{a}$ | 28.43±2.80$^{ab}$ | 30.29±3.12$^{ab}$ | 31.00±3.89$^{b}$ | 28.68±2.21 |
| **$T_2$** | 24.86±3.39$^{a}$ | 24.29±2.88$^{ab}$ | 21.71±1.86$^{ab}$ | 30.00±4.57$^{b}$ | 25.21±2.77 |
| **$T_3$** | 23.43±2.44$^{a}$ | 27.14±1.68$^{ab}$ | 24.00±1.21$^{ab}$ | 30.00±2.60$^{b}$ | 26.14±1.57 |
| **Overall** | 24.43±1.40 | 26.62±1.43 | 25.33±1.46 | 30.33±2.07 | 26.68±1.27 |

N.B. Means with different superscripts (row wise a,b) differs significantly.

**Table 3: Water drinking frequency of pre-parturient Kankrej cow before parturition**

| Day / Treatment | Day -7 | Day -3 | Day -2 | Day -1 | Overall |
|---|---|---|---|---|---|
| **$T_1$** | 3.86±1.03 | 3.71±0.97 | 3.86±1.06 | 4.29±1.17 | 3.93±1.01 |
| **$T_2$** | 3.57±0.72 | 3.14±0.55 | 4.00±0.98 | 4.57±1.07 | 3.82±0.74 |
| **$T_3$** | 4.00±0.82 | 4.14±0.55 | 4.00±0.76 | 3.57±0.65 | 3.93±0.63 |
| **Overall** | 3.81±0.48 | 3.67±0.40 | 3.95±0.51 | 4.14±0.55 | 3.89±0.44 |

**Table 4: Defaecation frequency of pre-parturient Kankrej cow before parturition**

| Day / Treatment | Day -7 | Day -3 | Day -2 | Day -1 | Overall |
|---|---|---|---|---|---|
| **$T_1$** | 10.71±0.68 | 11.00±0.79 | 11.29±0.61 | 10.86±1.01 | 10.96±0.63 |
| **$T_2$** | 10.43±0.37 | 11.14±0.55 | 11.14±0.40 | 11.57±0.90 | 11.07±0.37 |
| **$T_3$** | 12.00±0.58 | 11.71±0.87 | 10.86±0.67 | 13.00±1.31 | 11.89±0.45 |
| **Overall** | 11.05±0.34 | 11.29±0.41 | 11.10±0.32 | 11.81±0.63 | 11.31±0.29 |

**Table 5: Urination frequency of pre-parturient Kankrej cow before parturition**

| Day / Treatment | Day -7 | Day -3 | Day -2 | Day -1 | Overall |
|---|---|---|---|---|---|
| **$T_1$** | 4.00±0.62 | 4.43±0.43 | 4.14±0.26 | 4.71±0.52 | 4.32±0.35 |
| **$T_2$** | 4.57±0.78 | 4.14±0.40 | 4.43±0.87 | 5.00±0.65 | 4.54±0.31 |
| **$T_3$** | 4.29±0.36 | 3.43±0.37 | 3.43±0.37 | 4.43±0.53 | 3.89±0.24 |
| **Overall** | 4.29±0.34 | 4.00±0.24 | 4.00±0.32 | 4.71±0.32 | 4.25±0.18 |

Although, researchers [7 & 14] have reported less feeding duration on the day of calving compared to 2–4 days before calving but the difference found was not significant. The difference in the result might be due to different methodology in the experiments. Researcher[8] suggested that cows eat less on the day of calving because of the calving process and the associated stress. This stress can be due to social conflicts, deficiencies in housing and dietary changes during the dry period. Reduction in feeding time a few hours before calving may be due to shift in the motivational priorities of the cows or shift in the Dry matter intake (DMI) on the day of calving is a good indicator of the quality of dry cow management, as cows that eat more on the day of calving will get a better start to their lactation. Authors[17] suggested that rumination time and time spent feeding show promise as tools to identify cows close to calving.

**Feeding Frequency:** Mean feeding frequencies with their standard error of pre-parturient Kankrej cow during various days before parturition (Table 2) revealed that cow of all the treatments had taken feed for more times on the day of calving (-1 day) as compared to 2–7 days before calving. The difference found was significant ($P<0.05$). There was a gradual increase in the feeding frequency during the period and maximum was on the day of calving.

The mean frequency of feeding was almost 24.15 % higher on the day of calving (24.43 vs. 30.33) as compared to 7 days before calving and difference was significant ($P<0.05$) among the days. Frequency of feeding was not significant among the treatment groups. The feeding frequency might be higher on the day of calving likely due to increase in restlessness and to the discomfort associated with calving.

**Water drinking frequency:** The pre-parturient cows of all the treatments have drunken water more frequently on the day of calving (-1 day) as compared to 2–7 days before calving but the difference found was not significant. Mean water drinking frequencies was 8.66 % higher on the day of calving (4.14 vs. 3.81) as compared to 7 days before calving. But this was not true for the $T_3$ cows as they drunk less frequently on the day of calving than other days of observation. Further, the watering frequency was not significant among the treatment groups.

Other study showed that there was decrease in water intake on the day of calving, for example, researchers[7] observed non-significant reduction in water drinking duration; whereas[9&10] noticed non-significant less water intake of cows. In present study we have neither taken water intake nor duration, but considered watering frequency, hence it may not be compared. Less water frequency in $T_3$ cows on the day of calving may be due to unwillingness of older cows to move because of heavy weight. Higher watering frequency on the day of calving in $T_1$ heifers and $T_2$ cows may be due to increase in restlessness and to the discomfort associated with calving.

**Frequency of defaecation**: Cows of $T_3$ group defecated more frequently than the $T_2$ cows and $T_1$ and the difference found was not significant. The defaecation frequency was also non-significant among the days of observation. Further, mean defaecation frequency was 6.88 % higher on the day of of calving (11.81 vs. 11.05) as compared to 7 days before calving. All the cows defecated more frequently on the day of calving than other days of observation.

Defaecation frequency in the present study was in normal range as given by authors[15&18]. Although, it was higher than the values observed by[5] in lactating Kankrej cows in 5 min scan sampling process. The reason might be the attributed to the observation process as in the present study the frequency were counted for 24-hour period continuously. Generally, defaecation is performed while the animal is walking, standing, grazing or getting up[15], but in the present study it was observed that some of the periparturient cows defaecated while they were lying, which was unusual. Reason for this might be attributed to difficulty in standing with gravid uterus.

**Frequency of Urination**: Cows of $T_2$ group urinated more frequently than the $T_1$ cows and $T_3$ cows and the difference found was not significant Table. All the cows urinated 9.79 % more frequently on the day of calving (day-1) as compared to 2–7 days before calving but the difference found was not significant.

Urination frequency in the present study was similar to the findings of[5] in lactating Kankrej cows, but less than the study of[18] in crossbred lactating cows. In the present study the cows urinated less frequently than they defecate as reported by[6]. Our study further revealed that none of the peri-parturient cows were observed to urinate while they were lying, similarly as reported by[15] that most urination takes place while cattle are grazing, not while they are resting.

## CONCLUSION

It may be concluded from the study that Kankrej cows have higher feeding frequency, less feeding duration and higher watering frequency on the day of calving than 2-7 days before the calving. Elimination behaviour was at par throughout the observation period. The decrease in feeding duration on the day of calving is directly related to lesser feed intake and reason might be due to increase restlessness and discomfort associated with the parturition process. This stress behaviour was more prominent in primiparous than multiparous Kankrej cows. Dry matter intake (DMI) on the day of calving is a good indicator of the quality of dry cow management, as cows that eat more on the day of calving will get a better start to their lactation.

## ACKNOWLEDGEMENTS

The authors are thankful to the Director of Research S.D. Agricultural University for providing necessary facilities to carry out the research. The help rendered by the Staff and farm Manager of Kankrej unit, LRS, Sardarkrushinagar is also deeply acknowledged.

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*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 285-292 https://doi.org/10.48165/ijapm.2023.37.4.3

# A Study on the Effect of Housing on Growth Performance of Nellore Lambs

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**Received: 23.09.2023; Accepted: 12.01.2024**

**ABSTRACT**

A study was carried out to find out the effect of housing on growth performance of Nellore Jodipi lambs under tropical environmental conditions. Thirty weaned Nellore ram lambs of 3-4 months age were selected based on body weight (average initial body weight) and randomly divided into three groups of ten animals each. The lambs in Group-I were housed with morum flooring and asbestos roofing with tree shade, while Group-II lambs were housed with morum flooring and asbestos roofing without tree shade and Group-III lambs were housed with elevated slatted flooring and galvalume roofing without tree shade. Temperature and humidity values were significantly (P<0.05) different among all the groups. Lower mean maximum temperature (°C) values were observed in group III (35.53±0.28) when compared to group I (36.22±0.27) and II (37.29±0.25) and the lower average maximum relative humidity (%) was 69.59±2.92 in group III followed by group II (69.88±2.94) and I (70.65±2.96). The average body weight of lambs after 120 days in group I, II and III was 19.92±0.52, 18.89±0.32 and 22.26±0.44 kg, respectively. The mean ADG of Nellore lambs at different weekly intervals was 31.0±1.00, 23.0±1.00 and 49.0±1.00 g in group I, II and III, respectively. Significant (P<0.05) differences were observed in body weights and ADG among the three groups. It was concluded that the housing system of elevated slatted flooring with galvalume roofing proved to be effective in controlling heat stress and maintaining normal physiological responses for better growth performance of Nellore ram lambs.

**Key words:** Nellore Jodipi lambs, housing, tree shade, elevated slatted flooring, heat stress

Different practices of sheep rearing have different influence on their growth performance. The housing plays a key role in rearing of sheep. An ideal housing enables in moderating the range of microclimate to which the animals are exposed. The degree of comfort depends upon the types of housing. The principal functions of housing for livestock are health maintenance and provision of comfortable environment to the animals, desirable working conditions for labour and supervisory staff and integration of housing with feeding, watering, cleaning, handling and manure removal system. In housing management, particularly roof and floor management is an important aspect of sheep husbandry, which provides both comfort and cleanliness with minimal risk of injury. This gives better health cover to the animals and improves their growth rate and productivity. Therefore, ideal floor needs to be hygienic, dry, resilient, reasonably temperature resistant and comfortable to animals.

Elevated sheep houses offer many advantages in tropical and subtropical areas. It allows manure, urine and debris to drop through the slatted floor, thus eliminating a major source of disease and parasitic infestation. Slatted floor is easy to clean and maintain, and the waste that falls through it is easily collected and used as manure. It allows ventilation to circulate through the slats. During winter, chips, straw, plywood or other products can be placed over part of the

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slatted floor. The performance of the animals is also influenced by environmental factors like temperature and humidity in the region. Rearing of sheep in complete confinement with reduced floor space is difficult for the sheep farmers. Therefore, to overcome this situation, studying the growth performance of sheep on different types of housing is an important aspect for profitable sheep farming.

## MATERIALS AND METHODS

The present investigation was carried out at the Livestock Research Station (LRS), Palamaner, Chittoor District, Andhra Pradesh.

**Topography of the study area:** The Livestock Research Station, Palamaner, is located in the Chittoor District of Andhra pradesh at an elevation of 683 m above mean sea level on the 13.2 º North latitude and 78.7 º East longitude. The average annual rainfall of Chittoor district is about 862 mm, mostly during June to October months of the year. However, rainfall is rather erratic and uncertain. The average annual temperature is 27.4 ºC.

**Selection of experimental animals:** A total of thirty male Nellore Jodipi lambs of 3½ months age, 15 kg body weights were divided into three groups of ten animals each. The lambs were fed with green fodder and concentrate mixture as per ICAR 2013 standards. The experiment was conducted for a period of 120 days until the lambs reached the age of 7-8 months. A pre-experimental period of 10 days was given to the animals to acclimatize themselves to the housing environments. The study was conducted from April to July, 2019.

**Housing systems of experimental lambs:** The Nellore lambs were divided into 3 groups of ten lambs each.

Group I: House with morum flooring and asbestos roofing with tree shade.

Group II: House with morum flooring and asbestos roofing without tree shade.

Group III**:** House with elevated slatted flooring and galvalume roofing without tree shade.

**Feeding and management:** Measured quantity of mixture of Super Napier, Guinea grass, Jowar, Subabul, Stylo were offered to all the experimental animals twice daily in the portable manger. The concentrates were offered to the lambs of all three groups in the morning at 8 AM and evening at 4 PM. Dry matter requirement was calculated at the rate of 5 % of body weight of lambs and concentrates were calculated at the rate of 1/3 of total dry matter required for their body weight. All the lambs were stall fed and not sent for grazing. Pure clean drinking water is provided in the houses throughout the day. The three experimental houses were cleaned daily. The vaccination, deworming and other health measures for all experimental lambs were performed as a routine practice followed in the farm.

**Meteorological observations:** The information regarding the meteorological data i.e., maximum and minimum temperatures and humidity were recorded from morning to evening at the point of the experimentation weekly. For this purpose, the appropriate digital thermo-hygrometer (Digital Thermometer and Hygrometer - Model HTC-1) were fixed inside the houses at a point, well protected from direct as well as reflected radiation and yet with adequate air movement.

**Body weights:** Body weight (kg) of each individual lamb was recorded initially and at weekly interval by using the digital electronic weighing balance till the end of the experiment. Body weights were recorded in the morning before feeding.

## RESULTS AND DISCUSSION

**Environmental temperature:** The data on environmental temperature in different types of housing of Nellore lambs is presented in Table 1. The mean values of maximum temperature recorded experimental houses was 36.22±0.27,

**Table 1: The environmental temperature (°C) in the three different types of housing**

| PERIOD (Weekly Intervals) | Maximum (°C) | | | Minimum(°C) | | |
|---|---|---|---|---|---|---|
| | Group-I | Group- II | Group- III | Group-I | Group- II | Group- III |
| I | 36.2 | 37.2 | 35.7 | 26.4 | 26.5 | 26.4 |
| II | 36.3 | 37.2 | 35.8 | 26.5 | 26.6 | 26.5 |
| III | 36.6 | 37.6 | 36.0 | 26.6 | 26.7 | 26.5 |
| IV | 37.3 | 38.3 | 36.8 | 27.5 | 27.6 | 27.5 |
| V | 36.5 | 37.5 | 36.0 | 26.7 | 26.9 | 26.6 |
| VI | 38.9 | 39.8 | 37.4 | 27.8 | 27.9 | 27.7 |
| VII | 37.2 | 38.3 | 36.8 | 27.0 | 27.0 | 27.0 |
| VIII | 36.9 | 38.0 | 36.4 | 27.2 | 27.2 | 27.1 |
| IX | 35.4 | 36.5 | 34.8 | 26.9 | 27.0 | 26.9 |
| X | 36.1 | 37.2 | 35.5 | 26.2 | 26.3 | 26.1 |
| XI | 36.3 | 37.5 | 35.7 | 26.0 | 26.0 | 26.0 |
| XII | 36.0 | 37.1 | 35.2 | 25.1 | 25.2 | 25.1 |
| XIII | 36.1 | 37.2 | 35.5 | 23.2 | 23.4 | 23.2 |
| XIV | 36.0 | 37.1 | 35.4 | 23.0 | 23.0 | 23.0 |
| XV | 35.7 | 36.8 | 34.8 | 22.4 | 22.4 | 22.4 |
| XVI | 34.6 | 35.7 | 33.7 | 22.2 | 22.2 | 22.2 |
| XVII | 33.7 | 34.9 | 32.5 | 21.1 | 21.2 | 21.1 |
| **Mean±S.E** | **36.22$^{b}$ ± 0.27** | **37.29$^{c}$ ± 0.25** | **35.53$^{a}$ ± 0.28** | **25.40$^{b}$ ± 0.51** | **25.48$^{c}$ ± 0.52** | **25.37$^{a}$ ± 0.51** |

Values with different superscripts in a row differ significantly (P<0.05)

**Table 2: The environmental relative humidity (%) in the three different types of housing**

| PERIOD (Weekly Intervals) | Maximum (°C) | | | Minimum (°C) | | |
|---|---|---|---|---|---|---|
| | Group-I | Group- II | Group- III | Group-I | Group- II | Group- III |
| I | 71 | 70 | 70 | 54 | 53 | 53 |
| II | 69 | 68 | 67 | 52 | 51 | 49 |
| III | 70 | 68 | 68 | 49 | 48 | 48 |
| IV | 68 | 68 | 68 | 48 | 47 | 46 |
| V | 65 | 64 | 64 | 46 | 46 | 45 |
| VI | 62 | 62 | 62 | 43 | 43 | 42 |
| VII | 58 | 58 | 58 | 42 | 42 | 42 |
| VIII | 57 | 57 | 57 | 41 | 40 | 39 |
| IX | 57 | 56 | 56 | 43 | 43 | 43 |
| X | 60 | 59 | 59 | 51 | 50 | 49 |
| XI | 64 | 62 | 62 | 53 | 50 | 50 |
| XII | 68 | 68 | 66 | 54 | 53 | 52 |
| XIII | 74 | 74 | 74 | 54 | 53 | 52 |
| XIV | 81 | 80 | 79 | 55 | 54 | 55 |
| XV | 87 | 85 | 84 | 56 | 54 | 55 |
| XVI | 94 | 93 | 93 | 55 | 54 | 54 |
| XVII | 96 | 96 | 96 | 57 | 54 | 55 |
| **Mean±S.E** | **70.65$^{c}$ ± 2.96** | **69.88$^{b}$ ± 2.94** | **69.59$^{a}$ ± 2.92** | **50.18$^{c}$ ± 1.30** | **49.12$^{b}$ ± 1.65** | **48.82$^{a}$ ± 1.27** |

Values with different superscripts in a row differ significantly (P<0.05)

**Table 3. The body weights (kg) of Nellore lambs under different types of housing.**

| Period (Weekly intervals) | Group - I | Group - II | Group - III |
|---|---|---|---|
| **Initial body weight** | 15.76±0.18[a] | 15.91±0.41[a] | 15.98±0.23[a] |
| **I** | 16.00±0.13[a] | 16.05±0.40[a] | 16.22±0.24[a] |
| **II** | 16.21±0.12[a] | 16.18±0.39[a] | 16.52±0.26[a] |
| **III** | 16.40±0.17[a] | 16.29±0.38[a] | 16.82±0.29[a] |
| **IV** | 16.62±0.32[a] | 16.40±0.38[a] | 17.12±0.31[a] |
| **V** | 16.77±0.52[a] | 16.57±0.38[a] | 17.41±0.33[a] |
| **VI** | 16.95±0.39[a] | 16.74±0.37[a] | 17.79±0.34[a] |
| **VII** | 17.12±0.52[a] | 16.88±0.37[a] | 18.13±0.36[a] |
| **VIII** | 17.35±0.53[a] | 17.06±0.36[a] | 18.46±0.39[a] |
| **IX** | 17.56±0.53[ab] | 17.23±0.35[a] | 18.88±0.39[b] |
| **X** | 17.78±0.54[ab] | 17.41±0.34[a] | 19.26±0.40[b] |
| **XI** | 18.05±0.54[ab] | 17.59±0.33[a] | 19.60±0.43[b] |
| **XII** | 18.42±0.53[ab] | 17.79±0.35[a] | 19.96±0.44[b] |
| **XIII** | 18.71±0.53[a] | 17.99±0.34[a] | 20.42±0.45[b] |
| **XIV** | 19.03±0.54[a] | 18.21±0.32[a] | 20.87±0.44[b] |
| **XV** | 19.36±0.52[a] | 18.43±0.33[a] | 21.34±0.44[b] |
| **XVI** | 19.67±0.54[a] | 18.66±0.32[a] | 21.79±0.43[b] |
| **XVII** | 19.92±0.52[a] | 18.89±0.32[a] | 22.26±0.44[b] |

Values with different superscripts in a row differ significantly (P<0.05)

**Table 4. The Average Daily Gain (gm) of Nellore lambs at different weekly intervals under different types of housing.**

| Period (Weekly intervals) | Group - I | Group - II | Group - III |
|---|---|---|---|
| **I** | 33.0±0.30 | 19.0±0.20 | 33.0±0.30 |
| **II** | 29.0±0.40 | 18.0±0.30 | 42.0±0.50 |
| **III** | 26.0±0.30 | 18.0±0.30 | 42.0±0.50 |
| **IV** | 30.0±0.10 | 15.0±0.30 | 42.0±0.60 |
| **V** | 25.0±0.30 | 23.0±0.40 | 40.0±0.40 |
| **VI** | 25.0±0.30 | 23.0±0.30 | 53.0±0.40 |
| **VII** | 23.0±0.20 | 19.0±0.20 | 48.0±0.40 |
| **VIII** | 32.0±0.40 | 25.0±0.20 | 46.0±0.50 |
| **IX** | 29.0±0.30 | 23.0±0.20 | 59.0±0.60 |
| **X** | 30.0±0.40 | 25.0±0.20 | 53.0±0.60 |
| **XI** | 35.0±0.60 | 25.0±0.10 | 48.0±0.40 |
| **XII** | 38.0±0.50 | 29.0±0.20 | 52.0±0.60 |
| **XIII** | 38.0±0.40 | 29.0±0.20 | 64.0±0.60 |
| **XIV** | 45.0±0.70 | 30.0±0.10 | 63.0±0.60 |
| **XV** | 46.0±0.80 | 31.0±0.50 | 66.0±0.70 |
| **XVI** | 43.0±0.60 | 32.0±0.20 | 63.0±0.50 |
| **XVII** | 35.0±0.30 | 32.0±0.20 | 67.0±0.40 |
| **MEAN±S.E** | 31.0±1.00[b] | 23.0±1.00[a] | 49.0±1.00[c] |

Values with different superscripts in a row differ significantly (P<0.05)

37.29±0.25 and 35.53±0.28 °C and the mean values of minimum temperature were 25.40±0.51, 25.48±0.52 and 25.37±0.51 °C for group I (morum flooring and asbestos roofing with tree shade), II (morum flooring and asbestos roofing without tree shade) and III (elevated slatted flooring and galvalume roofing without tree shade), respectively.

