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Original Article

Pathogenicity Study on Extra-Intestinal Avian Pathogenic *Escherichia Coli* Isolated from Broiler Chickens

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Abstract

One of the major bacterial diseases that affect poultry industry is the Colisepticeamia, caused by *Escherichia coli.* The present study emphasise on understanding pathogenic potential of the extra-intestinal avian pathogenic *Escherichia coli* (APEC) isolated from heart blood of infected broiler chickens. The *in-vitro* pathogenicity studies carried on APEC isolates showed a clear haemolytic pattern on 10% Sheep blood agar and tested positive for biofilm formation. The multidrug resistant pattern of the APEC isolates along with biofilm formation made it difficult to control the disease. The *in-vivo* pathogenicity tests studied in day old chicks provided an understanding of the pathogenicity of the APEC isolates. The APEC isolates developed infection slowly with clear clinical signs that ends in 100% mortality of the infected chicks. The re-isolation of the injected APEC isolates from heart blood of the dead chicks clearly indicates the significance of virulence posed by the extra-intestinal avian pathogenic *E.coli* in developing Colisepticaemia.

Keywords: *Escherichia Coli;* APEC; Pathogenicity; Haemolysin; Biofilm.

Introduction

Escherichia coli, a member of the family Enterobacteriaceae is responsible for diverse diseases in humans, animals and birds. In poultry this Gram negative rod shaped bacterium causes a variety of conditions including Omphalitis, Coligranuloma, Cellulitis, Colibacillosis, Colisepticeamia etc. [13]. These infections are responsible for huge economic loses to the poultry industry. The avian pathogenic *E.coli* (APEC) strains may originate as extra-intestinal or intestinal *E.coli* [4, 6, 13]. The main economic losses are due to the extra-intestinal pathogenic *E.coli* [4, 13]. Generally, these bacterial infections can be controlled by antibiotic therapy. Instead, the property of acquisition of Multi-drug resistance by the APEC became problematic in the control of APEC infections [14, 15]. Many licensed vaccines are available for control of APEC infections in poultry, but they confer protection largely to the homologous strains [16]. Hence need exists for identifying and understanding pathogenic potential of the extra-intestinal avian pathogenic *E.coli.* In the present case the pathogenicity studies were carried out on the extra-intestinal APEC isolates isolated from an infected flock of 4-week old broiler chickens. Previous studies suggested that the extra-intestinal avian pathogenic *E.coli* also possess Zoonotic potential and cause infections in humans [11, 12].

Materials and Methods

In the infected flock the dying broiler chickens exhibit clinical symptoms like snoaring sounds and mild nervous signs. On post-mortem examination of the birds it reveals Pericarditis, Perihepatitis with slight enlargement of Liver, congested

gastrointestinal track (GIT) with catarrhal inflammation, catarrhal exudates, congestion and consolidation of Lungs, oedematous bursa and enlarged spleen were noticed. Aseptically swabs were collected from heart blood, liver and swabs were enriched in Brain-heart infusion broth for 6 hours at 37^0C followed by propagation on Eosin-Methylene blue (EMB) agar, Brain-Heart infusion (BHI) agar and incubated at 37^0C for 24 hrs. Greenish metallic sheen colonies on EMB agar were stained by Gram's Method and observed under 100X oil immersion objective. These colonies were processed by hanging drop method and observed for motility of the bacterium under 10X and 40X objectives. The greenish metallic sheen colonies on EMB agar were also subjected to Indole, Methyl Red, Voges-Proskauer and citrate (IMViC) tests.

The Antibiotic drug resistance pattern of APEC was studied by antibiotic disc diffusion method of Kirby and Bauer [2], by following the instructions of manufacturer (Hi-Media laboratories Pvt. Ltd.).

In-Vitro study of Virulence factor, Hemolysin of the APEC was analyzed qualitatively by the method described by Synder and Koch [18] with 10% Sheep blood agar and incubated at 37^0C for 48hrs. The results were recorded after 48hrs of incubation. The second virulence factor studied was biofilm forming ability of the pathogen, tested by Christensen tube method with 24 hrs. and 48 hrs. bacterial culture in nutrient broth [3]. After incubation, the culture was discarded aseptically and the biofilm was stained with crystal violet stain for 5 minutes followed by washing with distilled water. The test tubes were air dried and results were recorded.

In-Vivo Pathogenecity Study was carried by inoculating a single metallic sheen colony of both the isolates into 1ml. sterile nutrient broth and incubated aerobically at 37^0C. At regular intervals of every 3 hours the OD at 600 nm was recorded in a spectrophotometer so as to find out the growth period at which the bacterium reaches a balanced growth state. The bacteria at a stage of balanced growth curve was diluted and adjusted the turbidity to $3x10^8$ cells per ml, with the McFarland's turbidity standard tubes. This diluted bacterial culture was inoculated intra-peritonially into day old chicks at the rate of 100 µl. per chick. For each isolate two day old chicks were used for injection and one day old chick was kept as control. The control birds were injected with 100 µl. of sterile PBS (pH 7.2). All the chicks were maintained under similar conditions and the mortality pattern and post-mortem findings were recorded. From the dead chicks the pathogenic *E.coli* was re-isolated and biochemically characterized.

Results

Two extra-intestinal pathogenic *E.coli* isolates were isolated from the infected flock. On Grams staining, metallic sheen colonies from the EMB agar, revealed gram negative cocco-bacilli. The motility tested by Hanging drop method reveals motile rod shaped bacteria from the metallic sheen colonies. The biochemical characterization was done for all the bacteria isolated from two samples. The results (Table 1) confirmed the isolation of two extra-intestinal *E.coli* isolates.