Significant (P<0.05) difference was observed in the temperature among all the groups. The lower average maximum temperature was in group III (35.53±0.28) followed by group I (36.22±0.27) and II (37.29±0.25°C). The lower average minimum temperature was in group III (25.37±0.51) followed by group I (25.40±0.51) and II (25.48±0.52 °C). This might be due to continuous circulation of air inside the sheds, less heat absorption of galvalume roofing compared to asbestos roofs, less heat reflection from the ground as it is elevated.

The results of the present study are in agreement with [5] who reported that mean ambient temperatures in shaded (24.9 to 28.8) and unshaded (29.8 to 34.1 °C) groups which indicated that severity of heat stress is greater in unshaded group. Similar findings were reported by [11] in Madras red lambs maintained in slatted floor and mud floor houses.

The present findings on average maximum temperatures were in agreement with those of [8] who reported that the mean maximum temperature was 38.96±0.41 and 35.88±0.45°C in concrete roof with concrete floor and thatched roof with elevated slatted wooden floor housing respectively. However, [4] reported higher mean maximum temperature in Malpura lambs under three types of housing systems. They concluded that thatched roof in elevated house has superior protective cover against environmental changes than concrete roof.

With regards to average minimum temperature, similar findings were reported by [8] in crossbreed goats under different housing systems.

**Relative humidity:** The data on environmental relative humidity in different types of housing of ram lambs is presented in Table 2. The mean values of maximum relative humidity recorded in experimental houses were 70.65±2.96, 69.88±2.94 and 69.59±2.92 % and the mean values of minimum relative humidity were 50.18±1.30, 49.12±1.65 and 48.82±1.27 % for group I, II, and III, respectively.

Significant (P<0.05) difference was observed in the relative humidity among all the groups. The lower average maximum relative humidity was in group III (69.59±2.92) followed by group II (69.88±2.94) and I (70.65±2.96 %). The lower average minimum relative humidity was in group II (48.82±1.27) followed by group III (49.12±1.65) and I (50.18±1.30%).

Higher average maximum relative humidity in group I house might be due to higher condense of moisture under tree shade with asbestos roof. On the other hand, the group III reported lower relative humidity due to continuous circulation of air in slatted house and super protective mechanism of galvalume roofing.

The present findings were in agreement with those of [8] who reported that the mean relative humidity was 68.59±1.19 and 62.97±1.22% in concrete roof with concrete floor and thatched roof with elevated slatted wooden floor housing respectively. The present findings were in consonance with those reported by [11] in Madras red lambs maintained in slatted floor housing system which provided the better air quality for sheep. The results pertaining to the humidity are also in agreement with [4] who reported that the mean relative humidity was 23.61±1.91, 18.95±1.96 and 21.16±1.6 % in lambs kept in open area under tree shade, asbestos roofed and designed shed respectively.

**Body weight:** The data on body weights (kg) of Nellore lambs under different types of housing is presented in Table 3 and depicted in figure 1. The mean initial body weight before the experiment were 15.76±0.18, 15.91±0.41 and 15.98±0.23 kg

in group I (morum flooring and asbestos roofing with tree shade), II (morum flooring and asbestos roofing without tree shade), and III (elevated slatted flooring and galvalume roofing without tree shade), respectively.

The average body weights at 120 days in group I, II and III were 19.92±0.52, 18.89±0.32 and 22.26±0.44 kg, respectively. The body weights were significantly (P<0.05) different among all the experimental groups at 120 days. The highest body weight at 120 days was observed in group III (22.26±0.44 kg) followed by group I (19.92±0.52kg) and II (18.89±0.32kg).

The higher body weights in the present study were recorded in lambs housed in elevated slatted floor with galvalume roofing which might be due to amelioration of thermal stress during summer thus resulted in improved feed efficiency leading to beneficial effect on lambs in terms of better body weight gains.

The present results are in agreement with [6] who found that better growth performance was observed under slatted floor (19.65±0.71kg) as compared to mud floor housing system (18.15±0.44kg) in Madras Red lambs. Similarly, the results are also in agreement with Yasotha *et al.* (2002) who also found that a higher growth performance was observed under slatted floor (20.07±1.51 kg) as compared to mud floor housing system (19.27±1.39 kg) in weaned Madras Red lambs.

The results of the present study are also in partial agreement with [1] who reported that the mean body weights of Osmanabadi kids as 11.25 kg in loose house in open paddock, 12.42 kg in asbestos roof and concrete floor and 15.26 kg thatched roof and slatted floor housing at 6 months of age and concluded that maximum body weight gain was in the kids kept in house having thatched roof and slatted floor.

The present results are also in agreement but lower than the values reported by [2] who revealed that lambs housed in raised slatted floor cages (42.4±0.24 kg) were heavier than the lambs raised on floor pens (39.0±0.38 kg) in 90 days post-weaning of lambs due to lower contact with pathogens, energy expenditure in activities and better ventilation allowing better performance in slatted floor cages.

On contrary, [9] reported the final body weight of lambs as 22.98±1.08 kg (elevated slatted house) and 22.90±0.77 kg (mud floor system) and concluded that management system does not have any significant effect on the growth rate of Mecheri lambs.

**Average Daily Gain:** The average daily gain (g) of Nellore lambs under different types of housing was presented in Table 4 depicted in figure 2. The mean ADG at XVII week was 35.0±0.30, 32.0±0.20 and 67.0±0.40 g in group I, II and III, respectively. The mean ADG of Nellore lambs at different weekly intervals was 31.0±1.00, 23.0±1.00 and 49.0±1.00 g in group I, II and III, respectively. The ADG was significantly (P<0.05) higher in group III followed by group I and II.

The mean ADG of Nellore lambs at different weekly intervals was 31.0±1.00, 23.0±1.00 and 49.0±1.00 g in group I, II and III, respectively. The ADG was significantly (P<0.05) higher in group III followed by group I and II. The higher ADG in the present study was recorded in lambs housed in elevated slatted floor with galvalume roofing which might be due to better microclimate during summer thus resulted in increased feed intake thereby leading to beneficial effect on lambs in terms of average daily gain.

The results of the present study are in partial agreement with [11] who stated that the average daily weight gain of weaned Madras Red lambs at 4 months was 48.30±0.01 g in mud floor whereas in slatted floor group it is recorded as 75.00±0.02 g and concluded that lambs grown on slatted floor have significantly higher average daily gain than that of mud floor. Similarly, [6] studied the growth performance of madras red ewe lambs at 6-9 months age and concluded that average daily gain was higher in lambs kept in

slatted floor (69.16±5.32 g) as compared to lambs kept in mud floor (62.50±3.34 g) which might be due to better micro environment and good hygienic conditions in slatted floor.

However, comparatively a higher ADG was reported by [2] in lambs kept in raised slatted floor cages (306.5±2.69 g) compared to lambs kept in floor pens (269.4±4.24 g) due to lower contact with pathogens, energy expenditure in activities and better ventilation allowing better performance in slatted floor cages.

## CONCLUSION

The lower average maximum temperature was observed in group III followed by group I and II. This might be due to continuous circulation of air inside the sheds, less heat absorption of galvalume roofing compared to asbestos roofs, less heat reflection from the ground as it is elevated. The lower average maximum relative humidity was recorded in group III due to continuous circulation of air in slatted house and super protective mechanism of galvalume roofing, followed by group II and I. The highest body weight at 120 days and higher ADG was observed in group III followed by group I and II. The higher body weights were recorded in lambs housed in elevated slatted floor with galvalume roofing which might be due to amelioration of thermal stress during summer, resulted in improved feed efficiency leading to beneficial effect on lambs in terms of better body weight gains.

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*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 293-298 https://doi.org/10.48165/ijapm.2023.37.4.4

# Urban and Peri-urban Dairy Production System in Semi-arid Region of Uttar Pradesh

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**Received: 18.09.2023; Accepted: 25.01.2024**

**ABSTRACT**

Urban and peri-urban area are dairy intensive area which provides milk and milk products to the urban areas and thus help to generates regular income to these farmers. With rise in the urbanization the demands of milk and milk products is rising and farmers should be prepared the accelerating demands. The production of dairy animal is mostly influenced by feeding, management, health care and management practices with a clear understanding about scientific knowledge. Therefore, the efforts are made to assess the knowledge level of farmers and the factors affecting the dairy production in urban and peri-urban areas. This study was conducted purposively to assessing the Urban and Peri-urban Dairy production system in semi-arid region of Uttar Pradesh. The information on Urban and Peri-urban Dairy production system was collected using structured interview schedule from 120 households rearing cattle and buffalo from urban and peri-urban area. The results showed that majority of the respondents were having high dairy farming experience and buffalo was the preferred animal rather than cow. Majority of the farmers timely fed colostrum to newly born calves (97.50%) but the practice of feeding mineral mixture to animals is still the matter of concern. Majority of farmers were relying on natural service for breeding their bovines. Majority of farmers cleaned shed at regular interval to avoid infection and majority of them vaccinate their animals against one or the other diseases.

**Key words:** Dairy production system, peri-urban, urban, semi-arid, Uttar Pradesh

India being one of the most populous countries in the world with nearly one fifth of the world's population. The country population had grown by 17.64 percent with rural-urban distribution of 68.84 percent and 31.16 percent respectively as per 2011 census (Census of India, 2012). The increase in population is putting pressure on the agriculture and livestock production as there is sudden need to double the production to feed the growing population. It is expected that demand of milk will increase day by day due to rapid increase in demand of milk and milk products and it might be dream for anyone to capitalize this fact growing milk and its product market. Animal husbandry is an economic enterprise & considered as "*Survival Enterprise*" for millions of people in India especially in arid & semi-arid regions (Singh *et al.,* 2018). Dairy sector is one of the important segments providing food security to the millions of people living in the rural, urban and peri-urban area. The sector had significant impact on livelihood security of dairy farmers in existing conditions by providing food security to the millions of people living in the rural, urban and peri-urban area of India[11]. Additionally, dairy sectors help in boosting rural economic growth and empowering the rural women along with countries youth. The sector is changing its track

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by venturing itself on commercial basis leading to the growth of milk production in and around urban and peri-urban areas leading to a new production system pattern. The accelerating the demand for food of animal origin is having a favorable prospectus for local dairy production in urban and peri-urban area as it provides opportunity to develop their own milk industries, primarily through small scale production, which will have a major impact on different levels of cash income[13]. The main strength of this type of production system is that half of the total milk produced was directly sold to consumers followed by milk vendors and cooperative[7]. The production of dairy animal is mostly influenced by the scientific feeding, health care and management practices with a clear understanding about the urban and peri-urban production system practices followed by the farmers strengths and weaknesses about the rearing system adoption of suitable intervention policies. With this background, the study was undertaken to assess dairy production system in urban and peri-urban areas in semi-arid region of Uttar Pradesh.

## MATERIALS AND METHODS

The *expost facto* study was conducted in the state of Uttar Pradesh, where multi-hued Indian culture has blossomed from times immemorial. Agra division, which is one of the eighteen divisions of the state, was purposively selected for the study. Agra is one of the 100 smart cities of India is suited for urban and its fringes come under Peri-urban areas that are suitable for study. Among four district of Agra Division, two districts were selected by using simple random sampling method. A total 120 respondents were selected to assess the management practices in dairy production system of urban and peri-urban dairy farming. The primary data were collected through pretested structured interview schedule and group discussion method from the respondents. The collected data was analyzed and presented in tabular form for meaningful understanding.

## RESULTS AND DISCUSSION

The study data revealed that majority of urban dairy farmers (47.50%) comes under middle age group while majority of peri-urban dairy farmers (47.50%) belong to middle age group. It was also observed that nearly 45.00 percent respondents were having medium experience in livestock rearing followed by 40.00 percent with high experience and only 15.00 percent were having low experience in livestock rearing in urban dairy farmers. Peri-urban respondents were having high experience (45.00%) in livestock rearing followed by with medium and low experiences (38.75 %) and having low experience (16.25 %) in livestock rearing in urban dairy farmers.

Herd size of the respondent's revealed that nearly 47.50 percent of respondents had large herd size, while 31.67 percent had medium herd size and only 20.83 percent respondents had small herd size (Table 2). It is further observed that urban and peri-urban dairy farmers mostly prefer rearing of buffaloes (916) than cows (334). The importance of rearing the buffalo were also observed by[14].

### Management practices followed by respondents

Feeding practices in urban and peri-urban areas showed that majority of respondent (97.5 %) has adopted feeding of colostrum to newly born calves within one hour of birth (Table 3). The fodder to large animals is offered in groups whereas, the concentrate mixture are fed on an individual basis depending on quantity of milk produced by animal (65.0 %). Practices of mineral mixture feeding as well as feed supplementation were low in both urban and peri-urban areas due to inadequate knowledge about its importance. The finding of [10] also revealed that there is lack of knowledge about feeding mineral mixture and adequate ration to animals in the urban area (47.6 %) than peri-urban (45.04 %) area. Thus, the measure as suggested by [2] like providing information on cost-effective balanced feeding; enriching the dry fodder with urea and

**Table 1: Profile of Urban and Peri-urban dairy farmer (n=120)**

| Category | Urban | Peri-urban | Overall |
|---|---|---|---|
| **Age** | | | |
| Young (<35years) | 9 (22.50) | 11 (13.75) | 20 (16.67) |
| Middle (35-50 years) | 12 (30.00) | 38 (47.50) | 55 (45.83) |
| Old (>50 years) | 19 (47.50) | 31 (38.75) | 45 (37.50) |
| **Experience** | | | |
| Low (<10 years) | 6 (15.00) | 13 (16.25) | 23 (19.17) |
| Medium (10-19 years) | 18 (45.00) | 31 (38.75) | 41 (34.17) |
| High (>20 years) | 16 (40.00) | 36 (45.00) | 56 (46.67) |
| **Herd size** | | | |
| Small (<7 livestock) | 7 (17.50) | 12 (15.00) | 25 (20.83) |
| Medium (7-9 livestock) | 14 (35.00) | 18 (35.00) | 38 (31.67) |
| Large (>9 livestock) | 19 (47.50) | 40 (50.00) | 57 (47.50) |

**Table 2: Herd composition of urban and peri-urban dairy production system**

| Species | Cow | | Buffalo | | Overall |
|---|---|---|---|---|---|
| | Urban | Peri-urban | Urban | Peri-urban | |
| Heifer | 18 | 17 | 3 | 6 | 44 |
| Milch animal | 64 | 83 | 170 | 264 | 581 |
| Dry animal | 0 | 8 | 5 | 2 | 15 |
| Pregnant animal | 0 | 4 | 7 | 17 | 28 |
| Calves | 60 | 80 | 108 | 219 | 467 |
| **Total** | **142** | **192** | **318** | **598** | **1135** |

salt treatment, and use of compact feed blocks should also be adopted.

The role of breeding is very important to generate sufficient seed stock of improved germplasm to sustain the growth of livestock products. It was observed that majority of respondents (91.67 %) under study keeping close watch during heat or estrus time in cow/buffaloes. Natural service is preferred over Artificial Insemination (AI) in both Urban, Peri-urban areas. It reflects that the reach AI as well as preference was quite low in Urban and Peri-Urban which might be due to either poor conception rate or due to myths [8].

The animals as well as shed were managed by respondents as 99.00 percent use to clean animal's shed at regular interval to avoid infection and about 95.00 % percent provides clean and fresh water 2-3 times a day to their animal. The practices of clean milk production

**Table 3: Distribution of the respondents according to management practices. (n=120)**

| Practices | Urban (Percentage) | Peri-urban (Percentage) | Overall (Percentage) |
|---|---|---|---|
| **Feeding** | | | |
| Feeding colostrum to newly born calves | 100 | 96.25 | 97.50 |
| Feeding concentrate mixture on the basis of milk production | 70.00 | 62.50 | 65.00 |
| Feeding adlib green fodder | 25.00 | 23.75 | 34.17 |
| Feeding of mineral mixture | 42.50 | 16.25 | 25.00 |
| Feeding of feed supplements | 57.50 | 37.5 | 44.17 |
| **Breeding** | | | |
| Keeping watch on estrous cycle and heat symptoms of cow/buffaloes | 95.00 | 90.00 | 91.67 |
| A.I. in animal to proper time of heat | 51.25 | 35.00 | 45.00 |
| Practicing the pregnancy diagnosis between 45 – 90 days of service | 72.50 | 52.50 | 60.00 |
| Natural mating in cow/buffalo | 65.00 | 77.50 | 74.17 |
| **Management** | | | |
| Providing clean and fresh water for drinking to animals | 100 | 92.5 | 95.00 |
| Practicing full hand method of milking the animals | 85.00 | 78.75 | 62.83 |
| Cleaning of animal shed | 100 | 98.75 | 99.17 |
| Practicing disbudding in calves at the age of about 7-15 days | 45.00 | 27.50 | 32.50 |
| Record maintenance like income, milk production & animal health record | 92.50 | 47.50 | 63.33 |
| **Health Care** | | | |
| Practicing timely vaccination timely | 72.50 | 52.50 | 59.17 |
| Segregating the diseased animals suffering from Contagious disease | 82.50 | 30.00 | 48.33 |
| Practicing deworming in animal | 67.50 | 30.00 | 42.50 |
| Providing treatment of umbilical cord to new born calf | 65.00 | 41.25 | 47.50 |
| Practicing of prevention from internal and external parasitic diseases | 30.00 | 26.25 | 37.50 |

were adopted by washing the udders before milking. Milking of animals is generally carried out twice a day and mostly performed by full hand method. The practices of disbudding of calves were low in peri-urban areas than urban area (27.50% *vs.* 45.00%). Vaccination is adopted by

the farmers as more than 59.00% farmers vaccinated their animals against one or the other diseases and majority of them in urban areas kept the diseased animals in a separate isolation shed. Therefore, it is urgent need to train the farmers of peri-urban areas to keep the diseased animals separately so that the spread of contagious diseases can be minimized.

## CONCLUSION

Dairy sector is emerging as an important economic sector in urban and peri-urban area of India. The sector is changing its track by venturing itself on commercial basis leading to the growth of milk production activities in and around urban and peri-urban areas leading to a new production system pattern. Thus, the study concludes that due to its economic importance, buffalo is mostly preferred animals. The scientific practices need to be disseminated in the areas as the adoptions of these practices were quite low. There is tremendous scope of increasing milk production and productivity of dairy animal's by improving nutrient availability and management practices. Thus, a favorable policy in terms of addressing the technical constraints needs to be addressed for urban and peri-urban farmers with organization of animal health camps and extension support system need to be strengthen to create awareness among farmers regarding the adoption of better dairy production practices.

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*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 299-305 https://doi.org/10.48165/ijapm.2023.37.4.5

# Behavioural Activities of Large White Yorkshire Crossbred Pigs under Different Mating Regimens

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**Received: 27.09.2023; Accepted: 21.01.2024**

**ABSTRACT**

The present study was carried out on 18 crossbred LWY gilts and sows that were mated with suitable boars with the objectives to study the effect of various mating frequencies on various behavioural activities. They were randomly divided into 3 equal groups viz., Group I, II and III which were mated once, twice and thrice respectively with suitable boars, during a heat period and observed pre-coital and coital behavioural activities. Overall intermittent movement, slight forward movement, standing firmly were observed during, 5 (13.88%), 7 (19.44%) and 24 (66.66%) successful mating sessions, respectively. Gilts/sows exhibited frequent and partial vocalisation during 3 (8.33%), 10 (27.77%) mating sessions respectively out of total successful mating sessions. Gilts/ sows remained content during 22 (61.11%) successful mating sessions. Aggression, urinating and sniffing male genitalia was observed during 3 (8.33%), 11 (30.55%), 13 (36.11%) successful mating sessions out of total successful mating sessions. There was no significant difference between the groups. Overall mean of the primary changes in peri-partum behaviour viz., restlessness, grunting and anxiousness were observed 24.33 ± 3.16 h, 17.00 ± 3.11 h and 3.50 ± 0.64 h, respectively before farrowing. Overall mean of nest building behaviours viz., rooting & pawing, bar biting, chewing were observed 50.22 ± 4.47 h, 29.00 ± 2.66 h and 17.77 ± 1.41 h, before the birth of first piglet.

**Key words:** Crossbred LWY pigs, mating regimens, sexual behaviour, farrowing behaviour

Among the livestock species, pig finds an important place as it being reared by socio-economically weaker sections of the society. Pig as compared to other livestock species has a great potential to contribute faster economic return to the farmers, because of certain inherent traits like high fecundity, better-feed conversion efficiency, early maturity and short generation interval. Swine reproduction requires special attention as the prime factor determining the production and multiplication of the stock. Profitability in any commercial livestock-breeding unit is related to reproductive efficiency.

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Pen mating, hand mating and artificial insemination are the different mating systems usually practised in organised pig farms. Reproductive efficiency and behaviours vary between sows and gilts and it varies in different geographic locations[4]. The sexual behaviour of the boars during the mating session is of the utmost importance. In light of this, a study was conducted to determine the impact of different mating procedures on the expression of sexual behaviour in LWY Boars using an outdoor hand mating method.

## MATERIALS AND METHODS

Present research work was conducted on the stock of gilts and sows at livestock farm complex, NTR College of veterinary science, Gannavaram and a local farm at Simhadripuram,

Andhra Pradesh, India.

**General Management of Experimental Animals:** A stock of 18 Large white Yorkshire crossbred sows and gilts were utilized for the study. The animals were selected and distributed evenly between groups based on their age and body weight. Six crossbred LWY boars (aged 20.5 ± 0.5 m) were selected and matings were conducted randomly in outdoor system of mating with various frequencies and were recorded in closed circuit cameras. All the females were housed under group housing system with 2 females in each pen while boars were kept in individual pen throughout the study period. Feeding management was identical for all the experimental animals. Hand mating system was followed where the oestrus gilt/sow was brought to the boar's pen as per the laid down breeding plan of the farm. Other managemental practices like cleaning, sanitation and disinfection measures as well as health care were kept identical for all the animals during the experimental period. Skilled labourers were engaged for mating in animals along with some supervisory manpower.

**Design of the Experiment:** The 18 crossbred LWY gilts and sows were randomly mated with desired boars. In group (G I), gilts and sows (n=6) were mated once in a particular heat period, with desired boars. In group (G II), gilts and sows (n=6) were mated twice and in group (G III) gilts and sows (n=6) will be mated to the desired males three times during particular heat period. Behavioural parameters were recorded for all gilts and sows at the time of oestrus detection, mating, gestation period and during farrowing.

**Parameters Recorded:** The frequency of occurrence and duration of various sexual behavioural activities during mating were recorded for a 20-minute mating session after introduction of gilt/sow into boar's pen. Some of the female sexual behaviours like sniffing, urinating, vocalization and aggression were recorded during mating. The behavioural activities during pre- and peri-partum were recorded in selected gilts and sows of each group. The physical signs of approaching parturition and behavioural changes during peripartum period including nest building activity were documented for its first occurrence prior to start of farrowing process. The time taken for completion of farrowing mean time interval between delivery of piglets (inter-piglet birth interval) and time interval from expulsion of last piglet to that of placenta were also recorded.

## RESULTS AND DISCUSSION

**Sexual Behavioural Activity:** Sexual behavioural activity in crossbred LWY gilts and sows were presented in Table 11. Oestrous females stood firmly during 24 successful mounts, (66.66%) and slight forward movements were observed during 7 successful mounts. (19.44%). Intermittent movements were observed during 5 mounts (13.88%). In 22 successful mounts (61.11%) oestrous female remained content while partial vocalization was exhibited during 10 successful mounts (27.77%) whereas in three gilts (8.33%) vocalization was frequent throughout the mount. Aggression was exhibited by gilts/sows during 3 (8.33%) mounts. The percentage of estrous females that stood firmly, partial vocalisation, urinating and sniffing male genitalia during successful mating sessions were comparatively higher in the present study compared to previous studies which reported that 47.06% estrous gilts stood firmly, 17.65% showed partial vocalisation, 0.99% urinated and 13.73% sniffed male genitalia during successful mounts[1].

The percentage females that showed intermittent and slight forward movement, remained content were comparatively lesser than who reported that of previous study who reported 33.33% estrous gilts stood with slight forward movements and 13.33% showed Intermittent movements during successful mounts[1].

**Physical Signs of Approaching Parturition:** The overall mean swelling of vulva, enlargement of udder, cloudy mucus discharge from vulva and

**Table 1: Behavioural Activities in Crossbred LWY Gilts/Sows During Successful Mating (%)**

| Activity | G I (n=6) | G II (n=12) | G III (n=18) | Total |
|---|---|---|---|---|
| **Restlessness** | | | | |
| Restless | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Intermittent movement | 1 (16.6%) | 2 (16.66%) | 2 (11.11%) | 5 (13.88%) |
| Slight forward movement | 1 (16.66%) | 2 (16.66%) | 4 (22.22%) | 7 (19.44%) |
| Standing firmly | 4 (66.66%) | 8 (66.66%) | 12 (66.66%) | 24 (66.66%) |
| **Vocalization** | | | | |
| Frequent | 0 (0%) | 1 (8.3%) | 2 (11.11%) | 3 (8.33%) |
| Partial | 1 (16.66%) | 4 (33.33%) | 5 (27.77%) | 10 (27.77%) |
| Content | 5 (83.33%) | 6 (50%) | 11 (61.11%) | 22 (61.11%) |
| **Aggression** | **0 (0%)** | **1 (8.3%)** | **2 (11.11%)** | **3 (8.33%)** |
| **Urinating** | **4 (66.66%)** | **4 (33.33%)** | **5 (27.77%)** | **11 (30.55%)** |
| **Sniffing male genitalia** | **3 (50%)** | **3 (25%)** | **7 (38.88%)** | **13 (36.11%)** |

Data represents number of successful mating sessions (with percentages) in which the behaviour was observed. (n=6), (n=12), (n=18) represents total number of successful mating sessions in each group

**Table 2: Behaviours Expressed Prior to Farrowing in Crossbred LWY Gilts and Sows**

| Activity | G I | G II | G III | Overall Mean |
|---|---|---|---|---|
| **Physical signs of approaching parturition** | | | | |
| Swelling of vulva (h) | 137.00 ± 10.09 (6) | 154.67 ± 3.71 (6) | 140.33 ± 3.03 (6) | 148.77 ± 4.09 (18) |
| Cloudy mucus from vulva (h) | 49.2 ± 7.68 (5) | 40.5 ± 2.87 (4) | 36.67 ± 4.36 (4) | 43.84 ± 3.21 (13) |
| Udder enlargement (h) | 160.67 ± 10.55 (6) | 171.00 ± 6.53 (6) | 151.00 ± 4.98 (6) | 167.55 ± 4.54 (18) |
| Drooping of tail (h) | 1.74 ± 0.31 (5) | 1.15 ± 0.22 (4) | 0.92 ± 0.10 (4) | 1.37 ± 0.16 (13) |
| **Peri-partum Behavioural activity** | | | | |
| Restlessness (h) | 34.33 ± 5.76 (6) | 19.33 ± 4.40 (6) | 23.00 ± 2.97 (6) | 24.33 ± 3.16 (18) |
| Grunting (h) | $27.33 \pm 5.21^{a}$(6) | $10.80 \pm 3.19^{b}$(5) | $14.00 \pm 2.31^{b}$(5) | 17.00 ± 3.11 (16) |
| Looking anxious (h) | 5.17 ± 1.56 (6) | 2.67 ± 0.71 (6) | 4.00 ± 1.47 (6) | 3.50 ± 0.64 (18) |
| **Nest building behaviour** | | | | |
| Rooting &Pawing (h) | 58.67 ± 8.86 (6) | 46.00 ± 7.21 (6) | 64.33 ± 4.86 (6) | 50.22 ± 4.47 (18) |
| Bar biting (h) | 23.00 ± 2.41 (6) | 32.00 ± 5.29 (6) | 33.00 ± 3.39 (6) | 29.00 ± 2.66 (18) |
| Champing/chewing (h) | 19.33 ± 2.86 (6) | 17.00 ± 2.41 (6) | 11.67 ± 0.30 (6) | 17.77 ± 1.41 (18) |

Values in the parenthesis represents number of sows/gilts in which the activity/ behaviour is observed
a - b Values with dissimilar superscripts in a row differed significantly ($p<0.05$)

drooping of tail were observed 148.77 ± 4.09 h, 167.55 ± 4.54 h, 43.84 ± 3.21 h and 1.37 ± 0.16 h, respectively before the expulsion of first piglet. Swelling of vulva was observed 6.16 days (148.77 ± 4.09 h) before parturition. The results were in agreement with the findings of prior study which reported 6.25 days[1], swelling of vulva was reported 4 days before parturition[10,9,15.] The frequency of mating had no influence ($p>0.05$) on the time of appearance of physical signs of approaching parturition.

**Peri-Partum Behaviour:** The first changes in

**Table 3: Behaviours Expressed During Farrowing in Crossbred LWY Gilts and Sows**

| Parameter | G I | G II | G III | OVERALL MEAN |
|---|---|---|---|---|
| **Inter-piglet-birth interval number** | | | | |
| First | 26.16 ± 7.86 (6) | 19.33 ± 1.52 (6) | 21.33 ± 3.23 (6) | 22.27 ± 2.79 (18) |
| Second | 17.33 ± 1.47 (6) | 16.66 ± 1.58 (6) | 14.33 ± 1.08 (6) | 16.11 ± 0.82 (18) |
| Third | 16.33 ± 2.06 (6) | 15.83 ± 0.94 (6) | 15.33 ± 0.84 (6) | 15.83 ± 0.76 (18) |
| Fourth | 15.66 ± 2.62 (6) | 18.66 ± 2.76 (6) | 13.50 ± 0.62 (6) | 15.94 ± 1.31 (18) |
| Fifth | 16.33 ± 1.28 (6) | 16.50 ± 1.67 (6) | 14.17 ± 1.14 (6) | 15.66 ± 0.79 (18) |
| Sixth | 13.83 ± 1.66 (6) | 17.83 ± 2.35 (6) | 15.50 ± 1.76 (6) | 15.72 ± 1.13 (18) |
| Seventh | 14.80 ± 1.28 (5) | 16.33 ± 1.40 (6) | 14.33 ± 1.28 (6) | 15.17 ± 0.75 (17) |
| Eighth | 13.33 ± 3.17 (3) | 16.75 ± 1.60 (4) | 16.50 ± 2.19 (6) | 15.85 ± 1.29 (13) |
| Ninth | 12.00 ± 1.00 (2) | 12.50 ± 0.50 (2) | 13.80 ± 1.53 (5) | 13.11 ± 0.87 (9) |
| Tenth | | 13.50 ± 2.50 (2) | 10.50 ± 1.50 (2) | 12.00 ± 1.47 (4) |
| Eleventh | | 11.00 ± 0.00 (1) | 14.50 ± 1.50 (2) | 13.33 ± 1.45 (3) |
| **Average (min)** | 16.78 ± 1.23 (46)* | 16.80 ± 0.60 (51)* | 15.24 ± 0.58 (57)* | 16.22 ± 0.17 (154) |
| **Farrowing time (min)** | 128.66 ± 8.30 (6) | 142.83 ± 8.85 (6) | 144.83 ± 8.52 (6) | 138.78 ± 4.96 (18) |
| **Expulsion of placenta (min)** | 71.17 ± 17.82 (6) | 62.83 ± 5.46 (6) | 74.17 ± 9.69 (6) | 69.39 ± 6.68 (18) |

Values in the parenthesis represents number of gilts/sows in which the parameter is observed

*represents average inter-piglet interval for entire group

peri-partum behaviour were restlessness, grunting and anxiousness. In the present study, the peri partum gilts and sows frequently altered their position, either from side to side when lying down, or from lying to standing[2.] The overall peri-partum behaviour of restlessness was observed 24.33 ± 3.16 h before expulsion of first piglet, which was contradictory to the findings of prior study which reported restlessness of 32.25±8.73 h before expulsion of first piglet in crossbred landrace X desi gilts[1]. The time of first occurrence of restlessness did not differ significantly ($p>0.05$) between group I, II and III. The peri-partum behaviour of grunting was significantly ($p<0.05$) higher in group I (27.33 ± 5.21 h ) before parturition compared to group II and group III and overall grunting was for 17.00 ± 3.11 h, which was nearer to 19.56±4.77 h[1]. The overall peri-partum behaviour of looking anxious was 3.50 ± 0.64 h before the expulsion of first piglet, which is not in agreement to the findings of previous study that reported looking anxious behaviour 6.55±1.86 h before expulsion of first piglet in crossbred landrace X desi gilts[1]. The peri-partum behaviour of looking anxious did not differ significantly ($p>0.05$) between the groups.

**Nest Building Behaviour:** The gilts and sows exhibited the nest building behaviours like rooting, pawing, biting and chewing of hard object. The overall nest building related behavioural activities like rooting & pawing, bar biting, chewing were observed 50.22 ± 4.47 h, 29.00 ± 2.66 h and 17.77 ± 1.41 h respectively, before the birth of first piglet, which were in tune with the findings of previous study which reported that for rooting & pawing, bar biting, chewing72.67±12.41 h, 25.86±5.89 h and 18.83±3.53 h respectively[1].There was no significant ($p>0.05$) difference in nest building behaviour between the groups. Nest building behaviour was observed 1- 3 days before the

**Figure 1:** Drooping of tail and swelling of vulva in pregnant crossbred LWY gilt/sow

**Figure 2:** Enlargement of udder in pregnant crossbred LWY sow

**Figure 3:** Rooting behaviour

birth of first piglet which was in tune with findings of prior studies that reported that sow started to build the nest at approximately 24 h before parturition, showing most intensive activity 12 to 6 h before farrowing[14,3,12].

**Behaviour Expressed During Farrowing:** The durations of farrowing, Inter-piglet-birth interval and expulsion of placenta were presented in Table 13. The average inter-piglet birth interval was shortest before the birth of penultimate piglet

12.00 ± 1.47 min, whereas the first inter-piglet birth interval was the longest 22.27 ± 2.79. The inter-piglet birth interval was longest at early farrowing which was in tune with findings which reported longer first inter piglet interval[19] and the present findings were not in agreement with the findings that showed inter-piglet birth interval increased towards the end of farrowing[6]. Overall mean inter-piglet birth interval was 16.22 minutes which was identical to observations made by previous studies that mentioned overall mean inter-piglet-birth interval as 16 minutes[19] and 16.9 minutes[1] respectively. The results in the present study were in tune with the study that reported the interval was in the range of 5 to 47 min[21], but deviated with average inter-piglet birth interval of 27.55±5.97 min[23], 14.9±9.8 min[26] and was also contrary to mean inter piglet interval of 15.3 min in LWY and Landrace X LWY crosses[15.] Inter-piglet birth interval did not differ significantly ($p>0.05$) between the groups as observed by the study that reported that frequency of mating may not influence the interval between piglet births[1]. The duration of farrowing and time taken for expulsion of placenta did not differ significantly ($p>0.05$) between the groups. Overall mean duration of farrowing was 138.78 ± 4.96 min which was similar to the prior findings that reported average farrowing duration of 130±89 min[26]. The mean duration of parturition was within the range of 2.3-2.9 h[15,7,] but it was not in agreement with the prior findings that reported mean duration of parturition of 5.1 h[9]. The duration of farrowing was not in agreement with the prior findings that reported an average farrowing duration of 168±0.73 min in pen system for crossbred (L x D) sows in Indian conditions[23] and also average duration of farrowing as 175.80±24.93 min in pen system for crossbred (L x D) gilts[1].

Average time taken for expulsion of placenta after the birth of last piglet was observed to be 69.39 ± 6.68 min (Table no). The result was in agreement with the previous observations who reported 59.38 ± 23.18 min for expulsion of placenta in crossbred landrace gilts[1].This was not in agreement with the observations made by previous study that reported expulsion of placenta 159±99 min after the expulsion of last piglet[26].

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*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 306-309 https://doi.org/10.48165/ijapm.2023.37.4.6

# Knowledge Level of Improved Buffalo Husbandry Practices in Peri-urban areas of Surat city of Gujarat

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**Received: 02.09.2023; Accepted: 12.01.2024**

**ABSTRACT**

A field survey was conducted in the Peri-urban areas of Surat city of Gujarat to assess the knowledge level of randomly selected 50 buffalo farm owners about improved buffalo husbandry practices. The analysis of data collected by personal interview method revealed that majority of buffalo owners had medium knowledge level on different aspects of improved buffalo husbandry practices viz. 76% for feeding, 56% for breeding, 72% for general management and 50% for health care. The overall knowledge levels of the respondents in improved buffalo husbandry practices fall under low, medium and high categories are 16%, 68% and 16%, respectively. The knowledge index of different aspect of improved buffalo husbandry practices of feeding, breeding, general management and health care were 42.50, 67.575, 45.50 and 54.25%, respectively and overall knowledge index of improved buffalo husbandry practices was 52.50 % in the study area.

**Key words:** Buffalo, husbandry, knowledge, peri-urban areas

India has a total of 536.76 million livestock, including 193.46 and 109.85 million cattle and buffalo, respectively[2]. Gujarat has a total of 26.9 million livestock, including 9.6 million cattle and 10.5 million buffaloes. With an estimated 187.75 million tonnes of milk produced worldwide in the 2018–19 period, India holds the top rank. Gujarat contributes approximately 14.49 million tonnes of milk to India's overall milk supply, with a per-person availability of 626 g/day[1]. The management practices used to raise dairy animals generally determine their production performance, and these practices differ greatly across different agro-ecological regions due to a variety of factors. Farmers in a region must manage their dairy animals with care if they are to identify the production systems' strengths and weaknesses and create effective intervention strategies. Adoption of these practices, which ultimately increase the productivity of dairy animals, requires knowledge of improved dairy husbandry practices. In order to determine the level of buffalo farmers' knowledge regarding improved buffalo husbandry practices in peri-urban areas of Gujarat, the current study was conducted.

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## MATERIALS AND METHODS

A field survey was conducted in peri-urban areas of Surat city of Gujarat and data were collected from randomly selected 50 buffalo's farm owners who were kept more than 10 buffaloes with its followers. While choosing respondents due care was taken to ensure that they were evenly distributed and truly represented buffalo management practices in the study areas. The selected buffalo farm owners were single interviewed and the desired information was collected on the knowledge level of improved buffalo husbandry practices with the help of an interview schedule. Knowledge level of the respondents regarding improved buffalo husbandry practices was measured by asking various questions related to buffalo husbandry

practices Viz., feeding, breeding, general management and health care. Further, each practice contains eight questions. A score of 1 was assigned for each correct answer while for each incorrect answer a score of 0 was assigned. Data were tabulated and the total score obtained by individual respondent for all the statement was calculated and analyzed. Then with the help of mean and standard deviation the respondents were categorized as low (Below mean-S.D.), medium (mean±S.D.) and high (Above mean+S.D.) for their knowledge level[10]. The Knowledge index was determined by using formula given below[7].

$$Knowledge\ Index = \frac{Actual\ score\ obtained}{Maximum\ score\ obtainable} \text{ x } 100$$

Knowledge level of the respondents was further categorized into low, medium and high for individual practices viz. feeding, breeding, general management and healthcare practices in a similar way.

## RESULTS AND DISCUSSION

Data presented in Table 1 revealed that 76 percent of respondent had medium knowledge, followed by equal percent of respondent had low (12%) and high (12%) knowledge on feeding aspect. The present findings are in accordance with the earlier results of [5,7,8] who reported that 69.58, 71.00 and 74.00 percent of the respondents had medium level of knowledge in study areas of Jhansi district of Bundelkhand region, Navsari and Surat district of South Gujarat, respectively. However, present results are encouraging than earlier report of author [6] who found that 58.75 percent of the respondents had medium level of knowledge in feeding practices. Majority (56%) of the respondents had medium knowledge followed by high knowledge (24%) and low knowledge (20%) in breeding practices. The present findings are in accordance with the earlier results of author [8]. However, present findings are contrary to the results of earlier author [11] found that 86.56 percent of respondents had high level of knowledge regarding breeding management practices in Surendranagar district of Saurashtra region.

Data presented in Table 1 regarding general management practices, revealed that majority of the respondents had medium knowledge (72%) followed by low (18%) and high (10%) knowledge. The present findings are in accordance with the earlier results of authors [3,8] who reported that 70 and 67 per cent of the respondents had a medium level of knowledge in their survey areas of Punjab and Gujarat region, respectively. However, the present findings are contrary to the results of author [11] reported that 59.22 percent of the respondents had high level of knowledge in the Surendranagar district of Saurashtra region.

A perusal of data from Table1 revealed that 50 percent of respondents had medium knowledge, followed by low knowledge (36%) and only 14 percent of the respondents had high knowledge about improved healthcare practices in the area under study. The present findings are in accordance with the results of author [9]. However, present findings are contrary to the earlier results of author [11] reported that 79.91 percent of the respondents had high level of knowledge in Surendranagar district of Saurashtra region of Gujarat.

The overall knowledge in improved buffalo husbandry practices revealed that 68 percent of the dairy animal owners had medium level of knowledge, whereas remaining equal percent of the respondents had low (16%) and high (16%) levels of knowledge. (Table 2). It can be observed that majority of the respondents had a medium knowledge level regarding improved buffalo husbandry practices. The medium knowledge might be due to their exposure to information sources, contact with extension personnel and proper adequate technical guidance provided by the agencies working for the transfer of technology in the study area. Present results are in accordance with the findings reported by earlier authors [3,11] who revealed that 66.67 and 68.34 percent of the respondents had medium knowledge level

**Table 1: Distribution of the buffalo owners according to their knowledge in different areas of improved buffalo husbandry practices (N=50).**

| Area | Frequency | Per cent |
|---|---|---|
| **Feeding** | | |
| Low (<1.77) | 06 | 12.00 |
| Medium (1.77-5.03) | 38 | 76.00 |
| High (>5.03) | 06 | 12.00 |
| **Breeding** | | |
| Low (< 4.09) | 10 | 20.00 |
| Medium (4.09-6.75) | 28 | 56.00 |
| High (>6.75) | 12 | 24.00 |
| **General management** | | |
| Low (<2.26) | 09 | 18.00 |
| Medium (2.26-5.02) | 36 | 72.00 |
| High (>5.02) | 05 | 10.00 |
| **Healthcare** | | |
| Low (<3.02) | 18 | 36.00 |
| Medium (3.02-5.66) | 25 | 50.00 |
| High (>5.66) | 07 | 14.00 |

**Table 2: Distribution of the buffalo owners on the basis of overall knowledge regarding improved buffalo husbandry practices (N=50).**

| Categories | Frequency | Per cent |
|---|---|---|
| Low (<11.99) | 08 | 16.00 |
| Medium (11.99-21.61) | 34 | 68.00 |
| High (>21.61) | 08 | 16.00 |

**Table 3: Knowledge indices of improved buffalo husbandry practices.**

| Area | Knowledge index (%) | Rank |
|---|---|---|
| Feeding | 42.50 | IV |
| Breeding | 67.75 | I |
| General management | 45.50 | III |
| Healthcare | 54.25 | II |
| **Overall** | **52.50** | |

regarding improved dairy husbandry practices in their study areas of Punjab and South Gujarat region.