In Antibiotic disc diffusion method, out of eight antibiotic groups studied, the extra-intestinal pathogenic *E.coli* was resistant to three antibiotics namely Amoxycillin, Pencillin-G and Tetracyclin. The antibiotics Amikacin, Chloramphenicol, Enrofloxacin, Ciprofloxacin and Streptomycin were shown to be effective in controlling the disease caused by extra-intestinal pathogenic *E.coli in-vitro* (Table 2).

In-Vitro pathogenicity study on Haemolysin reveals a clear zone of Haemolysis around the colonies on 10% Sheep blood agar of both the isolates of APEC was developed after 48 hrs. of incubation followed by refrigeration at 4^0C. The exogenous toxin, Haemolysin secreted by the APEC is one of the major virulence factors that determine the pathogenic potential of the bacteria in causing disease. The Christensen tube method for biofilm forming ability of the APEC isolates revealed that both the isolates were weakly positive for the biofilm production only after 48 hrs. of incubation.

The *In-vivo* pathogenicity studies of two APEC isolates were carried out in day old chicks by intra-peritoneal route. The chicks which receive extra-intestinal APEC-1 & 2 isolates were died in between 24-36 hrs. of incubation where as the control chicks which received only sterile PBS did not show any clinical abnormality even after 7 days (Table 3). Before death the chicks exhibit clinical symptoms like dullness, depression with mild nervous symptoms. Post-mortem examination of the four chicks revealed generalized

Table 1: Biochemical characterization of the isolates

Name of the biochemical test	Isolate 1	Isolate 2
Indole	+	+
Methyl red	+	+
Voges proskeur	-	-
Citrate	-	-
Triple sugar iron	Yellow slant with Gas production	Yellow slant with Gas production
Greenish Metallic sheen on EMB	+	+
Catalase	+	+
Motility	+	+
Capsule	-	-
Confirmation	*E.coli*	*E.coli*

+: Positive; -: Negative

Table 2: Antibiotic disc resistance pattern of the *E.coli*

Name of the antibiotic	Disc concentration used (mcg)	Result
Amikacin (Ak)	30	Susceptible
Amoxyillin (AM)	30	Resistant
Chloramphenicol (C)	25	Susceptible
Ciprofloxacin (CF)	5	Susceptible
Enrofloxacin (Ex)	10	Susceptible
Pencillin-G (P)	10	Resistant
Streptomycin (S)	25	Susceptible
Tetracyclins (T)	30	Resistant

Table 3: Experimental design for in-vivo pathogenecity study

Parameter	Apec-1 Isolate			Apec-2 Isolate		
	Chick-A	Chick-B	Chick-C	Chick-D	Chick-E	Chick-F
BACTERIAL INOCULUM 3×10^8 cells/ml.	0.1 ml. of APEC-1	0.1 ml. of APEC-1	1 0.1ml. of PBS	0.1 ml. of APEC-2	0.1 ml. of APEC-2	CONTROL O.1ml. of PBS
Clinical symptoms before 24 hrs of incubation	NAD	NAD	NAD	NAD	NAD	NAD
Clinical symptoms after 24 hrs of incubation Dullness, Depression	++	++	NAD	++	+ Only inactiveness was noticed	NAD
Clinical symptoms 32-36 hrs of incubation	Dead	Dead	NAD	DEAD	Dull depression with mild nervous signs	NAD
Clinical symptoms after 36 hrs of incubation	NA	NA	NAD	NA	DEAD	NAD
Post-Mortem Findings	Congested heart, liver and lungs	Congested heart, liver and lungs	NAD	Congested heart, liver and lungs	Mild enlargement of liver, congested heart and lungs	NAD

NAD: No abnormality detected; NA: Not applicable; ++: severe symptoms; + = mild clinical signs.

congestion of viscera, hyperaemic heart, mild enlargement and congestion of liver, congested lungs were noticed. Microscopically septicaemic changes were noticed. Aseptically swabs were collected from the heart blood and re-isolation and its biochemical characterization of the extra-intestinal APEC isolates were successfully done.

Discussion

The *Escherichia coli*, a member of the Enterobacteriaceae family is associated with the most of clinical diseases in Poultry. The Extra-intestinal avian pathogenic *E.coli* alone is responsible for major diseases like Omphalitis, Coligranuloma, Cellulitis, Colibacillosis, Colisepticeamia etc. in poultry [4, 13]. These APEC isolates posses many kinds of virulence factors which includes adhesions, iron acquisition system, colicins, lethal and stable toxins, capsule, serum resistance offered by surface structures, temperature sensitive haemagglutinins and other virulence factors associated with genome etc.[6, 10, 12, 13]. The haemolysin, one of the major virulence factors of the APEC isolates, may contribute for septicaemia during the infections caused by extra-intestinal *E. coli*. The production of clear zone of haemolysis by these APEC isolates on 10% Sheep blood agar indicates the pathogenic potential of the haemolysin in disease production. The results of in-vitro study on haemolysin were correlates with the results of earlier studies [17]. The control of APEC infections will be achieved by both disinfecting the environment of poultry sheds and chemotherapy. In the environment of poultry sheds the control of the non-biofillm forming bacteria is much easier than

the biofilm forming bacteria. The biofilm itself protects the embedded bacteria from chemical disinfectants by preventing penetration of the drugs to their site of action [7]. The bio-film also offers certain antimicrobial resistance and protects bacteria from host innate immune defences such as lysozymes [20]. The lysozyme inhibitors protect the bacterium from the host innate immune system [19]. In the present case, two APEC isolates tested in-vitro were found to be moderately positive for the biofilm production. This should be of serious concern because if the biofilm producing APEC isolates were not controlled from the environment of poultry sheds, the problem of repeated infections by the Extra-intestinal APEC isolates will emerge. Moreover, the biofilms provides suitable environment for exchange of antibiotic resistant plasmids as the bacteria embedded in biofilms are very closely packed. The APEC isolates were also showed some resistance pattern towards the commonly used antibiotics Pencillins, Amoxycillins and Tetracyclins which may be due to irrespective use of antibiotics in the poultry feed results in development of resistance [10, 14, 15].