Data in Table 3 revealed that the knowledge index of different aspects of improved buffalo husbandry practices were found in the area of breeding (67.75%) followed by health care (54.25%), general management (45.50%) and feeding (42.50%). Overall knowledge level in improved buffalo husbandry practice was 52.50 percent. Similarly, earlier author[4] reported that knowledge index of breeding, feeding, health care and management were 42.00, 37.84, 39.75 and 41.73 percent, respectively and overall knowledge index of improved dairy farming

practice was 39.63 percent in their study areas of Banka district of Bihar. In contrast to present study, author[7] reported that knowledge index of different aspects of improved dairy husbandry practices of feeding, breeding, general management, and healthcare practices were 50.88, 80.93, 55.60 and 63.57 percent, respectively and overall knowledge index of improved dairy husbandry practice was 62.83 percent in the tribal area of South Gujarat. It indicated that overall knowledge possessed by buffalo farm owners is suggestive of a level which is not adequate to carry out buffalo farming scientifically. The reason may be the level of education of the respondents. Poor knowledge about buffalo husbandry leads to low productivity of animals, particularly in the area of feeding and general management ultimately which resulted in uneconomic buffalo farming.

## CONCLUSION

It can be concluded that majority of the buffalo farm owners had medium level of knowledge regarding improved buffalo husbandry practices. So there is lot of scope for improvement in existing level of knowledge of respondents through organizing training programmes, demonstrations, Kisan melas, Kisan ghosthis, exposure visits and camps organized by various government organizations and NGOs.

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*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 310-313 https://doi.org/10.48165/ijapm.2023.37.4.7

# Haematological Profile and Surgical Management of Lumpy Jaw Condition (Actinomycosis) in Crossbred Cattle

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**Received: 20.12.2023; Accepted: 14.01.2024**

**ABSTRACT**

A case series study was conducted from December 2022 to August 2023 in cattle referred to the Veterinary Dispensary Peddaputta village of Kadapa district. Total 6 cross bred cattle were diagnosed and most of them referred with swelling at the mandibular region showing leakage of pus and it was diagnosed as bovine Actinomycosis or lumpy jaw condition. Haematology revealed significant erythrocytopenia, higher PCV, lower haemoglobin concentration, significant leucocytosis with neutrophilia, presence of a greater number of immature neutrophils and decreased lymphocyte count. With the surgical intervention granulomatous tissue and pus was removed, and antibiotics like long acting Terramycin injection two doses within 48 hours, along with oral administration of Potassium Iodide and external dressing of wound with 2% povidone iodine. The animal recovered successfully within 12 days of post treatment.

**Key words:** Actinomycosis, crossbred cattle, lumpy jaw

Actinomycosis is a persistently infectious, inflammatory disease in cattle caused by *Actinomyces bovis*[2]. Actinomycosis in cattle is manifested by chronic osteomyelitis and rarefaction of the bones particularly the mandibular and maxillary region, which results in facial distortion. The alveoli of roots of cheek teeth are frequently involved leading to lose of teeth, making difficulty ion chewing [8]. Bovine Actinomycosis is characterized by presence of pus in the mandibular or maxillary region of the affected sinuses containing sulfur granules having bacterial clumps[4]. The *Actinomycosis bovis* is a gram positive, anaerobic, filamentous, non-capsulated, non haemolytic, non-acid test pleomorphic rods showing filamentous branches associated with Actinomycosis / Lumpy jaw condition in cattle[8]. The organism is an obligatory parasite on the mucous membranes of the oropharynx. Predisposition to disease seems to occur through direct extension of the infection from the gums[10]. Occasionally tracts draining purulent discharges from the afflicted area are present along with or without from ulceration. It finally has an impact on feeding behavior of an animal, and it refuses to eat because painful chewing. Weight loss is visible as a result, which causes financial losses in the livestock industry[1].

## MATERIALS AND METHODS

Six cross bred cattle were presented to Veterinary Dispensary, Peddaputta village in Kadapa district from December 2022 to August 2023 with a history of swelling at mandibular region with leaking of pus, unusual mastication (Fig.1&2). During the clinical assessment, the rectal temperature (102.5 ± 0.4 $^{o}$F), pulse (82 ± 0.6 per minute), and respiration rate (27 ± 0.2

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Fig. 1: Mandibular swelling in affected calf

Fig. 2: Leaking of blood and pus from mandibular region

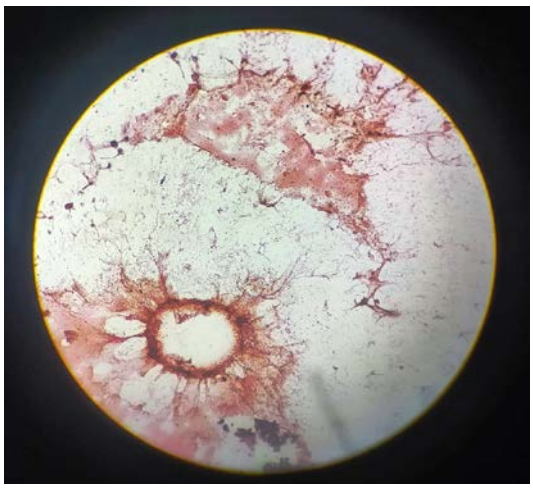

Fig. 3: Sulphur granules in pus discharge

breaths per minute) were found in Actinomycosis affected cattle. Upon palpation, soft tissues and the mandible were affected, and a yellowish pus discharge with sulphur granules was present (Fig.3). This disease was diagnosed on the basis of the study's history and clinical indications, demonstration of gram-positive filamentous rods to coccobacillin exudate from active lesions and demonstration of sulfur granules from pus discharges.

Whole blood was collected in EDTA containing vial for estimation of Hb, PCV, Total RBC count, Total WBC count, erythrocyte indices- mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were estimated by standard methods as described by[11]. The blood smears were stained by Leishman's stain to study the differential count (DLC) following which, the absolute counts were also calculated.

## RESULTS AND DISCUSSION

There was significant decrease in total erythrocyte count with lower haemoglobin concentrations and higher PCV, significant leucocytosis, neutrophilia, presence of a greater number of immature neutrophils (band cells) than mature neutrophils and decreased lymphocyte count. (Table 2). In the present study, the cattle affected with Actinomycosis had pyrexia,

**Table 1: Clinical findings of cattle suffering from Actinomycosis**

| Parameter | Control (Healthy) cattle | Actinomycosis cattle |
|---|---|---|
| Rectal Temperature (ºF) | 100.67 ± 0.2[a] | 102.50 ± 0.4[b] |
| Pulse rate (Per Minute) | 67.3 ± 0.4[a] | 82.0 ± 0.6[b] |
| Respiration (Per Minute) | 22.8 ± 0.6[a] | 27.0 ± 0.2[b] |

Means with different superscript(s) in each row differ significantly (P<0.05)

**Table 2: Hematological findings of cattle suffering from Actinomycosis**

| Parameter | Control (Healthy) cattle | Actinomycosis cattle |
|---|---|---|
| Total RBCs ($X10^6$/µl) | 7.2 ± 0.15[a] | 5.14 ± 0.21[b] |
| Total WBCs ($X10^3$/µl) | 8.1 ± 0.78[a] | 12.8 ± 0.14[b] |
| Hb (g/dl) | 11.6 ± 0.42[b] | 8.6 ± 0.32[a] |
| PCV (%) | 35.2 ± 0.17[a] | 39.7 ± 0.6[b] |
| Neutrophils (%) | 32.4 ± 0.52[a] | 64.6 ± 0.24[b] |
| Lymphocytes (%) | 56.2 ± 0.31[b] | 21.7 ± 0.32[a] |
| MCV (fl) | 51.2 ± 0.62[a] | 76.3 ± 0.12[b] |
| MCH (pg) | 14.7 ± 0.22[a] | 15.5 ± 0.2[a] |
| MCHC (g/dl) | 32.4 ± 0.12[b] | 22.4 ± 0.8[a] |

Means with different superscript(s) in each row differ significantly (P<0.05)

tachycardia, tachypnoea (Table 1). Based on the history, clinical signs and laboratory examination the condition was diagnosed as Actinomycosis.

In this study the observed decrease in total erythrocyte count and hemoglobin concentration indicates anemia, which could be attributed to the loss of blood. Increased in hematocrit values could be attributed to dehydration associated with fluid loss. Increase in total leukocytic count with neutrophilia was mainly because of inflammatory responses due to infection associated with Actinomycosis.

Flushed the area with 2% Povidone Iodine solution after washing it with regular saline solution. Opened the site and removed granulation tissue and pus discharges and sutured. Post operative care taken with the use of broad-spectrum antibiotics, non-steroidal anti-inflammatory drugs for one week. Injected Terramycin (long acting) @ 10ml/100 kg body weight daily along with Meloxicam @ 0.2 mg/ kg body weight and administered Potassium Iodide orally @ of 6 grams daily for one week along with local dressing with Betadine. In order to eradicate the pyogenic membrane until the lesion had fully healed, a gauze with povidone iodine was inserted on a regular basis for one week. The animal completely recovered in two weeks after surgical intervention.

As Actinomycosis bacteria are more sensitive to Oxytetracycline, pencillin, Streptomycin, Bacitracin, Cloxacillin and Dicrysticin according to[5]. Hence, we used Terramycin (Oxytetracycline) antibiotic injection intramuscularly two doses within 48 hours postoperatively has given good results and animal recovered successfully which is in agreement with the findings of [6] and[3]. Whereas,[7]

successfully treated an Actinomycosis affected cattle with oral administration of Streptomycin and Potassium Iodide. Dicrysticin @ 2.5 mg I/M twice daily for 10 days, combined with administering potassium iodide orally @ 7 gm once daily for 10 days, were effective treatments in Actinomycosis affected Jersey crossbred bull[9]. The severity of the wound may be the cause of variations in the recovery of past findings and current results. *Actinomycosis bovis* often enters an animal's body through abrasions or sores in the oral mucosa that are brought on by dry, coarse meals that are given to the animals. Therefore, in order to stop the spread of this disease, animals should be given smooth green grasses or straws that have been soaked in water to prevent injury to the buccal mucosa[8]. So as to prevent contamination of water and pasture and further transmission to healthy animals, affected animals should be segregated[2].

## CONCLUSION

In conclusion surgical intervention followed by flushing with 2% Povidone Iodine solution along with parenteral administration of broad-spectrum antibiotic (Terramycin-LA) and Non-steroidal anti-inflammatory injections intramuscularly followed by oral administration of Potassium Iodide for 7 days has given effective results for the treatment of bovine actinomycosis under field conditions.

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*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 314-320 https://doi.org/10.48165/ijapm.2023.37.4.8

# Study of Existing Barn and Animal Hygiene Practices in Milch Cows and Buffaloes in Sabarkantha District

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**Received: 14.07.2023; Accepted: 15.01.2024**

**ABSTRACT**

This study aimed to investigate the dairy farming practices and management in Sabarkantha district. A total of 90 livestock owners were randomly selected from six villages representing the Himatnagar, Idar, and Prantij talukas, encompassing three farm size categories based on the number of milch animals: Category A (<10 Milch animals), Category B (10-20 Milch animals), and Category C (>20 Milch animals). The herd composition analysis revealed that cattle were the primary milch animals in the studied farms, with an average total herd strength of approximately 20 cattle and 5 buffaloes. The respondents' personal characteristics indicated a relatively good level of education, with 32% having attained a graduate level of education. The majority of farmers fell into the 50-65 years age group, and most had more than 10 years of experience in dairy farming. Analysis of milking and healthcare practices revealed that a significant number of farmers employed the knuckling method of milking, which is not recommended. Dry cow therapy and milking parlour usage were less prevalent, but proper drying periods and vaccination and deworming practices were generally followed. Housing practices indicated that most farmers used pacca (concrete) floors and provided adequate light and ventilation. Single-line housing was the most popular system, and drainage facilities were generally adequate. However, milking hygiene practices were found to be suboptimal, with limited use of teat dips or antiseptic udder washing. Overall, the study highlights the need for improvement in milking hygiene practices, along with targeted interventions to enhance dairy management in Sabarkantha district.

**Key words:** Milking hygiene, barn hygiene, mastitis, milking management, buffaloes

Sabarkantha district in Gujarat, India, is characterized by favorable rainfall, canal irrigation, and abundant grazing resources, which attract livestock keepers to engage in dairy farming. Consequently, the majority of farmers in the district are involved in rearing livestock, with significant variations in the number of animals owned. Approximately 51% of farmers maintain up to 3 cows/buffaloes, while 18% and 31% of farmers possess 4 and more than 5 cows/buffaloes, respectively[10]. While the prevailing management conditions in the district are generally satisfactory, there is a notable concern regarding milking hygiene practices[10]. Good milking practices, along with proper barn and animal hygiene, is associated with the occurrence of mastitis. Bovine mastitis, a food-borne zoonotic disease, adversely affects the milk constituents, leading to a significant reduction in milk yield and detrimental impacts on the reproductive system of cows and buffaloes[4]. Furthermore, mastitis is one of the leading causes of cow culling, resulting in substantial economic losses[5,7].

The implementation of effective milking hygiene practices and the maintenance of clean barns and healthy animals are known to significantly reduce the incidence of mastitis. Milk quality, from farm to consumer, depends on appropriate barn and milking hygiene practices. In the context of profitable dairy farming, poor

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barn and milking hygiene practices are undesirable. Therefore, it is crucial to study the adoption of good milking management and barn and animal hygiene practices among farmers in Sabarkantha district before devising strategies for improvement. Hence, this study aims to investigate the current status of milking practices, animal hygiene, and barn hygiene in the dairy farms of Sabarkantha district. By comprehensively examining these aspects, we can gain valuable insights into the existing practices and identify areas that require attention and improvement.

## MATERIALS AND METHODS

**Study site and sample selection**: The study was conducted in Sabarkantha district, Gujarat, with a focus on six randomly selected villages from three talukas: Himatnagar, Idar, and Prantij. A comprehensive list of dairy farmers was obtained from the village milk producer's cooperative society. From this list, a random selection process was employed to choose five farmers from each of the three farm size categories: A (<10 milch animals), B (10-20 milch animals), and C (>20 milch animals). This resulted in a total of 90 livestock owners who participated in the survey conducted over the designated study period.

**Data collection**: Data collection was carried out using a standardized interview schedule and inspection by authors to ensure consistent and reliable information gathering across all participants. The interview schedule encompassed various aspects related to milking practices, healthcare management, housing conditions, and other relevant variables based on reviewing the related literature.

**Assessment of concrete floor quality**: To evaluate the quality of the concrete floors in the dairy farms, a scoring index was developed (Table 1). This index comprised of various dimensions, including slope, integrity, slipperiness, abrasiveness, and finishing. Each dimension was assigned a specific scoring criterion, resulting in a maximum score of 12. The concrete floor quality was assessed using this scoring index.

**Evaluation of milking hygiene practices**: To assess the adherence to good milking hygiene practices, another scoring index was developed (Table 2). This index focused on aspects such as the use of teat dips, antiseptic udder washing, the practice of using a napkin after washing the udder, prevention of sucking after milking, and the avoidance of immediate feeding after milking. The scoring index had a maximum score of 10.

**Cleanliness and locomotion scoring:** For farms with different herd sizes, cleanliness and locomotion scoring were conducted on a stratified basis. Farms with fewer than 9 milch animals were subjected to cleanliness scoring of one randomly selected animal, farms with 9-19 milch animals were assessed for cleanliness scoring of two animals, and farms with more than 19 milch animals underwent cleanliness scoring of three animals. The cleanliness scoring was performed following the standard procedure[6] on a 1-4 scale, with scores indicating different levels of cleanliness (1= Completely clean, minor spatter of manure on hoof.; 2= Spatter of manure on hoof, udder and up to hock.; 3= Several manure regions with dry manure on the udder, rump and flanks and 4= Several manure regions on the whole body). Additionally, the same selected animals were evaluated for locomotion scoring following standard procedure[13] on a scale ranging from 1 (normal locomotion) to 4 (severely lame).

**Assessment of shed hygiene:** The floor area hygiene within the animal sheds was assessed using a 1-4 scale[12], representing the levels of cleanliness: "most clean" (1), "clean" (2), "dirty" (3), and "very dirty" (4).

**Data analysis:** The data collected during the study were analyzed using the Statistical Package for the Social Sciences (SPSS). Statistical methods described elsewhre[12] were applied to analyze the generated data and draw appropriate conclusions.

**Table 1: Score index for study of quality of concrete floor (12 Marks)**

| **Dimension** Proper (2) Inadequate (1) | **Slope** Proper (2), Bad (1) | **Integrity** Proper (2), Broken (1) | **Slipperiness** Non-slippery (2) Slippery (1) | **Abrasiveness** No sharp edges (2) Sharp edges (0) | **Finishing** Uniform (2) Rough (0) |
|---|---|---|---|---|---|
| | | | | | |

**Table 2: Score index for study of good milking hygiene practices (10 Marks)**

| Use of teat dips (5 marks), antiseptic solution (4 marks), water splashing (2 marks), not any (0 Marks) | Use of napkin after washing udder (Yes=2, No=0) | Preventing suckling after milking (Yes=2, No=0) | Feeding after milking to avoid immediate sitting (Yes=1, No=0) |
|---|---|---|---|
| | | | |

## RESULTS AND DISCUSSION

**Herd composition:** The classification of livestock based on species and classes in small, medium, and large dairy farms is presented in Table 3. The findings indicate that cattle were the primary milch animals kept in significant numbers across the studied farms. The average total herd strength of cattle was approximately 20, while for buffaloes, it was around 5. This observation highlights that cattle are the principal animals in these herds. Furthermore, on average, small farms kept about 3 adult cows and 1 buffalo, medium farms had approximately 11 adult cows and 3 buffaloes, and large farms maintained around 23 adult cows and 4 buffaloes. The herd composition in all three farm categories favored milch animals, with fewer numbers of heifers observed. Similar trends have been reported in a study conducted on large dairy farms in the north Gujarat region[2]. However, it should be noted that their study focused on large specialized dairy farms, which typically have higher herd sizes compared to the farms in our study.

**Personal characteristics:** The classification of livestock based on species and classes in small, medium, and large dairy farms is presented in Table 4. The findings indicate that cattle were the primary milch animals kept in significant numbers across the studied farms. The average total herd strength of cattle was approximately 20, while for buffaloes, it was around 5. This observation highlights that cattle are the principal animals in these herds. Furthermore, on average, small farms kept about 3 adult cows and 1 buffalo, medium farms had approximately 11 adult cows and 3 buffaloes, and large farms maintained around 23 adult cows and 4 buffaloes. The herd composition in all three farm categories favored milch animals, with fewer numbers of heifers observed. Similar trends have been reported in a study conducted on large dairy farms in the north Gujarat region[2]. However, it should be noted that their study focused on large specialized dairy farms, which typically have higher herd sizes compared to the farms in our study.

**Milking and healthcare practices:** The prevailing milking and healthcare practices followed in the farms are summarized in Table 5. It is evident from the table that out of the 90 farmers surveyed, 63 were using the knuckling method of milking, which is an undesirable practice. Knuckling has been reported to be commonly used by dairy farmers in Gujarat[10,13]. In contrast, specialized farms in Gujarat have been observed to use machine milking to a greater extent[1]. Although the adoption of dry cow therapy, a preventive approach for mastitis, was relatively low, its utilization can still be considered favorable. The usage of milking parlors, which facilitate hygienic milking, was quite limited, especially among small farm owners, consistent with previous findings[13] where it was deemed impractical for small-scale or individual farmers. Notably, a significant number of farmers were adhering to the recommended drying period of less than 3 months, which is an improvement

**Table 3: Herd composition of the farms**

| Class | Small Farm | Medium Farm | Large Farm | Pooled |
|---|---|---|---|---|
| Adult cows | 3.10 ± 0.47 | 10.80 ± 0.65 | 23.10 ± 1.49 | 12.33 ± 1.04 |
| Adult buffalo | 1.33 ± 0.26 | 2.93 ± 0.48 | 3.70 ± 0.76 | 2.66 ± 0.33 |
| Cow heifers | 0.93 ± 0.18 | 1.77 ± 0.24 | 5.33 ± 0.66 | 2.68 ± 0.31 |
| Buffalo heifers | 0.70 ± 0.24 | 0.90 ± 0.21 | 0.83 ± 0.24 | 0.81 ± 0.13 |
| Calves cattle | 1.20 ± 0.19 | 3.53 ± 0.49 | 10.7 ± 1.07 | 5.14 ± 0.58 |
| Calves buffalo | 0.67 ± 0.18 | 1.13 ± 0.23 | 2.57 ± 0.84 | 1.46 ± 0.31 |
| Herd strength Cattle | 5.23 ± 0.75 | 16.10 ± 10 | 39.13 ± 2.34 | 20.16 ± 1.73 |
| Herd strength Buffalo | 2.70 ± 0.60 | 4.97 ± 0.75 | 7.10 ± 1.67 | 4.92 ± 0.66 |

**Table 4: Personal characteristics of livestock keepers**

| Parameter | | Category of farm | | | Total | % |
|---|---|---|---|---|---|---|
| | | Small Farm | Medium Farm | Large Farm | | |
| Education | Primary | 3 | 2 | 0 | 5 | 5.56 |
| | Secondary | 6 | 13 | 10 | 29 | 32.22 |
| | Higher secondary | 9 | 6 | 12 | 27 | 30.00 |
| | Graduate | 12 | 9 | 8 | 29 | 32.22 |
| Experience | >10 years | 26 | 22 | 28 | 76 | 84.44 |
| | 5-10 Years | 4 | 8 | 2 | 14 | 15.56 |
| Age | <35 Yr | 6 | 6 | 2 | 14 | 15.56 |
| | 35-50 Yr | 8 | 17 | 10 | 35 | 38.89 |
| | 50-65 Yr | 16 | 7 | 18 | 41 | 45.56 |
| **Total** | | **30** | **30** | **30** | **90** | **100** |

compared to urban and peri-urban farms in South Gujarat[13]. Vaccination against Foot and Mouth Disease (FMD) and Hemorrhagic Septicemia (H.S.) as well as deworming practices were commonly followed by the majority of farmers. Additionally, most farmers sought the assistance of veterinarians for the treatment of sick animals. These health management practices are in line with the findings of a previous study conducted in the same district[9] as well as other part in India[11].

**Housing practices:** The housing practices observed in the farms are summarized in Table 6. It is noteworthy that all large farm owners used *pucca* flooring, which is in line with previous studies[8,9,10,12]. Adequate light and ventilation facilities were present in the majority of the houses. Among the different housing systems, single-line housing was the most popular, accounting for 30% of respondents. In double-line housing, the tail-to-tail system was more prevalent than the head-to-head system. Many respondents, particularly those with medium and large farms, utilized both single-line and double-line housing systems. These housing systems

**Table 5: Prevailing milking and healthcare practices among farmers**

| Parameter | | Category of farm | | | Total | Chi square p |
|---|---|---|---|---|---|---|
| | | Small (< 10 milch animals) | Medium (10-20 milch animals) | Large (> 20 milch animals) | | |
| Method of milking | Machine | 1 | 5 | 14 | 20 | ** |
| | Full hand | 1 | 4 | 2 | 7 | |
| | Knuckling | 28 | 21 | 14 | 63 | |
| Dry cow therapy | Yes | 0 | 1 | 0 | 1 | NS |
| | No | 0 | 0 | 29 | 29 | |
| Milking place | Same place | 29 | 28 | 30 | 87 | NS |
| | Milking parlour | 1 | 2 | 0 | 3 | |
| Drying period | > 3 Months | 7 | 4 | 2 | 13 | NS |
| | < 3 Months | 23 | 26 | 28 | 77 | |
| Vaccination (F.M.D and H.S.) | Yes | 30 | 28 | 30 | 88 | NS |
| | No | 0 | 2 | 0 | 2 | |
| Deworming | Yes | 27 | 28 | 30 | 85 | NS |
| | No | 3 | 2 | 0 | 5 | |
| Treatment | Quack | 1 | 0 | 0 | 1 | NS |
| | Vets | 29 | 30 | 30 | 89 | |

**Table 6: Prevailing housing practices among farmers**

| Parameter | | Category of farm | | | Total | Chi square p |
|---|---|---|---|---|---|---|
| | | Small (< 10 milch animals) | Medium (10-20 milch animals) | Large (> 20 milch animals) | | |
| Type of floor | *Pacca* | 17 | 29 | **30** | 76 | ** |
| | *Kachcha* | 13 | 1 | **0** | 14 | |
| Light /ventil. facility | Adequate | 30 | 28 | 30 | **88** | NS |
| | Partial | 0 | 2 | 0 | 2 | |
| System of housing | Single line | 25 | 2 | 0 | 27 | ** |
| | Head to head | 2 | 6 | 2 | 10 | |
| | Tail to tail | 2 | **10** | **4** | 16 | |
| | Single line HH | 1 | 8 | 9 | 18 | |
| | Single line TT | 0 | 4 | 15 | 19 | |
| Drainage | Adequate | 22 | 23 | 28 | **73** | * |
| | Partial | 2 | 6 | 2 | 10 | |
| | Poor | 6 | 1 | 0 | 7 | |
| Open area | Yes | 27 | 23 | 23 | 73 | NS |
| | No | 3 | 7 | 7 | 17 | |
| Drinking water system | Water bowl | 9 | 16 | 26 | 51 | ** |
| | Water trough etc. | 21 | 14 | 4 | 39 | |
| Shed sanitary condition | Clean | 23 | 17 | 27 | 67 | * |
| | Dirty | 7 | 13 | 3 | 23 | |

**Table 7: The observed mean score indices for concrete flooring and milking hygiene**

| Category of farm | Small (< 10 milch animals) | | Medium (10-20 milch animals) | | Large (> 20 milch animals) | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Mean | SEM | Mean | SEM | Mean | SEM | Mean | SEM |
| Concrete flooring score index (out of 12) | 7.93 | 0.17 | 9.00 | 0.23 | 9.23 | 0.21 | 8.72 | 0.13 |
| Milking hygiene score index (out of 10) | 2.00 | 0.00 | 2.00 | 0.00 | 2.00 | 0.00 | 2.00 | 0.00 |

correspond to those observed in urban and peri-urban dairy farms[12]. Drainage facilities were adequate in 73 farms, and open spaces for animal exercise were present in or around the sheds in 73 farms, indicating good consideration for animal welfare. The usage of drinking water systems was significant, with the majority using advanced water bowl drinking systems, while others employed water troughs. Most farms were in good sanitary conditions, with larger farms showing significantly better hygiene. The adoption of sanitary measures, such as drainage provision, ventilation, open space provision, and the use of water bowl systems, aligns with the findings of other studies conducted in Gujarat[,9,12].

**Hygienic practices:** Table 7 presents the observed mean score indices for ideal concrete flooring and milking hygiene. The quality of the concrete floor was found to be consistently good across all farm sizes. The workmanship and quality of concrete floors were reported to be good in previous studies as well[9,12]. However, the adoption of proper milking hygiene practices was observed to be very poor in all types of farms. A significant number of farmers did not use teat dips or practice antiseptic udder washing. This aligns with the poor adoption of washing or dipping teats/udder with antiseptics among small farms in Gujarat[12]. In contrast, specialized farms in Gujarat were observed to at least use antiseptic udder washing[1].

## CONCLUSION

In conclusion, the study revealed important insights into dairy farming practices in Sabarkantha district. The composition of herds predominantly consisted of cattle, with a bias towards milch animals. The education level and experience of the respondents were generally favorable, while milking hygiene practices were found to be inadequate. Housing practices showed positive trends, with appropriate flooring and sanitation facilities. Overall, the findings highlight the need for improved milking hygiene practices and targeted interventions to enhance dairy management in the region.

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*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 321-325 https://doi.org/10.48165/ijapm.2023.37.4.9

# Constraints Perceived by Women Dairy Farmers and Veterinarians regarding Dairy Farming in Guntur District of Andhra Pradesh

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**Received: 10.10.2023; Accepted: 16.01.2024**

**ABSTRACT**

An investigation was conduct to study the constraints perceived by women dairy farmers and veterinarians on dairy farming in Guntur district of Andhra Pradesh. In technical constraints, majority (94.70%) of women dairy farmers in Narasaraopeta division perceived lack of preservation facility for milk as major constraint whereas majority (85.30%) of women dairy farmers in Guntur division perceived lack of preservation facility for milk as major constraint and majority of women dairy farmers (76.00%) in Pedaravuru division perceived low milk production by local breeds and lack of knowledge in identifying diseases of animals as major constraints**.** In economic constraints, 90.70% of women dairy farmers in Pedaravuru division perceived high cost of concentrate and other feeds as major constraint whereas 64.00% in Narasaraopeta division perceived low market price for milk as major constraint. and 58.70% in Guntur division perceived low market price for milk as major constraint. Overall majority of farm women (68.44%) in the study area perceived lack of preservation facility for milk was the major technical constraint. Low market price for milk was the major economic constraint perceived by farm women (60.90%) in the study area. It was observed that 75.56% of veterinarians perceived high investment for establishing an entreprise as major constraint in the study area.

**Key words:** Andhra Pradesh**,** constraints, dairy farming, Guntur district, women dairy farmers

Indian is primarily an agrarian society, with animal husbandry serving as the backbone of the economy. Livestock sector is an integral component for rural livelihoods and contribution of livestock in total agriculture sector and country's GDP is 25.6% and 4.11% respectively[4]. Women play a crucial and potentially transformative role in the animal husbandry growth in developing countries. Growing demand for milk and milk products in recent years strengthen dairy farming as a lucrative entreprise for women[8]. Andhra Pradesh stands fourth in the milk production in India in financial year 2019. The estimate milk production which was 0.76 million metric tons during 2005-06 in Andhra Pradesh, increases to 15.04 million metric tons in 2019-19. Livestock population has increased by 15.79% from 29.4 million in 2012 to 34.0 million in 2019.

Despite significant increase in milk production in recent decades, dairy animal productivity has remained low, dairy farmers confront a variety of socio- psychological, technical, economic and infrastructural challenges, which are a major concern preventing the industry's development[7]. Hence**,** the present investigation was carried out to study the constraints perceived by women dairy farmers and veterinarians in Guntur district of Andhra Pradesh.

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## MATERIALS AND METHODS

Guntur district has three animal husbandry divisions namely Pedaravuru, Guntur, Narasaraopeta. Five mandals were selected from each animal husbandry division and 5 villages from each Mandal were selected by using stratified random sampling**.** Three women dairy farmers were selected randomly from each village resulting in 225 respondents. The data were collected by administering the final refined interview schedule to the respondents. The data collected during the period of study were scrutinized and tabulated. The data were subjected to frequency and percentage using statistical package for social science (IBM SPSS 25.0 Version).

## RESULTS AND DISCUSSION

**Technical constraints perceived by women dairy farmers:** The present study from Table 1 revealed that technical constraint related to lack of preservation facility was viewed as major constraint by 68.44% of women dairy farmers in the study area. This constraint was higher in Narasaraopeta (94.70%) division than that in Guntur (85.30%) and Pedaravuru (25.30%) divisions. It was observed that 60.89% of women dairy farmers felt that incidence of repeat breeding was one of the technical constraints in the study area. The problem was slightly higher in Narasaraopeta (64.00%) division than Pedaravuru (60.00%) and Guntur (58.70%) divisions.

Shortage of green fodder was perceived as a constraint by 59.55% of women dairy farmers in the study area. These results were similar to the previous findings[6]. It was higher in Guntur & Narasaraopeta (80.00%) divisions compared to Pedaravuru (8.00%) divisions. It might be due to unavailability of fertile land in Guntur and Narasaraopeta divisions to cultivate fodder. Low milk production by local breeds and lack of knowledge in identifying diseases of animals perceived as a constraint by 51.11% of women dairy farmers in the study area. These were higher in Pedaravuru (76.00%) division compared to Narasaraopeta (45.30%) and Guntur (32.00%) divisions. Non availability of veterinary hospitals and veterinary services was considered as constraint by 27.11% women dairy farmers in the study area. These findings were similar in agreement with previous finding[5]. It was higher in Pedaravuru (30.70%) than Narasaraopeta (26.60%) and Guntur (24.00%) divisions. It was observed that 26.66% of women dairy farmers felt Non availability of AI facilities in time as the least constraint in the study area. It was slightly higher in Pedaravuru (30.70%) division compared to Narasaraopeta (25.30%) and Guntur (24.00%) divisions.

**Economic constraints perceived by women dairy farmers:** Data shown in Table 2 indicated that major economic constraint perceived by 60.90% of women dairy farmers in the study area was low market price for milk. It was similar with the previous findings[1]. It was higher in Narasaraopeta (64.00%) division compared to Guntur (58.70%) and Pedaravuru (40.00%) divisions. High cost of high yielding animals perceived as constraint by 51.10% of women dairy farmers in the study area. It was higher in Pedaravuru (76.00%) division than Narasaraopeta (45.30%) and Guntur (32.00%) divisions. It was observed that high cost of concentrate and other feeds was perceived as constraint by 39.60% of women dairy farmers in the study area. It was higher in Pedaravuru (90.70%) division than Narasaraopeta (20.00%) and Guntur (8.00%) divisions.

It was observed that 31.60% of women dairy farmers perceived high cost of medicine as constraint in the study area. The results in agreement with the previous findings[9]. It was higher in Pedaravuru (74.70%) division compared to Narasaraopeta (20.00%) and Guntur (8.00%) divisions. Inadequate money and lack of loan facility was perceived as least constraint by women dairy farmers (26.70%) in the study area. It was slightly higher in Pedaravuru (30.70%) division than

**Table 1: Technical constraints perceived by women dairy farmers in Guntur district**

| Category | Pedaravuru (N =75) | | Guntur (N =75) | | Narasaraopeta (N =75) | | Overall (N =225) | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| Shortage of green fodder | 6 | 8.00 | 68 | 80.00 | 60 | 80.00 | 134 | 59.55 |
| Non availability of AI facilities in time | 23 | 30.70 | 18 | 24.00 | 19 | 25.30 | 60 | 26.66 |
| Low milk production by local breeds | 57 | 76.00 | 24 | 32.00 | 34 | 45.30 | 115 | 51.11 |
| Lack of preservation facility for milk | 19 | 25.30 | 64 | 85.30 | 71 | 94.70 | 154 | 68.44 |
| Incidence of repeat breeding | 45 | 60.00 | 44 | 58.70 | 48 | 64.00 | 137 | 60.89 |
| Lack of knowledge in identifying diseases of animals | 57 | 76.00 | 24 | 32.00 | 34 | 45.30 | 115 | 51.11 |
| Non availability of veterinary hospitals and veterinary services | 23 | 30.70 | 18 | 24.00 | 20 | 26.66 | 61 | 27.11 |

N = No. of women dairy farmer

**Table 2: Economic constraints perceived by women dairy farmers in Guntur district**

| Category | Pedaravruru (N =75) | | Guntur (N =75) | | Narasaraopeta (N =75) | | Overall (N =225) | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| High cost of concentrate and other feeds | 68 | 90.70 | 6 | 8.00 | 15 | 20.00 | 89 | 39.60 |
| High cost of high yielding animals | 57 | 76.00 | 24 | 32.00 | 34 | 45.30 | 115 | 51.10 |
| Inadequate money and lack of loan facility | 23 | 30.70 | 18 | 24.00 | 19 | 25.30 | 60 | 26.70 |
| High cost of medicine | 56 | 74.70 | 11 | 14.70 | 4 | 5.30 | 71 | 31.60 |
| Low market price for milk | 45 | 40.00 | 44 | 58.70 | 48 | 64.00 | 137 | 60.90 |

N = No. of women dairy farmers

Narasaraopeta (25.30%) and Guntur (24.00%) divisions.

**Constraints perceived by veterinarians:** Data from Table 3 showed that 73.33% of veterinarians perceived lack of knowledge to manage dairy animals as the major constraint in Pedaravuru division whereas majority of veterinarians in Guntur (73.33%) and Narasaraopeta (86.67%) divisions perceived high investment for establishing an enterprise as major constraint in the study area.

**Table 3: Constraints perceived by Veterinarians in Guntur district**

| Category | Pedaravruru (N =75) | | Guntur (N =75) | | Narasaraopeta (N =75) | | Overall (N =225) | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| Lack of knowledge to manage dairy | 55 | 73.33 | 50 | 66.67 | 60 | 80.00 | 165 | 73.33 |
| Inadequate bank finance to purchase milch animals | 20 | 26.67 | 15 | 20.00 | 18 | 24.00 | 53 | 23.55 |
| High investment for establishing an entreprise | 50 | 66.67 | 55 | 73.33 | 65 | 86.67 | 170 | 75.56 |
| Low price for milk and milk products | 45 | 40.00 | 44 | 58.70 | 48 | 64.00 | 137 | 60.90 |
| Lack of availability of sufficient fodder | 10 | 4.44 | 40 | 17.78 | 60 | 80.00 | 110 | 48.89 |
| Lack of knowledge regarding feeding practices | 35 | 46.67 | 30 | 40.00 | 38 | 50.67 | 103 | 45.78 |
| Lack of maintenance of records | 42 | 56.00 | 44 | 58.67 | 46 | 61.33 | 132 | 58.67 |

N = No. of women dairy farmers

Overall, major constraints perceived by veterinarians in the study area are high investment for establishing an enterprise (75.56%), lack of knowledge to manage dairy animals (73.33%), low price for milk and milk products (60.90%), lack of maintenance of records (58.67%), lack of availability of sufficient fodder (48.89%), lack of knowledge regarding feeding practices (45.78%) and inadequate bank finance to purchase milch animals (23.55%). In case of inadequate supply of quality medicines, the results were in contrast with the previous findings[3]. In case of feeding practices the results in agreement with the previous findings[2].

## CONCLUSION

It can be concluded that farm women in the study area perceived lack of preservation facility for milk was the major technical constraint. Low market price for milk was the major economic constraint perceived by farm women in the study area. It was observed veterinarians perceived high investment for establishing an enterprise as major constraint in the study area. The constraints perceived by women dairy farmers and Veterinarian's should be considered while formulation of strategies for upliftment of dairy farming in Andhra Pradesh.

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*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 326-330 https://doi.org/10.48165/ijapm.2023.37.4.10

# Effect of Probiotic, Prebiotic and Synbiotic Supplementation on Haemato-Biochemical Profile in SVVU T-17 Grower Pigs

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**Received: 21.11.2023; Accepted: 24.01.2024**

**ABSTRACT**

The experiment was aimed to assess the influence of dietary supplementation with probiotic, prebiotic, and synbiotic on the haemato-biochemical profile of SVVU T-17 grower pigs. Twenty-four pigs, aged 2-3 months and with similar body weights, were randomly assigned to four treatment groups: Control (basal diet alone), T1 (basal diet with 0.1% multi-strain probiotic), T2 (basal diet with 0.1% mannan-oligosaccharide prebiotic), and T3 (basal diet with 0.1% synbiotic). Haematological parameters showed no significant differences among the groups ($P > 0.05$). However, serum albumin levels were significantly ($P < 0.01$) higher in the T3 group. Both serum cholesterol and triglycerides exhibited significant ($P < 0.01$) decreases in the treatment groups (T1, T2 and T3) compared to the control group, while total protein and serum glucose remained consistent. In conclusion, synbiotic supplementation demonstrated a positive effect on serum albumin, and all treatments led to a significant decrease in lipid profiles.

**Key words:** SVVU T-17 grower pigs, probiotic, prebiotic, synbiotic, haemato-biochemical profile

Pigs are attributed to its rapid growth and prolificacy, which causes the pigs to more prone for stress and leads to poor performance and high mortality rate. Renowned for its prolificacy and rapid growth, the pig has become a primary focus for meat production. Historically, antibiotics were extensively employed to modulate alimentary microbiota and amplify productivity and growth rates. This past reliance on antibiotics prompts a reconsideration of the risks associated with their extended usage. The emergence of drug-resistant microorganisms has underscored the need for alternative, natural substances that can maintain and enhance pig health without compromising human health or the environment.

Probiotics, prebiotics, and synbiotics emerge as non-antibiotic promoters in this pursuit, offering a potential strategy to mitigate the risks associated with antibiotic overuse and also contribute to enhance the meat quality, nutrient utilization, immune function, and growth performance in swine.

## MATERIALS AND METHODS

**Animal diets and Management:** Twenty-four SVVU T-17grower pigs aged 2-3 months, and displaying consistent body weights, were randomly divided into four groups. Each group, consisting of six pigs, received different dietary treatments: the Control group received only the basal diet, T1 received the basal diet with 0.1% multi-strain probiotic (Spectra DFM$^{GTH}$, a commercial product containing *Pediococcus acidilactici, Enterococcus faecium, Bacillus licheniformis, Bacillus subtilis, Lactobacillus,* and *Bacillus amyloliquefaciens*), T2 received the basal diet with 0.1% mannan-oligosaccharide prebiotic, and T3 received the basal diet with 0.1% synbiotic. The experiment spanned 90 days and conducted at ICAR-AICRP on Pigs, SVVU,

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**Haemato-biochemical Analysis:** Blood samples were collected from the lateral saphenous vein of all the experimental pigs on both the $0^{th}$ and $90^{th}$ days. The samples were carefully preserved in EDTA-coated vacutainer tubes and clot activator vials to facilitate subsequent haematological and serum biochemical analyses. For haematological assessments, various parameters were measured using the Mindray BC-2800 vet fully automatic haematology analyser. These parameters included white blood cell (WBC) count, red blood cell (RBC) count, haemoglobin levels, packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), and platelet count. On the other hand, serum biochemical parameters were determined using the semi-automatic Mispa VIVA biochemistry analyser (Agappe), which utilized kits from Erba. The assessed serum biochemical parameters included total protein, albumin, glucose, cholesterol, and triglycerides. These analyses were carried out in strict accordance with industry standards to ensure the reliability and accuracy of the obtained results.

**Statistical Analysis:** The collected data was subjected to statistical analysis, employing One-way Analysis of Variance (ANOVA) to assess significance, followed by Duncan's multiple range test using SPSS Statistics Version 20.0 to ascertain the significance of treatment means. All the statistical procedures were performed as per [22].

## RESULTS AND DISCUSSION

In the present study, the obtained results are tabulated in Table 1 and Table 2 which represents the haematological and serum biochemical profile of the experimental grower pigs, respectively. In our study, none of the treatment groups exhibited significant ($P > 0.05$) differences in haematological parameters compared to the control group. The values obtained in the treatment groups were similar to those in the control group and fell within the normal physiological range. This aligns with previous research, where dietary probiotic supplementation showed no significant impact on the haematological profile of pigs [1]. Consistent with other studies, we found no significant effects on red blood cell and white blood cell counts in pigs treated with probiotics [2,3,4]. Similar results were reported by various authors on treating the pigs with dietary prebiotics [7,8]. However, there were contrasting findings in a study where the RBC and WBC counts remained stable in probiotic-fed pigs even when combined with different nutrient density diets [5], and another study reported inconsistencies with stable haemoglobin levels [6]. Our study partially agrees with previous research, indicating some variations. Specifically, we observed partial alignment with studies that reported higher significance in haemoglobin levels with no changes in RBC, WBC, and packed cell volume in pigs treated with synbiotic milk powder [9]. Additionally, synbiotic effects on pigs were studied, with no notable changes in Hb, PCV, and RBC, except for a higher total leucocyte count in the probiotic group, suggesting a potential immune-stimulating effect [10]. In contrast, our findings differ from a study that reported elevated RBC count, increased haemoglobin, elevated mean corpuscular volume and reduced mean corpuscular haemoglobin concentration upon supplementation of Bifidobacterium spp. as a probiotic in pig diets [11].