The day old chicks were one of the best models for understanding the pathogenic potential of APEC isolates by intra-peritoneal route [1, 7]. In all the four birds tested, the clinical findings were noticed only after 24 hrs. of incubation. The slow increase in the rate of severity of infection in the infected birds like dullness, depression, mild nervous signs followed by death was a good indication for slow progression of infection from site of injection to systemic infection. Moreover, the pathogenicity in Colisepticaemia was also associated with damage to the bone marrow cells [5]. The re-isolation and their biochemical characterization of APEC isolates from heart blood of experimentally injected dead birds, reveals the potential of APEC isolates in causing the septicaemic conditions there by death in the infected birds. The gross lesions appeared in dead birds includes congestion and mild enlargement of liver, congested heart and lungs which correlates with that of the earlier experimental studies suggested the death resulted from colisepticaemia [7, 9]. Further studies were required for serotyping, identifying strain variations and development of a good vaccine candidate for effective control of these of Extra-Intestinal Avian pathogenic *E.coli*.

The study of the virulence factors like haemolysin, biofilm production, motility in-vitro and in-vivo pathogenicity studies in day old chicks were an useful diagnostic tools for understanding the pathogenic potential of the of Extra-Intestinal Avian pathogenic *E.coli*.

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Original Article

Stability in Sorghum Prices in Maharashtra: An Empirical Analysis

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Abstract

The paper examined the sorghum prices in Maharashtra state, using 12 years prices obtained from APMC Varanasi and AGMARKNET. The result revealed a very low coefficient of variation (C.V) which is an indication of stability in price of sorghum. In changing climate scenario, farmers are experiencing increased cost of production as well as risk of low output in many crops, which are more remunerative. Due to these high risks, farmers are either under debt or depression. Maharashtra Govt has also put a ban on cultivation of sugarcane due to water crisis in the state. Under these circumstances, sorghum may be an alternative option, being drought tolerance and having very low variability in prices. It is suggested that sorghum production should be encouraged in the Maharashtra and linkage between farmers and processing industry may be strengthened to produce highly nutritive products from sorghum.

Keywords: Sorghum; Sugarcane; Coefficient of Variation (C.V) .

Introduction

With the recent ban on sugarcane farming as a result of Sugar cultivation and crushing require huge amounts of water from dams, rivers and bore wells and have to be banned in order to preserve the water level in the area, the over use of water by the sugarcane production lead to drought in some areas. Sorghum is one of the most drought tolerant cereal crops currently under cultivation. It enables the farmers to reduce costs on irrigation and other on-farm expenses. The International Water Management Institute (IWMI) warns that by the year 2025, 25 percent of the world's population will experience severe water scarcity. However, water productivity in both irrigated and rain-fed areas can be increased through the use of more water-use efficient crops, like sorghum [8].

Comparison of Sugarcane and Sorghum

Characteristics	Sugarcane	Sweet sorghum
Crop Duration	About 12−13 months	About $3^1/_2$ months
Growing Season	Only one season	All season - Kharif, Rabi, and summer
Soil Requirement	Grows well in loamy soil	All types of drained soil
Water Management	Requires water throughout the year	Less water requirement; can be grown as rain-fed crop
Crop Management	Requires good management.	Little fertilizer required; less pest and disease complex; easy management
Yield Per Acre	25−30 tons	10−20 tons
Ethanol production directly from juice	1700−2700 L/acre	1140−1640 L/acre
Harvesting	Difficult and laborious	Very simple; both manual and with simple small mechanical machine can be used

Table 1 compares sugar and sorghum based on some characteristics such as crop duration, growing season, soil requirement, water management, crop management, yield per acre, ethanol production directly from juice and harvesting. The table revealed that sorghum has more advantage based on the following characteristics.

Maharashtra state far excels all other states and produces more than 54 per cent of the total jowar production of India. As many as 22 districts of Maharashtra produces jowar, Osmanabad, Nanded, Yavatmal, Buldhana, Parbhani, Kolhapur, Amravati, and Ahmednagar are important producing districts [12]. Developing market infrastructure is the major concern to boost Indian agriculture. It is considered as one of the important factor for improving market efficiency and controlling food inflation. Greater price volatility, especially of perishable commodities and underdeveloped markets are key marketing constraints faced by producers [3] [4]. Volatility in the agricultural prices has catastrophic effect on all the stakeholders involved in the production, marketing and consumption of the food commodities. This has increased the risk faced by farming community. Besides temporal volatility, which either might be inter annual or intra annual, there also exist wide spatial variability in the prices of agricultural commodities. So, there is fluctuation in prices from market to market within India during these months. Maharashtra ranks first in the production of Sorghum. Keeping in view the maximum production, high volatility in the prices low per capita income of the state, the present study was conducted to examine the pattern of price of sorghum in the major market and its price behaviour over a period of time. An attempt was also made to analyse the season index of major sorghum market in Maharashtra for the development of various logistics.