In our current study, we observed an increase in total protein among the four experimental groups from Table2, although this increase was not statistically significant ($P>0.05$), consistent with findings from [12, 13, 14]. Serum albumin, indicating improved protein utilization, was notably higher in the T3 group with higher significance ($P < 0.01$) according to [14]. On the other hand, serum glucose did not show significance among the groups ($P>0.05$), aligning with observations in [21]. Notably, cholesterol and

**Table 1. Effect on haematological profile of experimental groups (90th day)**

| Parameter | Control | $T_1$ | $T_2$ | $T_3$ |
|---|---|---|---|---|
| WBC ($x10^3/mm^3$) | 20.27 ± 0.36 | 20.30 ± 0.33 | 20.44 ± 0.28 | 20.41 ± 0.29 |
| RBC ($x10^6/\mu l$) | 6.20 ± 0.15 | 6.36 ± 0.24 | 6.20 ± 0.20 | 6.23 ± 0.18 |
| Hb(g/dl) | 12.07 ± 0.30 | 12.17 ± 0.35 | 12.24 ± 0.20 | 12.21 ± 0.38 |
| PCV (%) | 36.97 ± 0.72 | 37.11 ± 1.20 | 36.95 ± 0.72 | 36.67 ± 0.75 |
| MCV (fL) | 58.38 ± 3.05 | 58.87 ± 2.66 | 58.81 ± 1.80 | 57.41 ± 1.25 |
| MCH (pg) | 19.58 ± 0.20 | 18.63 ± 0.47 | 18.43 ± 0.40 | 18.52 ± 0.33 |
| MCHC(g/dl) | 33.05 ± 0.57 | 31.77 ± 0.48 | 31.97 ± 0.35 | 32.15 ± 0.82 |
| PLT ($x10^5/\mu l$) | 3.83 ± 0.26 | 3.66 ± 0.20 | 3.7 ± 0.24 | 3.62 ± 0.27 |

Values bearing different superscripts in a row differ significantly ($P < 0.05$)

**Table 2. Effect on serum biochemical profile of experimental groups (90th day)**

| Parameter | Control | $T_1$ | $T_2$ | $T_3$ |
|---|---|---|---|---|
| Total protein (g/dl) | $10.02 \pm 0.51^c$ | $10.87 \pm 0.64^b$ | $10.92 \pm 0.43^b$ | $12.28 \pm 0.46^a$ |
| Albumin (g/dl)* | $4.23 \pm 0.18^b$ | $4.50 \pm 0.15^b$ | $4.22 \pm 0.95^b$ | $5.12 \pm 0.18^a$ |
| Glucose (mg/dl) | 102.83 ± 6.47 | 106.83 ± 8.41 | 106.5 ± 5.16 | 104.83 ± 4.63 |
| Cholesterol (mg/dl)* | $88.17 \pm 2.14^a$ | $75.33 \pm 1.84^b$ | $76.83 \pm 3.15^b$ | $77.5 \pm 2.13^b$ |
| Triglycerides (mg/dl)* | $47.83 \pm 2.06^a$ | $32.33 \pm 1.23^b$ | $35 \pm 1.57^b$ | $32.83 \pm 2.85^b$ |

Values bearing different superscripts in a row differ significantly ($P < 0.01$) *

triglycerides exhibited a significant reduction in the treatment groups compared to the control group ($P < 0.01$) in our current study.

Contrary to our results, a study [15] reported a significant effect on total protein in treated pigs. While serum albumin remained consistent in some studies [12, 13, 17], our findings were not supported by investigators who observed significant variations in glucose levels among pigs treated with dietary probiotics [2, 11, 16, 17]. Our study is partially in contrast with the results of [4], who found no significance of dietary probiotics on total protein, albumin, glucose, and cholesterol. Some researchers [13, 17, 18] noted a positive significant decrease in cholesterol and triglycerides in pigs, similar to our current study. Similarly, some studies reported a significant decrease in cholesterol [11, 19], while others consistently found lowered cholesterol levels [9,21]. However, our results are not in agreement with studies [3, 6, 20] reporting no significant decreases in serum profile.

## CONCLUSION

In the current study, a significant increase in serum albumin levels and a noteworthy decrease in cholesterol and triglycerides were observed in the treatment groups compared to the control. Glucose and total protein levels remained consistent, while no significant changes were noted in any haematological parameters. Additionally, it's worth highlighting

that the observed alterations in serum albumin, cholesterol, and triglycerides suggest a positive impact on metabolic health and lipid regulation in the treated groups. This aligns with the growing body of evidence supporting the potential of dietary supplementation with probiotics, prebiotics, or their combination in influencing metabolic markers. Furthermore, the stability in glucose and total protein levels indicates that the observed effects are specific to certain biochemical pathways, emphasizing the nuanced impact of these supplements on different physiological processes. In conclusion, the findings underscore the potential of probiotic, prebiotic, or synbiotic supplementation to not only influence haematological parameters positively but also to bring about favorable changes in key biochemical markers associated with metabolic health.

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*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 331-334 https://doi.org/10.48165/ijapm.2023.37.4.11

# Effect of Nano Vitamin E and Selenium Supplementation on Serum Biochemical Profile in Japanese Quails

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**Received: 06.12.2023; Accepted: 12.01.2024**

**ABSTRACT**

This study investigated the impact of nano vitamin E with Selenium on serum parameters in Japanese quails. The experiment involved three groups: a control group (C1) fed a basal diet, a T1 group receiving vitamin E (150mg/kg) and Selenium (0.3mg/kg), and a T2 group receiving nano vitamin E (15mg/kg) and Selenium (0.03mg/kg). Results revealed significant differences ($p<0.05$) in serum analyses among the groups. The T2 group showed the highest total protein and globulin levels, while the T1 group exhibited the highest total albumin levels. Total cholesterol levels were significantly lower in the T2 group, with the highest HDL cholesterol. LDL cholesterol levels were lower in the T2 group. SGOT and SGPT levels were significantly lower in the T2 group. These findings suggest the potential benefits of nano vitamin E with Selenium in modulating serum biochemistry in Japanese quails.

**Key words:** Nano vitamin E, Selenium, Japanese quails, serum biochemistry

The serum profile in poultry, including Japanese quails, offers crucial insights into health and physiological status[8]. Proteins like albumin and globulins are vital for osmotic balance, nutrient transport, and immune function. Enzymes such as AST and ALT serve as liver function markers, and lipid profiles indicate energy metabolism status[6,9]. Essential minerals, particularly selenium, play a critical role in antioxidant defense and immune function[8].Understanding the serum profile is crucial, especially under heat stress, where changes in enzyme activities, lipid metabolism, and mineral concentrations occur[4]. Regular monitoring enables early issue identification, facilitating targeted interventions and optimized nutritional strategies for overall poultry health. Regarding[6] highlighted changes in glucose, triglycerides, and cholesterol in heat-stressed broilers supplemented with vitamin E and selenium. In conclusion, analyzing the serum profile provides a comprehensive understanding of poultry physiology, aiding effective management strategies[6,8]. Therefore, a study was undertaken to observe the effect of vitamin E with Selenium and nano vitamin E with Selenium on Serum Biochemical profile in Japanese quails.

## MATERIALS AND METHODS

The study aimed to assess the impact of nano vitamin E and Selenium supplementation on Japanese quail performance during the summer months. Conducted at the Department of Poultry Science, College of Veterinary Science, Tirupati, the experiment involved 96-day old quail chicks from Manvi Quails Breeding Farm. Lab analyses were performed at various departments within the College of Veterinary

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**Table 1: Experimental diets**

| Group | Quails/group | Treatment | Dose rate and schedule |
|---|---|---|---|
| **C1** | 16x2 | Basal diet (asper BIS,2007) | No supplementation |
| **T1** | 16x2 | Basal diet + vitamin E<br>and Selenium | 150mg/kg<br>0.3mg/kg |
| **T2** | 16x2 | Basal diet + nano vitamin E<br>and Selenium | 15mg/kg<br>0.03mg/kg |

Science Tirupati and Frontier Institute of Technologies, R.A.R.S Tirupati. The chicks were randomly distributed into three treatment groups with two replicates, in total 16 birds per replicate. The six-week experiment, spanning May and June, provided ad libitum access to feed and water, with the birds housed in battery cages.

**Serum biochemical profile:** At the end of the experiment, five birds from each replicate were sacrificed. 2ml of blood was collected from five birds from each replicate in clot activator tubes and allowed to clot for 3 hours and later centrifuged at 3000 rpm for 10 min. Serum was collected in Eppendorf tubes and stored at -20$^0$C for further analysis. The serum biochemical constituents like serum total cholesterol, serum total Protein, Albumin, globulin, SGOT and SGPT were estimated in A15 automated biochemical analyser by using Bio-systems kits.

## RESULTS AND DISCUSSION

The study revealed significant differences in total serum protein levels(fig;1) among the Japanese quail groups, with the T2 group exhibiting the highest concentration at 5.06 g/dl, while the control group had the lowest at 4.84 g/dl ($p<0.05$). Additionally, distinctions were observed in serum albumin and globulin levels, with the T2 group showcasing superior total protein and globulin levels, and the T1 group demonstrating superiority in albumin levels. This aligns with findings from[7,9], emphasizing the positive impact of vitamin E and selenium on total protein and albumin concentrations in quail serum. Similarly[2,11], reported increased total protein and albumin concentrations following vitamin E and nano-selenium supplementation. Improved feed efficiency in the T2 group enhanced nutrient utilization, leading to elevated total serum protein levels, as supported by[5].

The mean serum total cholesterol (fig;2) results demonstrated high significance ($p<0.01$), with the T2 group exhibiting the lowest total cholesterol at 213.5 mg/dl and the control group having the highest at 265.90 mg/dl. Serum HDL, LDL, and triglycerides also showed significant differences ($p<0.05$). Conversely,[6]observed increased serum concentrations of glucose, triglycerides, total cholesterol, and LDL-cholesterol in heat-stressed broilers fed vitamin E and selenium. Similar to our results,[10] reported a significant decrease in total cholesterol and triglyceride levels in layer chicks with Nano-selenium supplementation. Rizk (2018) found that Che-SeNPs in chicken diets reduced cholesterol, triglycerides, and LDL, while increasing HDL. Correspondingly[1] confirmed a significant decrease in total cholesterol, triglycerides, and very-low-density lipoprotein in Che-SeNPs-treated groups compared to controls. Dietary supplementation of Che-SeNPs also increased HDL, supporting the hypocholesteremic activity of Selenium.

The mean SGOT and SGPT values(fig;3) in Japanese quails, the T2 group showing the lowest values at 175.10 mg/dl and the control group having the highest at 219.10 mg/dl. This is consistent with[3], who found that vitamin E and selenium deficiency in aging quails increased AST activities. In contrast, no significant

**Figure 1: Serum total protein of Japanese quail reared from day old to 6 weeks of age by feeding vitamin E with Se, nano vitamin E with Se**

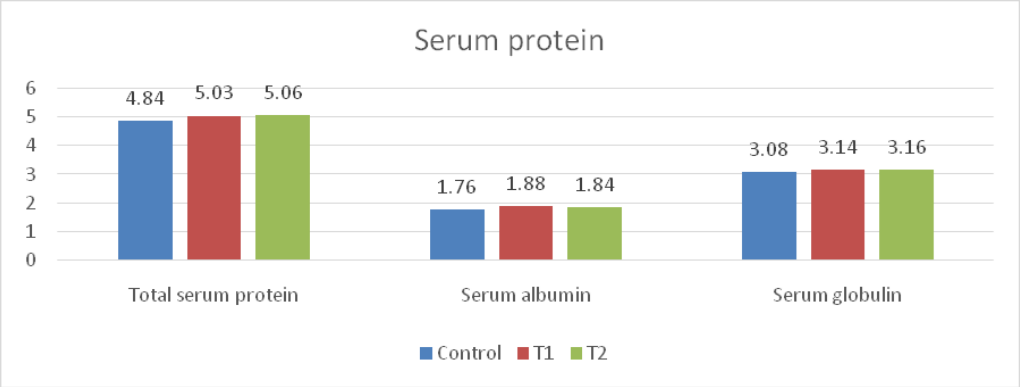



**Figure 2: Serum total cholesterol of Japanese quail reared from day old to 6 weeks of age by feeding vitamin E with Se, nano vitamin E with Se**

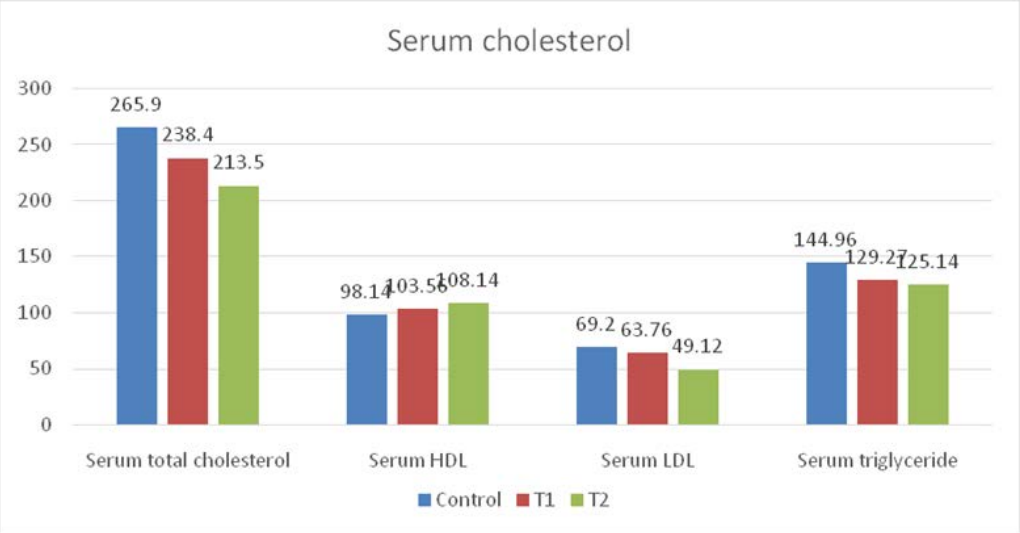
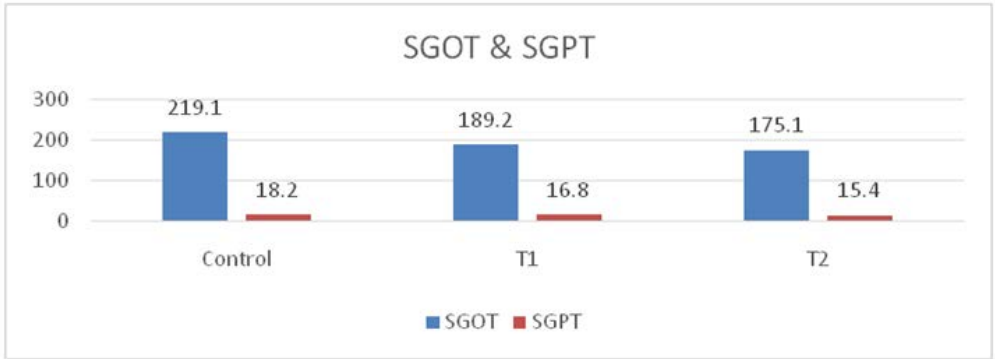



**Figure 3: SGOT and SGPT values of Japanese quail reared from day old to 6 weeks of age by feeding vitamin E with Se, nano vitamin E with Se**



difference (p>0.05) in serum AST activity was observed in chicks fed a diet containing Che-SeNPs[1].

## CONCLUSION

The present study revealed the effect of dietary supplementation of nano vitamin E and Selenium on serum biochemical profile in Japanese quails. The serum analysis of C1, T1, and T2 groups revealed notable differences. T2 group, with nano vitamin E and Selenium, consistently showed higher levels in total serum protein, total albumin, and total globulin. In lipid profile, T2 group displayed the lowest levels of total cholesterol, HDL, LDL cholesterols, and triglycerides, while C1 group exhibited the highest. Additionally, T2 consistently had the lowest SGOT and SGPT levels, with C1 group having the highest.

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*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 335-341 https://doi.org/10.48165/ijapm.2023.37.4.12

# Personal and Socio-Economic Characteristics of Dairy Farmers of Valsad District of Gujarat

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**Received: 15.12.2023; Accepted: 20.01.2024**

**ABSTRACT**

A field survey was conducted in Valsad district of Gujarat to ascertain the personal, socio-economic characteristics of dairy farmers and data were collected randomly from 240 dairy animal owners through personal interview with the help of structured interview schedule. The present study revealed that majority of the owners were belonged middle age group, literate, nuclear type of family with more number of children making big size family. Most of the respondents were from schedule tribe category having medium level of extension contacts and mass media exposure with membership in one organization. Only few of the respondents were landless categories. Majority of respondents had small herd size and they possessed agriculture and livestock as their livelihood.

**Key words:** Dairy animals, characteristics, personal, socio-economic

The national economy and socioeconomic development of the nation are significantly impacted by animal husbandry. The largest agricultural product, milk from cows and buffalo, plays a significant role in the Indian economy. With an unprecedented increase in milk production over the past three decades, India's dairy industry has made impressive strides. India is one of the nations that has modernized its dairy industry and increased production through the integration of cutting-edge scientific technologies. It is acknowledged that for dairy farmers to advance, they must modernize their knowledge, adoption, and other personal, social, and economic traits. India has become the world's top producer of milk, but its production potential per milking animal is very low i.e. the wet average daily milk production of its native cows, crossbred cows, and buffalo is 1.98, 6.75, and 4.50 kg, respectively[2]. The primary cause of India's low production is the dairy farmer's ignorance of modernized methods of animal husbandry that can affect socio-economic conditions. In light of these circumstances, the current study was conducted to examine the socio-economic and personal characteristics of the dairy animal's owners of Valsad district of Gujarat.

## MATERIALS AND METHODS

A field survey was conducted in Valsad district of South Gujarat during September, 2017 to January, 2018. Valsad district possess six talukas namely- Valsad, Dharampur, Vapi, Pardi, Umargaon and Kaparada. This district covers 3008 square kilometers and has 434 villages. There are 416 milk co-operative societies and 428 milk collection centers in Valsad district. Out of six talukas in the district, two talukas were randomly selected. From each selected taluka, twelve villages having functional primary milk producer's co-operative societies and ten dairy animal owners from each village were randomly selected using a multi stage random sampling technique with the help of Talati cum Mantri/ village dairy cooperatives which constituted a

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total of 240 respondents. The selected dairy animal owners were interviewed and the desired information was collected regarding personal, socio-economic characteristics of respondents with the help of structured interview schedule. Data were tabulated and analyzed as per the standard statistical procedure suggested by[15] to draw meaningful interference.

## RESULTS AND DISCUSSION

Perusal of the data in Table 1 showed that majority (67.92%) of dairy animal owners were from middle age group followed by old (20%) and young (12.08%) age group. Data indicated that the middle age group had better experience and interest, so they were always ready to adopt new innovation without considering the reaction of the other ones. The present results are in accordance with earlier findings of authors[1,3,4,5&9].

Majority (37.08%) of respondents were primary level, 31.67 percent secondary level of education, 25.00 percent respondents were illiterate and few 6.25 percent graduate and above level of education (Table 1). From the finding, it can be concluded that 75.00 per cent of the respondents selected were literate, moreover majority of them were falling between primary and secondary level of education. This showed that dairy farmers have realized the importance of formal education in their social development. Similar findings were also reported by earlier authors [4,11&16].

Data in Table 1 revealed that majority (95.83%) of the respondents found to be from scheduled tribe (ST) followed by 1.67 percent other backward category (OBC), 1.67 percent scheduled caste and 0.83 percent general category. ~~Author~~[11] reported that 40 percent of the respondents were from other backward category followed by scheduled tribe (39.33%), general category (13.67%) and scheduled caste (7.00%) in Surat district of Gujarat. However, author[18] reported that 78.33 percent of the farmers were from OBC followed by 21.67 percent from ST category in the study of socio-economic profile of maldhari dairy farmers of South Saurashtra region. There are variations in the findings related with the caste of the dairy animal owners in various parts of Gujarat due to the overall demographic structure of the region.

Data presented in Table 1 revealed that majority (67.5%) of dairy animal owners were from large family size followed by 32.5 percent from small size of family. Significant ($p<0.05$) different was observed with respect of involvement of family size between the talukas. Present findings are similar with findings of authors[12,14&17]. However, present findings are in contrast with earlier findings of authors [4&5].

Out of total respondents, 58.75 percent of dairy farmers had nuclear type family and 41.25 percent belonged to joint type family. Significant ($p<0.05$) difference was observed with respect of involvement of family type between the talukas. The smaller family size in the household with small holding might be due to division of the joint families. Many of them wanted to remain as small nuclear family for ease of family management in most economical way. Similar findings were reported by earlier authors [1&16].

Data in Table 1 indicated that majority (94.6%) respondents had membership in one organization while, 0.8 percent respondent had membership in more than one organization, 0.4 percent respondent had membership with holding position in organization and 4.2 percent respondents had no participation in any organization. The possible reason for these findings might be that the most popular and service-oriented village organizations meet the needs of dairy farming and financial assistance by village dairy co-operative societies. Hence, most of the respondents were members of only one organization for availing these benefits. These findings are supported by the findings of [10&12].