Methodology

Sholapur being one of the major sorghum markets on the basis of frequent arrivals was selected purposively. Data was collected from APMC Varanasi and AGMARKNET for 12 years (2003-2015).

$$Seasonal\ Index\ (Price) = \frac{Actual\ average\ price\ for\ the\ month}{Moving\ average\ price\ for\ the\ month} \times 100$$

$$Seasonal\ Index\ (Arrival) = \frac{Actual\ average\ quanty\ for\ the\ month}{Moving\ average\ quanty\ for\ the\ month} \times 100$$

Three types of infrastructure index were calculated i.e. trade, storage and support:

Trade Related Infrastructure

Common covered auction halls, Common open Auction Platforms, Common drying yards, Weighing equipments, Grading equipments, Rate display boards.

Infrastructure for Storage and Processing

Warehouses, Cold Storage, Processing units, Storage go downs.

Support Infrastructure

Farmers rest rooms, Canteen/tea shops, Common utility (washrooms etc), Water supply, Parking facilities, Banks, Post office, Police and security posts

Infrastructure development index was computed as a weighted average of various components of infrastructure services where the weights vary inversely to the variation of the components.

$$Y_{ij} = \frac{X_{ij} - Min_j\ X_{ij}}{Max_j X_{ij} - Min_j X_{ij}}$$

Where,

Y_{ij} is the standardized value of a marketing infrastructure indicator

X_{ij} represent the value of the i^{th} infrastructure development indicator in j^{th} mandi

Marketing Infrastructure development index can be calculated as

$$Y_j = W_1 Y_{1j} + W_2 Y_{2j} + \ldots\ldots\ldots + W_m Y_{mj}$$

Where the weights Wi vary inversely as the variation in the respective indicator of the infrastructure services:

$$0 < W_i < 1\ and\ W_1 + W_2 + W_3 + \ldots\ldots\ldots + W_m = 1$$

$$Wi = \frac{K}{\sqrt{Varience\ Yi}}$$

$$K = \left[\sum \frac{1}{\sqrt{VarianceYj}}\right]^{-1}$$

Result and Discussions

The price of sorghum shows fluctuating trend not only year to year but also month to month within the same year. During off season, the prices are generally high and it falls suddenly after the post harvest period during which the arrival of sorghum is more in the market. The seasonal indices of price and arrival of sorghum in Sholapur market is presented below in Table.

It is discernible from table 1 that seasonal indices of price vary from 93.63 to 104.01 from the month of January to December. It was observed that prices in the month of August (starting season) were comparatively higher than other months. A decreasing trend of price indices can be observed up to the month of February and it was slightly increasing in the month of April. The peak season of the sorghum has been characterized by low seasonal indices [1][2][5] which can be observed during the month of February and March. The coefficient of variation was estimated to be 0.990056 which indicated variability among the seasonal indices of prices which is very low that is making the prices stable for the farmers.

The plot indicates seasonal pattern in time series data due to influence of seasonal factors which recurs on a regular basis. Figure 1 indicates the general trend of the prices of Sorghum in the market for the period from 2003 to 2015. After differencing the series was found stationary as shown in figure 2.

Table 1: Seasonal indices of prices in Sholapur market, 2003 to 2014-15

Sr. No.	Month	Price Seasonal Index
1	January	100.4239
2	February	93.62699
3	March	95.63883
4	April	102.7151
5	May	99.8857
6	June	100.215
7	July	96.8559
8	August	104.0076
9	September	99.98149
10	October	102.1749
11	November	102.2437
12	December	102.2308
13	Mean	99.96146
14	S.D.	0.989663
15	C.V.	0.99006

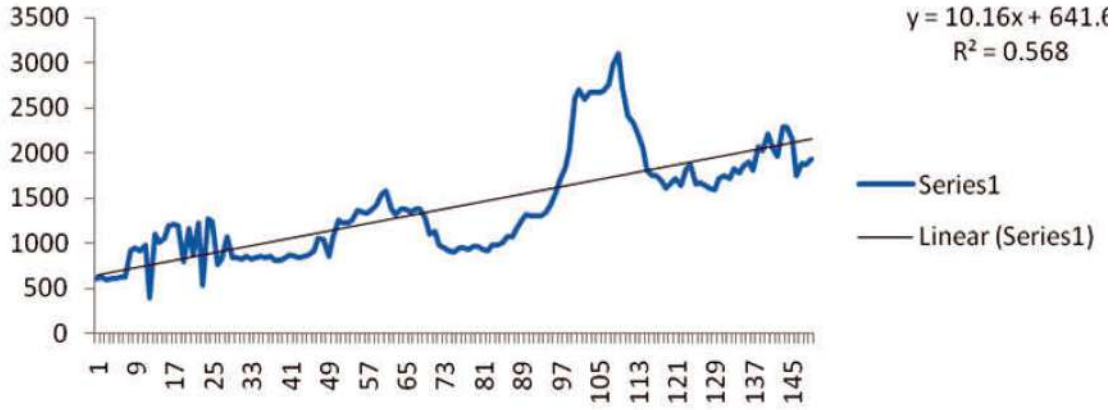


Fig. 1: Seasonal plot of price of Sorghum obtained from the market

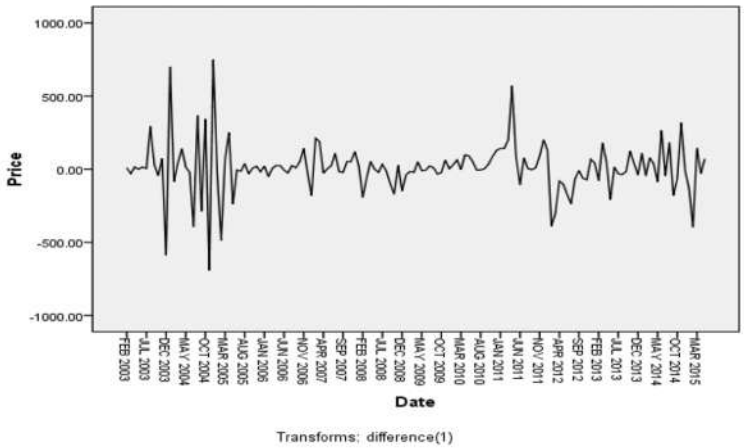


Fig. 2: Seasonal plot of price of Sorghum obtained from the market after differencing

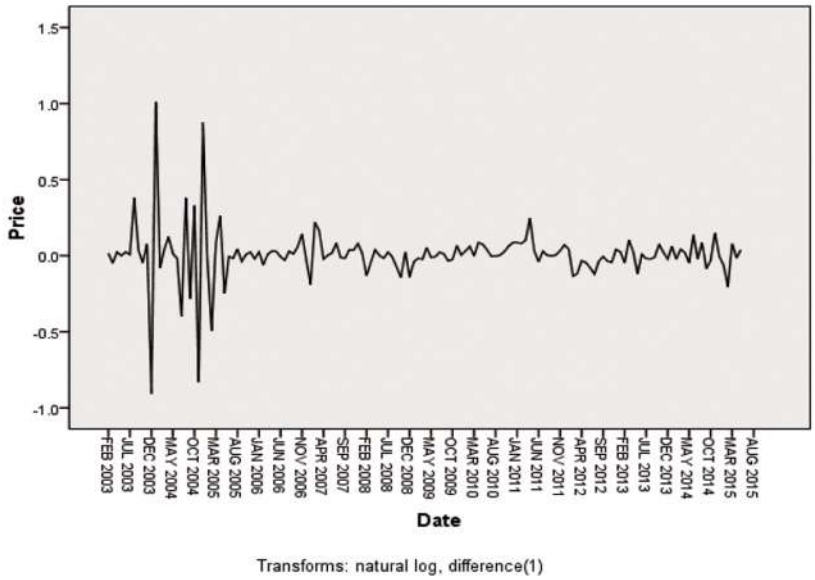
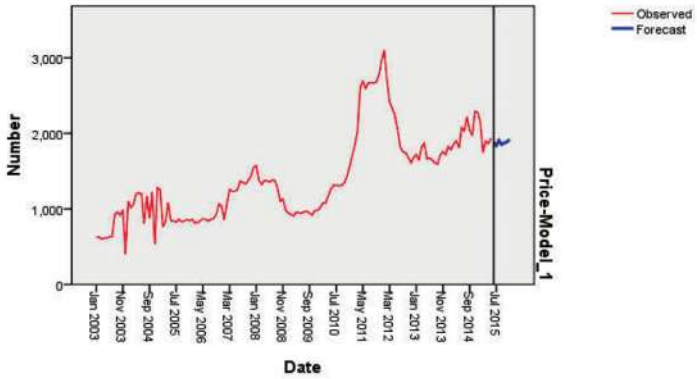


Fig. 3: Seasonal plot of price of Sorghum obtained from the market after differencing and natural log

Model Description			
Model ID	Price	Model_1	Model Type Simple Seasonal



Model		Jun 2015	Jul 2015	Aug 2015	Sep 2015	Oct 2015	Nov 2015	Dec 2015
Price -Model_1	Forecast	1881.52	1839.41	1905.19	1852.14	1874.23	1886.29	1922.70
	UCL	2207.55	2256.70	2397.08	2408.72	2488.73	2553.70	2639.12
	LCL	1555.48	1422.13	1413.30	1295.56	1259.73	1218.88	1206.28

For each model, forecasts start after the last non-missing in the range of the requested estimation period, and end at the last period for which non-missing values of all the predictors are available or at the end date of the requested forecast period, whichever is earlier. From the above table we can notice that with even the forecast of prices the prices of sorghum tend to be stable with little or no fluctuation

Conclusion

In changing climate scenario, farmers are experiencing increased cost of production as well as risk of low output in many crops, which are more remunerative. Due to these high risks, farmers are either under debt or depression. Maharashtra Govt has also put a ban on cultivation of sugarcane due to water crisis in the state. Under these circumstances, sorghum may be an alternative option, being drought tolerance and having very low variability in prices. It is suggested that sorghum production should be encouraged in the Maharashtra and linkage between farmers and processing industry may be strengthened to produce highly nutritive products from sorghum.

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Original Article

Awareness of Respondents in Terms of Turmeric, Neem and its Products

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Abstract

A study was conducted in Kanpur district on awareness of respondents in terms of turmeric, Neem and its products from Zone of Kanpur with 180 respondents. 38.4% females were belonged to general category, backward and SC/ST were 27.8, 27.8. Both have same rate respondents were unmarried, respectively. 55.10%t respondents belonged to nuclear family and 44.4% belonged to joint family respectively. 55.6%respondents were in service, 16.7% in business and 27.7% were housewives respectively. 27.8% belonged to high income group. It was found that 93.3% respondents were aware about turmeric powder. From the studies it was concluded that medicinal plants for beauty purpose plays an important role in women beauty. Through studies was knew about medicinal, plants their uses about these plants. How much adoption rate of plants, some have higher amount of adoption rate. Women are too much aware about they use a lot of products for beauty.