Data depicted in Table 2 revealed that majority (73.33%) of the respondents were found to have medium level of extension contacts,

**Table 1: Distribution of the dairy animal owners according to personal and social characteristics**

| Variables | Category | Dharampur (N=120) | | Pardi (N=120) | | Overall (N=240) | |
|---|---|---|---|---|---|---|---|
| | | F | % | F | % | F | % |
| Age | Young (≤35 years) | 11 | 09.16 | 18 | 15.00 | 29 | 12.08 |
| | Middle (36–50 years) | 86 | 71.66 | 77 | 64.17 | 163 | 67.92 |
| | Old (>50 years) | 23 | 19.16 | 25 | 20.83 | 48 | 20.00 |
| | | | $\chi^2$= 2.27 | | | | |
| Education | Illiterate | 41 | 34.17 | 24 | 15.83 | 65 | 25.00 |
| | Primary level (up to 7th) | 44 | 36.67 | 48 | 37.51 | 92 | 37.08 |
| | Secondary level (8th-12th) | 30 | 25.00 | 38 | 38.33 | 68 | 31.67 |
| | Graduate and above | 05 | 04.16 | 10 | 08.33 | 15 | 06.25 |
| | | | $\chi^2$= 7.32 | | | | |
| Caste | General | 00 | 0.00 | 02 | 01.67 | 02 | 00.83 |
| | OBC | 00 | 0.00 | 04 | 03.33 | 04 | 01.67 |
| | SC | 02 | 01.67 | 02 | 01.67 | 04 | 01.67 |
| | ST | 118 | 98.33 | 112 | 93.33 | 230 | 95.83 |
| | | | $\chi^2$= 6.16 | | | | |
| Family size | Small size (up to 4) | 31 | 25.8 | 47 | 39.2 | 78 | 32.50 |
| | Large size (above 4) | 89 | 44.2 | 73 | 60.8 | 162 | 67.50 |
| | | | $\chi^2$= 4.86* | | | | |
| Family type | Nuclear type | 62 | 51.67 | 79 | 65.83 | 141 | 58.75 |
| | Joint type | 58 | 48.33 | 41 | 34.16 | 99 | 41.25 |
| | | | $\chi^2$= 4.97* | | | | |
| Social Participation | No participation | 03 | 2.5 | 07 | 5.8 | 10 | 4.20 |
| | Membership in one organization | 117 | 97.5 | 110 | 91.7 | 227 | 94.60 |
| | Membership in more than one organization | 00 | 0.00 | 02 | 1.7 | 02 | 0.80 |
| | Holding position in organization | 00 | 0.00 | 01 | 0.8 | 01 | 0.40 |
| | | | $\chi^2$= 4.82 | | | | |

followed by 16.25 and 10.42 percent with low and high level of extension contacts, respectively. Participation of respondents in animal husbandry practices as per extension contact was highly significant (p=0.00) between talukas. Thus, it can be concluded that majority (83.75%) of the respondents had medium to high level of extension contacts. The reason for this might be that, various extension agencies like T & V system of state agriculture department, Vasundhara dairy, State animal husbandry department, Vanbandhu College of Veterinary Science and A.H., Navsari, Krishi Vigyan Kendra were actively involved for various extension activities. In such a situation, because majority of them were literate, they might have created awareness about how to make contact these extension agencies. These findings are similar to the earlier findings revealed by authors [7,9&12].

Data in Table 2 indicated that majority (54.58%) of the respondents had medium level of

**Table 2: Distribution of the dairy animal owners according to their extension contact and mass media exposure.**

| Variables | Category | Dharampur (N=120) | | Pardi (N=120) | | Overall (N=240) | |
|---|---|---|---|---|---|---|---|
| | | F | % | F | % | F | % |
| Extension contact | Low | 28 | 23.33 | 11 | 09.17 | 39 | 16.25 |
| | Medium | 85 | 70.83 | 91 | 75.83 | 176 | 73.33 |
| | High | 07 | 05.84 | 18 | 15.00 | 25 | 10.42 |
| | | $\chi^2$=12.45** | | | | | |
| Mass media exposure | Low | 46 | 38.33 | 43 | 35.83 | 89 | 37.08 |
| | Medium | 66 | 55.00 | 65 | 54.17 | 131 | 54.58 |
| | High | 08 | 06.67 | 12 | 10.00 | 20 | 8.34 |
| | | $\chi^2$=0.90 | | | | | |

**Table 3: Distribution of the dairy animal owners according to land and animal holding size.**

| Variables | Category | Dharampur (N=120) | | Pardi (N=120) | | Overall (N=240) | |
|---|---|---|---|---|---|---|---|
| | | F | % | F | % | F | % |
| Land Holding size | Landless | 04 | 3.33 | 12 | 10.00 | 16 | 6.67 |
| | Marginal (up to 1.5 acres) | 33 | 27.51 | 30 | 25.00 | 63 | 26.25 |
| | Small (1.5 to 2.5 acres) | 46 | 38.33 | 44 | 36.67 | 90 | 37.50 |
| | Large (above 2.5 acres) | 37 | 30.83 | 34 | 28.33 | 71 | 29.58 |
| | | $\chi^2$ = 4.31 | | | | | |
| Animal Holding size | Small (1-5 animals) | 80 | 66.67 | 78 | 65.00 | 158 | 65.83 |
| | Medium (6-10 animals) | 34 | 28.33 | 32 | 26.67 | 66 | 27.50 |
| | Large (> 10 animals) | 06 | 5.00 | 10 | 8.33 | 16 | 6.67 |
| | | $\chi^2$ = 1.08 | | | | | |

mass media exposure followed by 37.08 and 8.34 per cent of the respondents with low and high level of mass media exposure, respectively. In general, it is observed that majority (91.66%) of the dairy animal owners possessed low to medium exposure to mass media. This might be due to their low to medium level of awareness regarding importance of various mass media in improving their knowledge. Because of this reason they might not have shown their expected interest in useful programmes broadcasted and telecasted on radio and television, respectively, as well as from literature published by different agencies. The present results are supported by the findings of [12&13].

The observations of Table 3 revealed that majority (37.5%) of the dairy animal owners were small followed by 29.58, 26.25 and 6.67 percent respondents were large, marginal and landless, respectively. These findings are in accordance with the findings of author[6].

It is apparent from the Table 3 that majority of the respondents (65.83%) had small herd size followed by medium size (27.5%) and large size (6.67%) herd. The possible reason for small herd size might be the majority of the respondents possessed crossbred cows which require more

**Table 4: Distribution of the dairy animal owners according to type of animal's possessed and vocational diversification.**

| Variables | Category | Dharampur | | Pardi | | Overall | |
|---|---|---|---|---|---|---|---|
| | | F | % | F | % | F | % |
| Type of animals | Only Indigenous cows | 08 | 06.67 | 03 | 02.50 | 11 | 04.58 |
| | Indigenous cows + Crossbred cows | 09 | 07.50 | 04 | 03.33 | 13 | 05.42 |
| | Only Crossbred cows | 29 | 24.17 | 45 | 37.50 | 74 | 30.83 |
| | Crossbred cows + Buffalo | 19 | 15.83 | 33 | 27.50 | 52 | 21.67 |
| | Only Buffalo | 43 | 35.83 | 23 | 19.17 | 66 | 27.50 |
| | Indigenous cows + Buffalo | 07 | 05.83 | 04 | 03.33 | 11 | 04.58 |
| | Indigenous cows + Crossbred cows + Buffalo | 05 | 04.17 | 08 | 06.67 | 13 | 05.42 |
| | | $\chi^2$ =19.00** | | | | | |
| Vocational diversification | Only Dairy | 02 | 0.00 | 05 | 2.50 | 07 | 2.90 |
| | Agriculture + Dairy | 107 | 92.50 | 90 | 82.5 | 197 | 82.10 |
| | Agriculture + Dairy+ Service | 05 | 4.17 | 12 | 9.17 | 17 | 7.10 |
| | Dairy+ Service | 02 | 0.00 | 06 | 0.00 | 08 | 3.30 |
| | Dairy+ Labour | 04 | 3.33 | 07 | 5.83 | 11 | 4.60 |
| | | $\chi^2$ =8.45 | | | | | |

amount of green fodder and most of the respondents were small and marginal farmers so it would not be possible for them to allocate more area for fodder crop production. The price of such dairy animal is also very high. These findings are well supported by the results of earlier authors [10&16].

Perusal of the Table 4 revealed that 30.83 percent respondents possessed only crossbred cows followed by 27.50 percent only Buffaloes, 21.67 percent Crossbred cows + Buffaloes, 5.42 percent Indigenous cows + Crossbred cows, 5.42 percent Indigenous cows + Crossbred cows + Buffaloes, 4.58 percent only Indigenous cows and 4.58 percent Indigenous cows + Buffaloes. Distribution of type of animals possessed by respondents was found highly significant ~~difference~~ between the Dharampur and Pardi talukas of Valsad district of South Gujarat. This tribal area is having certain natural resources which are helpful for rearing of crossbred cows. Looking to the need of upliftment of tribal people BAIF started their livestock development programme giving prime importance to crossbreds as a unit of remunerative milk production. The Vasundhara dairy is also encouraging the crossbred cow keeping. Vasundhara dairy provides loan and other help in kind for improving the financial status of tribal population. Because of these factors the numbers of crossbreds are very high as compared to others.

It was observed from Table 4 that the majority (82.1%) of the respondents possessed Agriculture + Dairy as their livelihood and the others either depend only on Dairy (2.9%), Dairy + Labour (4.6%), on Agriculture + Dairy + Service (7.1%) and on Dairy + Service (3.3%). From these observations, it can be concluded that majority of the respondents had farming with dairying as a main source of income for their livelihood. Present results agree with earlier

findings of [8]. However present findings are higher than that of findings of [12] who revealed that majority (61.67%) of the dairy animal owners were engaged in agriculture and livestock as their livelihood and the others were either depend only on livestock (14.33%), dairy and labour (19.00%) or on agriculture - dairy and service (3.33%) or on dairy and service (1.67%) in Surat district of Gujarat.

## CONCLUSION

It can be concluded that majority of the respondents were belonged middle age group and literate having nuclear type of big family. Majority of the respondents had medium level of extension contacts and mass media exposure with membership in one organization. Majority of the respondents were marginal to large category farmers with small herd size and having agriculture and dairy farming as their livelihood.

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*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 342-349 https://doi.org/10.48165/ijapm.2023.37.4.13

# A Study on the Effect of Housing on Haematological Parameters of Nellore Lambs

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**Received: 23.09.2023; Accepted: 18.01.2024**

**ABSTRACT**

A study was carried out to find out the effect of housing on haematological parameters of Nellore Jodipi lambs. Thirty weaned Nellore ram lambs of 3-4 months age were divided into three groups of ten each. The lambs in Group-I were housed with morum flooring and asbestos roofing with tree shade, while Group-II lambs were housed with morum flooring and asbestos roofing without tree shade and Group-III lambs were housed with elevated slatted flooring and galvalume roofing without tree shade. Temperature and humidity values were significantly (P<0.05) different among all the groups. Lower mean maximum temperature (°C) values were observed in group III (35.53±0.28) when compared to group I (36.22±0.27) and II (37.29±0.25) and the lower average maximum relative humidity (%) was 69.59±2.92 in group III followed by group II (69.88±2.94) and I (70.65±2.96). The mean haematological parameters like RBC, WBC, Hb, PCV were significantly (P<0.05) lower in group III (8.22±1.00×$10^6$/µl, 6.99±1.00×$10^3$/µl, 10.22±0.08 g/dl, 28.23±1.00 %) when compared to group I (9.66±1.00×$10^6$/µl, 9.01±1.00×$10^3$/µl, 10.85±0.08 g/dl, 31.27±1.00 %) and II (11.96±1.00×$10^6$/µl, 11.73±1.00×$10^3$/µl, 13.64±1.00 g/dl, 37.27±1.00%), respectively, whereas, other parameters like MCH, MCV, MCHC are significantly (P<0.05) higher in group III (11.52±1.00 pg, 34.92±1.00 fl, 36.57±1.00 g/dl) when compared to group I (10.23±1.00 pg, 31.85±1.00 fl, 34.02±1.00 g/dl) and II (8.92±1.00 pg, 28.05±1.00 fl, 32.15±1.00 g/dl), respectively. It was concluded that the housing system of elevated slatted flooring with galvalume roofing proved to be effective in controlling heat stress and maintaining normal hematological parameters for better growth performance of Nellore ram lambs..

**Key words:** Nellore Jodipi lambs, housing, haematological parameters, slatted flooring

Housing plays a key role in rearing of sheep. An ideal housing enables in moderating the range of microclimate to which the animals are exposed. The degree of comfort depends upon the types of housing. The principal functions of housing for livestock are health maintenance and provision of comfortable environment to the animals, desirable working conditions for labour and supervisory staff and integration of housing with feeding, watering, cleaning, handling and manure removal system. In housing management, particularly roof and floor management is an important aspect of sheep husbandry, which provides both comfort and cleanliness with minimal risk of injury. This gives better health cover to the animals and improves their growth rate and productivity. Therefore, ideal floor needs to be hygienic, dry, resilient, reasonably temperature resistant and comfortable to animals.

Elevated sheep houses offer many advantages in tropical and subtropical areas. It allows manure, urine and debris to drop through the slatted floor, thus eliminating a major source of disease and parasitic infestation. Slatted floor is easy to clean and maintain, and the waste that falls through it is easily collected and used as manure. During winter, chips, straw, plywood or

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other products can be placed over part of the slatted floor. It allows ventilation to circulate through the slats thus maintaining all the physiological & hematological parameters favourable for better performance of the sheep.

The performance of the animals is also influenced by environmental factors like temperature and humidity in the region. Rearing of sheep in complete confinement with reduced floor space is difficult for the sheep farmers. Therefore, to overcome this situation, studying the growth performance & hematological parameters of sheep on different types of housing is an important aspect for profitable sheep farming.

## MATERIALS AND METHODS

The present investigation was carried out at the Livestock Research Station (LRS), Palamaner, Chittoor District, Andhra Pradesh. Livestock Research Station, Palamaner is located in the Chittoor District of Andhra Pradesh at an elevation of 683 m above mean sea level on the 13.2 º North latitude and 78.7 º East longitude. The average annual rainfall of Chittoor district is about 862 mm, mostly during June to October months of the year. However, rainfall is rather erratic and uncertain. The average annual temperature is 27.4 ºC. A total of thirty male Nellore Jodipi lambs of 3½ months age, 15 kg body weights were divided into three groups of ten each. The lambs were fed with green fodder and concentrate mixture as per ICAR 2013 standards. The experiment was conducted for a period of 120 days until the lambs reached the age of 7-8 months. A pre-experimental period of 10 days was given to the animals to acclimatize themselves to the housing environments. The study was conducted from April to July, 2019.

**Housing systems of experimental lambs:** The Nellore lambs were divided into 3 groups of ten lambs each.

Group I: House with morum flooring and asbestos roofing with tree shade.

Group II: House with morum flooring and asbestos roofing without tree shade.

Group III**:** House with elevated slatted flooring and galvalume roofing without tree shade.

The three experimental houses were cleaned daily. The vaccination, deworming and other health measures for all experimental lambs were performed as a routine practice followed in the farm. Measured quantity of mixture of Super Napier, Guinea grass, Jowar, Subabul, Stylo were offered to all the experimental animals twice daily in the portable manger. The concentrates offered to the lambs of all three groups in the morning at 8 AM and evening at 4 PM. Dry matter requirement was calculated at the rate of 5 % of body weight of lambs and concentrates were calculated at the rate of 1/3 of total dry matter required for their body weight. All the lambs were stall fed. Drinking water was provided in the houses throughout the day.

**Collection of blood samples and its processing:** Blood samples were collected at fortnightly interval during the complete experimental period (4 months) in all the 3 housing groups. Six ml blood was drawn aseptically from the jugular vein of each lamb by using disposable syringe. Immediately 2 ml blood was diverted in another vial containing Disodium ethylene diamine tetra acetate (Na2 EDTA) as anticoagulant. The remaining 4 ml blood was diverted in to silicon gel coated clot activator vial. The anti-coagulated blood samples were used for hematological examination. The blood samples without anti-coagulant were left at room temperature for 4 hours to clot. Then the samples were centrifuged at 3500 rpm and haemolysis free serum was harvested in the glass vials and kept in deepfreeze at -20ºC until analysis. Serum samples were used for determination of certain biochemical parameters.

**Measurement of Hematological Parameters:** Hematological parameters such as hemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (RBC), total leukocyte count (WBC), mean

corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were estimated by using fully automated hematology analyzer (UBM F- 19T VET).

## RESULTS AND DISCUSSION

**Red Blood Cells:** The data on red blood cells (RBC) count of Nellore lambs under different types of housing was presented in Table 1. The average RBC count recorded was 9.66±1.00, 11.96±1.00 and 8.22±1.00 ($\times 10^6$/µl) in group I, II and III, respectively. The RBC count was significantly (P<0.05) higher in group II when compared to group I and III. The higher RBC level in sheep during heat stress might be due to the demand of oxygen increased by tissues to meet their physiological needs. The level of erythrocytes increased in blood and thus heat stress leads to dehydration in animals and caused hemoconcentration during summer season.

The results obtained in the present study are in agreement with other workers [12,13,16,10,14]. However, [21] reported that the red blood cell count was significantly (P<0.05) decreased under heat stress conditions in Merino sheep.

**White Blood Cells:** The data on white blood cells (WBC) count of Nellore lambs under different types of housing was presented in Table 2. The average WBC count was 9.01±1.00, 11.73±1.00 and 6.99±1.00 ($\times 10^3$/µl) in group I, II and III, respectively. The WBC count were significantly (P<0.05) higher in group II when compared to group I and III. This might be due to higher WBC level in sheep during heat stress wherein the level of leukocytes increased in blood due to dehydration in animals and caused hemoconcentration during summer season and also stress induced by high temperatures caused more immune response and increased WBC count.

The results obtained in the present study are in agreement with [16,14,12]. However, comparatively slightly higher values for WBC were observed by [10] who concluded that stress induced by high temperatures in unshaded group caused more immune response and increased WBC count. In contrast to the present findings, [21] reported that the white blood cell counts were significantly decreased under heat stress conditions in merino sheep. Further the present findings are also not in agreement with [4] who observed that the level of WBC count was significantly (P<.001) increased during winter season, than that of summer season.

**Hemoglobin:** The data on hemoglobin (Hb) levels of Nellore lambs under different types of housing was presented in Table 3. The average Hb level was 10.85±0.08, 13.64±1.00 and 10.22±0.08 (g/dl) in group I, II and III, respectively. The Hb level was significantly (P<0.05) higher in group II when compared to group I and III. This higher Hb level in group II might be due to increased demand of oxygen by tissues as adaptive mechanism to improve blood capacity for carrying oxygen in animals during summer season.

The results obtained in the present study are in agreement with those reported by [18,3,15,14]. However, comparatively a lower Hb values were observed by [21] who reported that the hemoglobin level was significantly (P<0.05) decreased from 6.47±0.9 to 5.71±1.0 g/dl under heat stress conditions in merino sheep. [17] observed no significant difference in Hb levels in Omani & Australian Merino sheep. Further [2] reported that there was non-significant difference in haemoglobin concentration in Group I maintained under house having asbestos roof and slatted floor vs Group II maintained under house having shed net as roofing material and kaccha floor in Osmanabadi kids.

**Hematocrit:** The data on hematocrit (PCV) values of Nellore lambs under different types of housing was presented in Table 4. The average hematocrit values recorded were 31.27±1.00, 37.27±1.00 and 28.23±1.00 (%) in group I, II and III, respectively. The PCV values were significantly (P<0.05) higher in group II when

**Table 1: RBC(×10$^6$/µl) count in Nellore lambs under different types of housing.**

| PERIOD (Fortnight Intervals) | GROUP – I | GROUP – II | GROUP - III |
|---|---|---|---|
| I | 9.11±0.33 | 11.18±0.22 | 8.15±0.14 |
| II | 10.15±0.38 | 11.83±0.30 | 7.97±0.49 |
| III | 9.91±0.37 | 12.79±0.14 | 8.05±0.54 |
| IV | 9.90±0.39 | 12.42±0.15 | 8.70±0.13 |
| V | 10.77±0.47 | 11.66±0.25 | 8.50±0.91 |
| VI | 8.50±0.21 | 11.84±0.29 | 7.85±0.08 |
| VII | 9.44±0.25 | 12.18±0.16 | 8.33±0.15 |
| VIII | 9.53±0.35 | 11.82±0.39 | 8.27±0.15 |
| MEAN | 9.66 $^b$ ±1.00 | 11.96 $^c$ ±1.00 | 8.22 $^a$ ±1.00 |

Values with different superscripts in a row differ significantly (P<0.05)

**Table 2: WBC (×10$^3$/µl) count in Nellore lambs under different types of housing**

| PERIOD (Fortnight Intervals) | GROUP – I | GROUP – II | GROUP - III |
|---|---|---|---|
| I | 8.65±0.31 | 11.81±0.31 | 6.30±0.28 |
| II | 8.15±0.32 | 12.96±0.37 | 6.63±0.22 |
| III | 8.72±0.34 | 11.51±0.65 | 7.29±0.29 |
| IV | 8.27±0.26 | 11.40±0.14 | 6.91±0.31 |
| V | 7.90±0.48 | 12.23±0.41 | 7.37±0.37 |
| VI | 9.88±0.32 | 10.49±0.63 | 6.99±0.44 |
| VII | 10.80±0.36 | 11.58±0.58 | 7.32±0.48 |
| VIII | 9.78±0.67 | 11.89±0.34 | 7.18±0.30 |
| MEAN±S.E | 9.01 $^b$ ±1.00 | 11.73 $^c$ ±1.00 | 6.99 $^a$ ±1.00 |

Values with different superscripts in a row differ significantly (P<0.05)

**Table 3: Hb (g/dl) levels in Nellore lambs under different types of housing.**

| PERIOD (Fortnight Intervals) | GROUP – I | GROUP – II | GROUP - III |
|---|---|---|---|
| I | 10.46±0.31 | 12.76±0.16 | 10.24±0.35 |
| II | 10.97±0.16 | 13.29±0.17 | 9.78±0.16 |
| III | 10.96±0.19 | 14.13±0.40 | 10.03±0.13 |
| IV | 9.79±1.00 | 13.80±0.39 | 10.38±0. 21 |
| V | 10.67±0.27 | 13.58±0.35 | 10.48±0. 15 |
| VI | 10.70±1.13 | 14.12±0.33 | 10.50±0. 26 |
| VII | 10.98±0.33 | 13.70±0.47 | 10.19±0. 39 |
| VIII | 12.27±0.47 | 10.22±0.18 | 10.22±0. 18 |
| MEAN | 10.85 $^a$ ±0.08 | 13.64 $^b$ ±1.00 | 10.22 $^a$ ±0.08 |

compared to group I and III. In the present study, the increased PCV value in group II might be due to dehydration which leads to hemoconcentration during heat stress in sheep or may be due to increased concentration of RBC.