Keywords: Medicinal Plants; Home Remedies; Women Beauty; Awareness; Turmeric; Neem; Product.

Introduction

Medicinal plants are used at the household level by women taking care of their families, at the village level by medicine men or tribal shamans, and by the practitioners of classical traditional systems of medicine such as Ayurveda, Chinese medicine, or the Japanese Kampo system. According to the World Health Organization, rely upon such traditional plant-based systems of medicine to provide them with primary health care.

Some Indian medicinal plant and Aromatic plants most useful to women health care beauty also. The Indigenous knowledge and uses of medicinal plants among women. They use a lot of product for beauty purpose such as herbs, leaves, fruits etc., Medicinal plants are very useful for their beauty. As the study has been find out the problems of women for beauty.

Methodology

The study was conducted in Kanpur district. Four zones were selected in this study area. 180 respondents were selected. Dependent and independent variables were used such as age, education, caste etc., The statistical tools were used such as weighted mean, percentage, correlation coefficient etc.

Results

The marital status of women respondents and represents that 44.6% were married and 55.6% women were unmarried. Marriage influences a person's personal as well as social life.

The distribution of respondents according to family type, 55.6% women belonged to nuclear family,

whereas, 44.4%women belonged to joint family system. Now a day's joint family system disintegrate into nuclear family system.

The distribution of respondents according to occupation, 55.6% women were doing service like in government organization as well as semi-government, 16.7% women have in business class like parental business or own small scale manufacturing and 27.7% women were housewives.

The awareness of the respondents about turmeric and its product. 93.3% respondents were aware about turmeric powder. Turmeric raw powder topically on fresh open wounds. 50.0% respondents were aware about mask. It is used for wrinkles remove. 23.3% respondents were aware about turmeric lape. It apply all over the body for removing unwanted hairs and curing pimples.

The awareness of respondents about neem and its product, 62.2% respondents were aware about neem paste, turmeric, neem and sesame seeds is recommended in Ayurveda for fungal infection between toes, whereas, 40.0% respondents have aware about neem tablet is useful for family planning, and for skin disorders. 49.4 per cent respondents were aware about neem oil to scallop removes headache and prevents dandruff, 46.1% respondents aware about neem soap. Medicated soaps with neem odour are packed to have very effective anti-germ properties. 18.9% respondents aware about neem talcum powder. It is used in itching, 37.2% respondents were aware about neem seeds and bark. Neem seed pulp is useful for methane gas production. Neem bark contains tannins which are used in tanning, dyeing etc.

Table 1: Distribution of respondents according to marital status

Marital status	Frequency	Percent
Married	80	44.4
Un- married	100	55.6
Total	180	100.0

Table 2: Distribution of respondents according to type of family

Type of family	Frequency	Percent
Nuclear	100	55.6
Joint	80	44.4
Total	180	100.0

Table 3: Distribution of respondents according to occupation

Occupation	Frequency	Percent
Service	100	55.6
Business	30	16.7
Housewife	50	27.7
Total	180	100.0

Table 4: Awareness of respondents in terms of turmeric and its product

	Turmeric			
Products	Always	Sometimes	Never	Scores
Turmeric powder	168 (93.3)	10 (5.6)	2 (1.1)	2.92
Turmeric mask	90 (50.0)	30 (16.7)	60 (33.3)	2.17
Turmeric lape	42 (23.3)	38 (21.1)	100 (55.6)	1.68

Table 5: Awareness of respondents in view of Neem and its product

Products	Neem			
	Always	Sometimes	Never	Scores
Neem paste	112 (62.2)	43 (23.9)	25 (13.9)	2.48
Neem tablet	72 (40.0)	41 (22.8)	67 (37.2)	2.03
Neem oil	89 (49.4)	54 (30.0)	37 (20.6)	2.29
Neem soap	83 (46.1)	61 (33.9)	36 (20.0)	2.26
Neem talcum	34 (18.9)	30 (16.7)	116 (64.4)	1.54
Neem seeds/bark	67 (37.2)	32 (17.8)	81 (45.0)	1.92

Conclusion

Many women are aware about medicinal plants. They use a lot of product for increasing their body and skin beauty. Some women are uses some product daily life, but some are use it sometime. Adoptions of the products are very essential for every one without its adoption we cannot justified the good result of any plant and product.

Recommendations

Turmeric mask to reduce wrinkles – Mix two tablespoons of papaya pulp with a spoonful of dry oatmeal. Apply to face and let it work for 10 minutes. Wash gently rubbing with a flannel. It also helps to eat papaya since it slows the aging process and delays the appearance of wrinkles.

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Original Article

Contribution of Enterprises of Integrated Farming System Approach in Income Generation among Tribal Farmers of Tripura and their Socio Economic Status

Sankhyashree Roy*, S. K. Acharya**

Abstract

In India, farmers concentrate mainly on crop production which is invariably subjected to a high degree of uncertainty in income and employment. To sustain the income and productivity, the farmers has to integrate ancillary propositions with crop production. Under such circumstances, it will be required to undertake some land use based enterprises which will complement their existing farming activity to get more income and employment, leading to better standard of living. Such enterprises include crop husbandry, dairy, piggery, backyard poultry, goat keeping, sericulture, etc. The objective of the study is to identify the components of Integrated Farming System, to estimate the percentage of contribution of each enterprises in income generation, to estimate the socio economic status of the tribal peoples and to generate micro level policies. To conclude the work, following independent and dependent variables were taken: Age, Education, Family Education Status, Family Size, Educational Aspiration, Farm Mechanization, Farm Size, Economic Status, Adoption leadership, Scientific Orientation, Risk Orientation, Management Orientation, Orientation towards Competition and Annual Income of farmers. State Tripura, district West Tripura, block Kamalghat and village Shantipara were selected purposively as because there are more number of Tribal farmers and the number of respondents 82 were selected randomly. By analyzing the data with statistical tools, such as, Frequency, Percentage, Mean, Standard Deviation, Coefficient of Variation and Factor analysis, the following results were obtained: Among the component enterprises, contribution of piggery is highest and Forestry is lowest towards income generation of the farmers as all the respondents are tribal people. Socio-Economic profile concludes that most of the villagers are middle aged, have land holding of 1 to 5 acres, studied up to primary school, resides in mixed type of houses and have annual income up to Rs 1,50,000.

Keywords: Annual Income; Productivity; Tribal Farmers; Socio-Economic Status; Integrated Farming System; Enterprises.

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Introduction

The Indian economy is predominantly rural and agricultural. Indian agriculture has responsibility of providing national as well as household food and nutritional security to its spilling over millions. Wide spread occurrence of ill-effects of green revolution technologies in all intensively cultivated areas like Punjab and Haryana is threatening the sustainability of the important agricultural production systems and national food security. The declining trend in size of

land holding poses a serious challenge to the sustainability and profitability of farming. The average size of the landholding has declined to 1.16 ha during 2010-11 from 2.28 ha in 1970-71. If this trend continues, the average size of holding in India would be mere 0.68 ha in 2020 and would be further reduced to 0.32 ha in 2030 (Agriculture Census, 2010-11). This situation in India calls for an integrated effort to address the emerging issues. It is imperative to develop strategies and agricultural technologies that enable adequate employment and income generation, especially for small and marginal farmers who constitute more than 80 per cent of the farming community. The integrated farming system approach is considered to be the most powerful tool for enhancing profitability of farming systems. These integrated farming systems required to be planned, designed, implemented and analyzed for increasing productivity and profitability. These systems also need to be socially acceptable, economically viable and eco-friendly. Integration of enterprises lead to greater dividends than single enterprise based farming, especially for small and marginal farmers. It also leads to improvement in nutritional quality of daily diet of farmers.

Integrated Farming (IF) is a whole farm management system which aims to deliver more sustainable agriculture. It is a dynamic approach which can be applied to any farming system around the world. It involves attention to detail and continuous improvement in all areas of a farming business through informed management processes. The International Organization of Biological Control (IOBC) describes Integrated Farming as a farming system where high quality food, feed, fibre and renewable energy are produced by using resources such as soil, water, air and nature as well as regulating factors to farm sustainably and with as little polluting inputs as possible.

Particular emphasis is placed on a holistic management approach looking at the whole farm as cross-linked unit, on the fundamental role and function of agro-ecosystems, on nutrient cycles which are balanced and adapted to the demand of the crops, and on health and welfare of all livestock on the farm. Preserving and enhancing soil fertility, maintaining and improving a diverse environment and the adherence to ethical and social criteria are indispensable basic elements. Crop protection takes into account all biological, technical and chemical methods which then are balanced carefully and with the objective to protect the environment, to maintain profitability of the business and fulfill social requirements.

Indian tribal people play a key part in constructing the cultural heritage of India. They occupy a major part in the history of India as they are considered as the true habitants of India. The tribal people are scattered in different parts of India and they form a considerable number of the population of India. The traditional and cultural distinction of each tribal community has made them distinguishable from each other and their cultural and traditional heritage add colour and variation to the Indian culture as a whole and form a compact culture. Indian tribal people reside in approximately fifteen percent of the country's area. They primarily live in various ecological and geo-climatic conditions ranging from plains, forests, hills and inaccessible areas that perhaps lie dotted in the panoramic Indian terrain. . The forests in the Asian context are part of a cultural landscape linked to livelihood concerns of traditional societies particularly those living close to nature and natural resources (Ramakrishnan, P S, 2007). Sericulture-based Agroforestry Systems (AFS) have great potential for higher returns in the North-Eastern region with sloping and valley-land conditions (Dhyani S K, Chauhan D S, Kumar D, Kushwaha V and Lepcha S T, 1996).

In the north eastern part of India, there is a concentration of a number of tribes. The main tribes of North East India are Aimol, Anal, Angami, Chiru, Chothe, Gangte, Hmar, Kabui, Kacha, Naga, Koirao, Koireng, Kom, Lamgang, Mao, Maram, Maring, Lushai, Monsang, Moyon, Paite, Purum, Ralte, Sema, Simte, Sukte, Tangkhul, Thadou, Vaiphei, Zou, Tripuri, Mog, Lushai, Jamatia, Chakma, Hrangkhal, Khashi, Bodo, Mishing, Reang, Murasingh, Debbarma, etc. Shifting cultivation locally called jhum is an integral part in tribal life of the northeastern hill regions of India and has direct bearing on their socio-cultural systems (Tomar J M S, Das A, Puni L, Chaturvedi O P and Munda G C, 2012). Tripura is a hilly and land locked state located in the south-west extreme corner of the north eastern region of India. The agro-climatic conditions (humid subtropical) are fertile and acidic so good depth and abundant rainfall favour the cultivation of different minor fruit crops (Chandra S, Das J P, 2011). Orissa is one of the most backward states of India with 47% of its population living below poverty line. Forests constitute 37% of the state's geographical area and are the major source of income for the poor, particularly tribes. For most of the tribal households, forests provide essential food and nutrition, medicine, fodder, fuel, thatch and construction materials and non-farm income (Minaketan B, 2009). A work was carried out at Chandel Khullen village of Chandel hill district of Manipur during 2010-11

to 2012-13. The average holding size of the farmer was 1.33 ha in 2010-11, 1.96 ha in 2011-12 and 2.21 ha in 201213. The tribal farmer adopted seven components, i e crop production, vegetables, fruits, piggery, backyard poultry, fishery and water management as suggested by ICAR Manipur Centre (Ansari M A, Prakash N, Baishya L K, Punitha P, Sharma P K, Yadav J S, Kabuei G P and Levis K Ch, 2014).