**Table 4: Hematocrit /PCV (%) levels in Nellore lambs under different types of housing.**

| PERIOD (Fortnight Intervals) | GROUP – I | GROUP – II | GROUP - III |
|---|---|---|---|
| I | 31.10±0.64 | 39.60±0.33 | 29.30±0.66 |
| II | 31.40±0.68 | 37.60±0.37 | 28.50±0.77 |
| III | 32.10±0.37 | 36.20±0.61 | 28.30±0.55 |
| IV | 31.80±0.59 | 38.80±1.15 | 27.00±0.57 |
| V | 29.10±0.52 | 27.60±0.91 | 27.60±0.42 |
| VI | 32.10±0.73 | 27.80±0.56 | 27.80±0.61 |
| VII | 31.50±0.56 | 28.60±0.73 | 28.60±0.56 |
| VIII | 31.10±0.62 | 28.80±0.87 | 28.80±0.69 |
| MEAN | 31.27 $^{b}$ ±1.00 | 37.27 $^{c}$ ±1.00 | 28.23 $^{a}$ ±1.00 |

Values with different superscripts in a row differ significantly (P<0.05)

**Table 5: MCH (pg) levels in Nellore lambs under different types of housing.**

| PERIOD (Fortnight Intervals) | GROUP – I | GROUP – II | GROUP - III |
|---|---|---|---|
| I | 10.60±0.30 | 8.80±0.24 | 11.80±0.35 |
| II | 10.30±0.44 | 8.80±0.32 | 11.80±0.35 |
| III | 9.90±0.23 | 8.50±0.16 | 11.20±1.17 |
| IV | 10.40±0.26 | 8.60±0.22 | 11.70±0.36 |
| V | 10.30±0.30 | 8.80±0.24 | 12.30±0.30 |
| VI | 10.30±0.30 | 9.00±0.25 | 9.90±1.05 |
| VII | 10.10±0.43 | 8.90±0.23 | 11.90±0.43 |
| VIII | 10.00±0.25 | 10.00±1.03 | 11.60±0.40 |
| MEAN | 10.23 $^{b}$ ±1.00 | 8.92 $^{a}$ ±1.00 | 11.52 $^{c}$ ±1.00 |

**Table 6: MCV (fl) levels in Nellore lambs under different types of housing.**

| PERIOD (Fortnight Intervals) | GROUP – I | GROUP – II | GROUP - III |
|---|---|---|---|
| I | 30.60±0.80 | 26.80±0.74 | 34.50±0.71 |
| II | 31.70±0.59 | 28.80±0.48 | 36.50±0.40 |
| III | 32.20±0.85 | 27.00±0.51 | 34.20±0.20 |
| IV | 33.30±0.52 | 27.40±0.26 | 35.40±0.47 |
| V | 32.70±0.33 | 28.70±0.36 | 33.90±0.54 |
| VI | 32.30±0.55 | 28.80±0.38 | 33.80±1.16 |
| VII | 32.00±0.59 | 28.30±0.30 | 35.50±0.54 |
| VIII | 30.20±0.38 | 28.60±0.30 | 35.60±0.49 |
| MEAN | 31.85 $^{b}$ ±1.00 | 28.05 $^{a}$ ±1.00 | 34.92 $^{c}$ ±1.00 |

The results obtained in the present study are in agreement with [7,16,13,]. However, comparatively a lower level of PCV was observed by [10] who studied the effect of shade on welfare

**Table 7: MCHC (g/dl) levels in Nellore lambs under different types of housing.**

| PERIOD (Fortnight Intervals) | GROUP – I | GROUP – II | GROUP - III |
|---|---|---|---|
| **I** | 34.90±0.31 | 31.70±0.30 | 31.20±0.20 |
| **II** | 35.00±0.25 | 32.40±0.33 | 36.70±0.33 |
| **III** | 34.20±0.24 | 32.50±0.34 | 36.50±0.47 |
| **IV** | 30.70±0.32 | 31.90±0.31 | 36.00±0.49 |
| **V** | 33.00±0.49 | 32.20±0.24 | 36.40±0.33 |
| **VI** | 34.00±0.25 | 32.20±0.24 | 36.10±0.27 |
| **VII** | 35.50±0.34 | 32.10±0.23 | 30.60±0.22 |
| **VIII** | 34.90±0.31 | 32.20±0.20 | 37.10±0.23 |
| **MEAN** | 34.02 $^{b}$ ±1.00 | 32.15 $^{a}$ ±1.00 | 36.57 $^{c}$ ±1.00 |

Values with different superscripts in a row differ significantly (P<0.05)

and meat quality of grazing sheep.

**Mean Corpuscular Hemoglobin:** The data on Mean corpuscular hemoglobin (MCH) levels of Nellore lambs under different types of housing was presented in Table 5. The average MCH levels recorded were 10.23±1.00, 8.92±1.00 and 11.52±1.00 (pg) in group I, II and III, respectively. The MCH levels were significantly (P<0.05) higher in group III when compared to group I and II. In the present study, the decreased MCH value in group II might be due to increase in the number of erythrocyte membrane vesicles formed and shed from the erythrocytes with decrease in the size of parent erythrocytes, and reduced mean corpuscular hemoglobin due to iron deficiency during heat stress [5].

The results obtained in the present study are in agreement with [20,16,11]. However, a slightly lower values of MCV were recorded by [1] in Nubian goats.

**Mean Corpuscular Volume:** The data on Mean corpuscular volume (MCV) levels of Nellore lambs under different types of housing was presented in Table 6. The average MCV levels recorded were 31.85±1.00, 28.05±1.00 and 34.92±1.00 (fl) in group I, II and III, respectively. The MCV levels were significantly (P<0.05) higher in group III when compared to group I and II. In the present study, the decreased MCV value in group II might be due to increase in the number of erythrocyte membrane vesicles formed and shed from the erythrocytes as a result of elevation in body temperature, with a resultant decrease in the size of parent erythrocytes [5].

The results obtained in the present study are in agreement with [20,]. However, comparatively a lower value of MCV (fl) were recorded by [1] in Nubian goats.

**Mean Corpuscular Hemoglobin Concentration:** The data on Mean corpuscular hemoglobin concentration (MCHC) levels of Nellore lambs under different types of housing was presented in Table 7. The average MCHC levels recorded were, 34.02±1.00, 32.15±1.00 and 36.57±1.00 (g/dl) in group I, II and III, respectively. The MCHC level was significantly (P<0.05) higher in group III when compared to group I and II. In the present study, the decreased MCHC value in group II might be due to increase in the number of erythrocyte membrane vesicles formed and shed from the erythrocytes as a result of elevation in body temperature, or may be due to reduced size of RBC and which have a decreased level of hemoglobin.

The results obtained in the present study are in agreement with [20,16,21,1].

## CONCLUSION

To study the effect of housing on growth performance of Nellore lambs, they were housed in three different groups. The lower average maximum temperature was observed in group III followed by group I and II. This might be due to continuous circulation of air inside the sheds, less heat absorption of galvalume roofing compared to asbestos roofs, less heat reflection from the ground as it is elevated. The lower average maximum relative humidity was recorded in group III due to continuous circulation of air in slatted house and super protective mechanism of galvalume roofing, followed by group II and I. As there is significant difference among various hematological parameters, group III animals shown better performance.

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*Indian J. Anim. Prod. Manage.* (2023) *37*(4), 350-355 https://doi.org/10.48165/ijapm.2023.37.4.14

# A Study on Biometric Parameters and Chemical Composition of Super Napier Green Fodder

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**Received: 04.01.2024; Accepted: 16.01.2024**

**ABSTRACT**

An experiment was conducted to study the biometric parameters of Super Napier green fodder along with assessment of chemical composition, cell wall constituents and fodder characteristics at different days of harvest at Livestock Research Station, Siddarampuram, in Anantapur district. The fodder characteristics of Super Napier i.e., plant height (cm), basal circumference (cm), tillers per plant (number), leaves per tiller (number), leaves per plant (number) increased as age advanced showing a significant difference ($P < 0.01$) at 15, 30, 45 and 60 days of harvesting. The mean proximate values of Super Napier fodder for DM, CP, CF, EE, TA and NFE were 22.43 ± 2.35, 9.94 ± 1.04, 32.66 ± 1.63, 1.94 ± 0.23, 11.32 ± 1.23 and 44.11 ± 1.47 per cent, respectively. The mean cell wall constituents of NDF, ADF, Hemicellulose, Cellulose, ADL and Silica were 63.64 ± 1.51, 37.90 ± 1.54, 25.74 ±1.47, 27.31 ± 1.74, 8.26 ± 1.31 and 3.38 ± 0.28 per cent, respectively. The leaf area index noticed at the time of harvest was 9.43. The leaf to stem ratio observed at 15$^{th}$, 30$^{th}$, 45$^{th}$ and 60$^{th}$ day of harvest was 1.50 ± 0.22, 0.65 ± 0.05, 0.43 ± 0.03 and 0.22 ± 0.11, respectively. Highest leaf to stem ratio was recorded at 15 days of age and lowest at 60 days of age.

**Key words:** Biometric parameters, chemical composition, Super Napier

The quantity and quality of forages fed to animals is important for enhancing productivity of livestock. Forages continue to represent the single most important feed resource for livestock in developed and developing countries[7]. Half of the total losses in livestock productivity are contributed to by inadequacy in supply of feed and fodder. At present, country faces a net deficit of 61.1 per cent green fodder, 21.9 per cent dry crop residues and 64 per cent of concentrates. Hence, a need arises to search for best yielding and fast-growing fodder varieties for the feeding of the animals for better production. Among the various fodders available in the country, hybrid napier grass is one of the high yielding crops. Hybrid Napier grasses are known for tillering capacity, green forage yield, regeneration capacity, leaf to stem ratio, crude protein content and resistance of pest and diseases. Several varieties of Napier grasses were developed by crossing the Napier with Pearl millet. A new variety named as Super Napier fodder variety developed by crossing of *Pennisetum purpureum* (Ordinary Napier) and *Pennisetum glaucum* (Pearl millet) developed in Thailand popularly called as *Pennisetum purpureum* cv. Pak chong-1. This variety is also propagated through root-slips or stem cuttings and could be maintained as a perennial crop upto 4-5 years. It is becoming popular because of its high yield,

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faster growth, shorter cutting interval and no winter dormancy when compared with other Napier varieties. Hence, the present study was conducted to evaluate the chemical composition and cell wall constituents along with fodder characteristics (leaf to stem ratio, leaf area index etc.) of Super Napier fodder variety at different days of harvest.

## MATERIALS AND METHODS

The experiment was carried out at Livestock Research Station, Siddarampuram, Anantapur district of Andhra Pradesh. The laboratory analysis was undertaken at department of Livestock Production Management and Department of Animal Nutrition, College of Veterinary Science, Tirupati. The study was carried out during March to May 2018. The field was ploughed twice with a tractor drawn cultivator and levelled. This is followed by the formation of bunds around each individual plots, which were levelled with spade manually. Buffer channels were formed around each individual plot measuring one acre. Stem cuttings having two nodes were used as a planting material. The stem cuttings were placed into the soil at an angle of 45° and the slips were planted. The spacing between the slips in each row was 3×3 feet. 11,000 slips per acre were used for sowing. During planting 5 tonnes of farm yard manure (FYM) and NPK in the ratio of 40:60:40 kg $ha^{-1}$ was applied. Later 20 kg of N $ha^{-1}$ was applied 10-15 days after each harvest. First irrigation was given soon after planting. The fodder plot was irrigated in alternate days as the study was conducted during summer season. The first cut was at 60-75 days after planting. Subsequent cuts were done at an interval of 45 to 50 days. Leaf area was computed at the time of harvest based on the length and width of the green leaf (at its mid-point) by the following method suggested by[8].

$$\text{Leaf area} = L \times W \times K$$

where, L = Length of leaf (cm), W = Maximum width of leaf (cm) and K = a constant

By computing the leaf area as explained above, LAI was calculated by using the following formula as suggested by[20].

$$Leaf\ Area\ Index = \frac{Leaf\ area}{Land\ area}$$

Leaf stem ratio was arrived by separating the leaf and stems and then weighing the leaf content and stem portion separately and measuring the ratio of leaf to stems. Super Napier fodder samples were collected at different days i.e. 15$^{th}$, 30$^{th}$, 45$^{th}$, and 60$^{th}$ day of growth, and dried in a hot air oven at 70°C for 48 hours and later ground in laboratory Wiley Mill using a medium mesh screen of 2 mm. The ground materials were stored in air tight wide mouthed glass bottles for further laboratory evaluation. The DM, Ash, EE and N content of the Super Napier fodder were analyzed by the methods of the Association of Official Analytical Chemists[2]. The NDF, ADF, and ADL content of grass were analyzed / estimated by the procedures of[17]. The data obtained from the study was tabulated and subjected to statistical analysis using a SPSS software package for statistical significance as per the methods laid down by[15].

## RESULTS AND DISCUSSION

The biometric parameters of Super Napier fodder at different days of harvest were presented in the Table 1. The plant length, number of tillers per plant, basal circumference, number of leaves per tiller and number of leaves per plant differ significantly ($P < 0.01$). The plant height increases as the age of the plant advanced. The age of the plant is positively related with the number of tillers, basal circumference, number of leaves per tiller and number of leaves per plant, respectively. The proximate composition (%) of Super Napier grass at different days of age were presented in the Table 2. The cell wall constituents (%) of Super Napier fodder at different stages of harvest were presented in the Table 3. The Leaf to Stem ratio of Super Napier fodder was recorded as 1.50 ± 0.22, 0.65 ± 0.05, 0.43 ±

**Table: 1 Biometric parameters of Super Napier fodder at different days of harvest**

| Growth parameter | 15 days | 30 days | 45 days | 60 days |
|---|---|---|---|---|
| Plant height** (cm) | $40.57^{a} \pm 0.62$ | $82.08^{b} \pm 0.70$ | $116.80^{c} \pm 1.65$ | $158.78^{d} \pm 1.52$ |
| Basal Circumference** (cm) | $21.30^{a} \pm 0.88$ | $38.96^{b} \pm 0.89$ | $60.70^{c} \pm 1.03$ | $82.43^{d} \pm 1.26$ |
| Tillers per plant** (no) | $2.46^{a} \pm 0.13$ | $8.06^{b} \pm 0.41$ | $11.60^{c} \pm 0.37$ | $12.53^{c} \pm 0.51$ |
| Leaves per tiller** (no) | $5.86^{a} \pm 0.23$ | $10.86^{a} \pm 0.38$ | $18.86^{c} \pm 0.61$ | $23.40^{c} \pm 1.51$ |
| Leaves per plant** (no) | $14.46^{a} \pm 0.76$ | $106.93^{b} \pm 6.02$ | $205.73^{c} \pm 7.81$ | $287.06^{d} \pm 13.61$ |

Values in a row not sharing common superscripts differ significantly ** ($P < 0.01$)

**Table 2: Proximate Composition (% DM basis) of Super Napier fodder at different days of harvest**

| Age of the grass | DM | CP | CF | EE | TA | NFE |
|---|---|---|---|---|---|---|
| 15 days | 19.00 | 11.70 | 30.40 | 2.17 | 9.43 | 46.28 |
| 30 days | 19.09 | 11.00 | 31.65 | 2.30 | 14.96 | 40.08 |
| 45 days | 22.61 | 10.13 | 31.10 | 2.04 | 10.34 | 46.38 |
| 60 days | 29.03 | 6.95 | 37.50 | 1.25 | 10.58 | 43.70 |
| Mean ± SE | 22.43±2.35 | 9.94±1.04 | 32.66±1.63 | 1.94±0.23 | 11.32±1.23 | 44.11±1.47 |

**Table 3: Cell wall Constituents of Super Napier fodder at different days of harvest (on % DM basis)**

| Age of the grass | NDF | ADF | Hemi-cellulose | Cellulose | ADL | Silica |
|---|---|---|---|---|---|---|
| 15 days | 63.08 | 35.61 | 27.47 | 28.59 | 4.70 | 2.80 |
| 30 days | 66.85 | 37.91 | 28.94 | 29.82 | 7.89 | 4.13 |
| 45 days | 59.71 | 35.81 | 23.90 | 22.14 | 10.35 | 3.13 |
| 60 days | 64.93 | 42.26 | 22.67 | 28.68 | 10.12 | 3.45 |
| Mean ± SE | 63.64±1.51 | 37.90±1.54 | 25.74±1.47 | 27.31±1.74 | 8.26±1.31 | 3.38±0.28 |

0.03 and 0.22 ± 0.11 at 15, 30, 45 and 60 days of age, respectively. Highest leaf to stem ratio was recorded at 15 days of the age and lowest recorded at 60 days of age.

The biometric parameters of Super Napier at different days of harvest (Table 1) showed a significant difference ($P < 0.01$) at 15, 30, 45 and 60 days of age, showing that the plant height (cm), basal circumference (cm), tillers per plant (number), leaves per tiller (number), leaves per plant (number) increased as the age advanced. These parameters are in agreement with the findings of [14], [16] who reported in other Napier Bajra hybrid crosses attributed to more uptake of nutrients by the crop which resulted in more vegetative growth. [18] also reported that the increase in plant height due to the elongation of internodes due to

continuous availability of nutrients in an experiment conducted in Bajra Napier hybrids at 60 days of age. The harvesting interval had significant effects on plant height and basal circumference, with height increasing progressively as cutting interval increased ($P < 0.01$) at 30, 45 and 60 days of age which is in agreement with the[19] for Pak chong-1 variety of hybrid napier grass at 40, 60 and 80 days of harvest.

The proximate composition (DM, CF, EE, TA) of Super Napier grass in the present study (Table 2) increased from 15 days of age to 30 days of harvest indicating that cutting interval (15, 30 day of harvest) showed an increase in the content of all the components except that crude protein. Age of the plant at harvest (15 days) resulted in highest CP content (11.7%) and lowest CF content (30.4%) indicating that increase in plant maturity results in the lower CP content and high CF content observed at 60 days of harvest of fodder samples. This is in agreement with the findings of [9] who reported that dry matter content and crude fiber contents increased as the harvesting age increases. Hence, higher age of harvesting results in low crude protein and higher fiber contents. The mean nutritive values (DM: 22.43 ± 2.35, CP: 9.94 ± 1.04, CF: 32.66 ±1.63, EE: 1.94 ± 0.23, TA: 11.32 ± 1.23) of Super Napier fodder at different days of harvest in the present study were comparable with the findings of [6] in APBN-1 and CO-3 varieties of Napier hybrids at 60 days of harvest and [12] in Super Napier variety at 45 day of harvest. However, higher nutritive values were reported by [11] in Napier grass, [3] in Elephant grass, and [13] in CO-3 grass varieties. The variations in the nutritive contents might be due to soil type, stage of cutting, fertilizers application, environmental temperatures besides the variety of Napier hybrid used in the investigation.

The average cell wall constituents (NDF, ADF) of Super Napier grass in the present study (Table 3) at various days of harvest were 63.64 ± 1.51, 37.90 ± 1.54 were similar with the [9] for king Napier grass; [5] for different varieties of Hybrid Napier grasses and [3] in Elephant grass. However, [10] reported a slightly higher values in Napier grass (*Pennisetum purpureum*). The cell wall constituent (NDF, ADF and Lignin) content increases, as the age of the plant advances in the present study. The Leaf area index of Super Napier at 60 days of harvest in the present study was 9.43 is comparable with the observations of [1] who reported a leaf area index of 8.27 and 7.76 in irrigated and non-irrigated areas in Napier grass. However, [6] also reported lower leaf index value of 7.06, 6.83 and 6.6 in CO-3, APBN-1 and CO-63 varieties of Napier hybrids. The variations observed in the leaf area indices might be due to the variations in irrigation intervals and fertilizer application. The leaf to stem ratio is associated with the nutritive value of the forage because leaf is generally of higher nutritive value. The leaf to stem ratio at 15 day of age (1.50 ± 0.22) in the present study is comparable with observations of [4] in Guinea grass and [6] for Congo signal, Bracheria grass and Elephant grass. The leaf to stem ratio at 30 day of harvest was (0.65 ± 0.05) coincides with findings of [6] in CO-63, APBN-1 and CO-3 varieties of Hybrid Napier and also comparable with the observations of [14] for BNH-10 and CO-3 varieties of Napier grass. The leaf to stem ratio at 45 days of harvest (0.43 ± 0.03) is similar to findings of [18] for Bajra Napier hybrid grass. [5]opined that dwarf Napier varieties resulted in more leaf to stem ratio than the longer Napier variety due to leafier portion present in dwarf varieties.

## CONCLUSION

Based on the results of the study it can be concluded that Super Napier fodder with its nutritive content is comparable with other Napier varieties. The plant height (cm), tillers per plant (number), leaves per tiller (number), basal circumference, leaves per plant differ significantly ($P < 0.01$). The biometric parameters of the Super Napier fodder increases as the age of the plant advances. It has faster

growth rate, good tillering capacity and better plant height even under harsh environmental conditions

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