Objective

1. To identify the components of Integrated Farming System popular among the Tribal farmers of Tripura.
2. To estimate the contribution of each enterprise of Integrated Farming System in income generation of the tribal farmers of Tripura.
3. To estimate the Socio-economic status of the tribal farmers practising Integrated Farming System in Tripura.
4. To generate a micro level policy from the empirical research conducted under the topic.

Research Methodology

Locale of research; Variables selected; Tools and Techniques of Data collection; Statistical Analysis and interpretation of data.

Locale of Research

- Keeping in view agriculturally and socio-economically developing area and the area where most of the villagers are engaged in Integrated Farming System, West District of Tripura was selected for the study.
- Kamalghat Block of West Tripura district was purposively selected for the study. This block was selected because the researcher has close familiarity with the area, the people, their culture and the local dialect, which facilitate the study and the process of data collection and the area was also easily accessible to the researcher in terms of transportation and place of residence.
- Village Shantipara under the Block kamalghat was selected purposively for the study. The main reason behind selection of Shantipara village was due to the presence of large number of farmers involved in Integrated Farming System.

Variables Selected

Dependent variables selected are Age (x_1); Education (x_2); Family Education Status (x_3); Family Size (x_4); Educational Aspiration (x_5); Farm Mechanization (x_6); Farm Size (x_7); Economic Status (x_8); Adoption Leadership (x_9); Scientific Orientation (x_{10}); Risk Orientation (x_{11}); Management Orientation (x_{12}); Orientation towards Competition (x_{13}). Independent variable selected is the Annual Income of the farmers (y).

Tools and Techniques of Data Collection

The major tool used for collection of primary data in the study was structured schedule and secondary data were collected from the Agriculture Department of Tripura, College of Agriculture Tripura, internet, journals and departmental library.

Statistical Analysis and Interpretation of Data

Main statistical tools used in the study are Frequency, Percentage, Range; Mean; Standard Deviation (SD), Coefficient of Variation (C.V.) and Factor analysis.

Results and Discussion

The Table 1 and 2 represents the descriptive distribution of consequence variables considered for the present study. Consistency of the variables depends upon the percentage of Coefficient of Variation (CV). If the CV value is less than 50%, then the variable is consistent in nature. If the CV value is in between 50% to 100%, then the variable is inconsistent in nature and if the CV value goes beyond 100%, then the variable is highly inconsistent in nature.

Table 1: Descriptive statistics of Independent variables with respect to Mean, Standard Deviation and Coefficient of Variation

Sl. No	Variables	Range		Mean	SD	CV (%)
		Min	Max			
1.	Age (×1)	25	75	48.45	11.44	23.63
2.	Education (×2)	0	5	3.28	1.24	38.10
3.	Family Education Status (×3)	3	21	1.96	3.63	30.39
4.	Family Size (×4)	1	2	1.47	0.50	34.05
5.	Educational Aspiration (×5)	4	10	8	1.45	18.21
6.	Farm Mechanizatio n (×6)	0	10	1.92	2.37	123.35

7.	Farm Size (×7)	1	4	2.02	0.92	45.90
8.	Economic Status (×8)	6	18	10.79	2.80	25.99
9.	Adoption leadership (×9)	13	22	17.36	2.67	15.42
10.	Scientific Orientation (×10)	29	38	33.53	2.13	6.37
11.	Risk Orientation (×11)	28	37	32.32	2.18	6.75
12.	Management Orientation (×12)	69	99	80.74	6.66	8.25
13.	Orientation Towards Competition (×13)	26	32	28.42	2.04	7.18

Table 2: Descriptive statistics of Dependent variables with respect to Mean, Standard Deviation and coefficient of Variance

Sl. No.	Variables	Range		Mean	SD	CV (%)
		Min	Max			
1.	Annual income of farmers (y)	42000	303000	139708.53	57945.38	41.47

Identification of Component Enterprises under Integrated Farming System

The village where the study have been conducted, tribal people are engaged in Integrated Farming System, where one of the main components are pig rearing or piggery. Other components are Agriculture, Horticulture, Dairy, Poultry, Fishery and Forestry. These enterprises are related to each other, such as poultry droppings are used as fish feed, rice bran is used as cattle feed, etc.

Piggery

Piggery is very popular in the state because most of the people are tribal and pork is one of the main food items of the tribal people. There are many undertakings by the Government of Tripura to improve the Piggery section of the state. They are undertaking many training program for the farmers to boost up this enterprise. The main breeds of pig reared in Tripura are Hampshire, Large white Yorkshire, Duroc, Landrace, and indigenous breeds are Mali and Dome. Out of the total piggery of the country, 28% of piggery is found in North East India. Pigs are mainly reared for their meat.

The flooring have a rough finish and of a regular masonary type made up of water proof cement mortar. Proper drains are provided so that the effluents are disposed off. Generally under village conditions the housing are made up of measuring 3 m X 2.4 m or 3 m X 3 m with an open yard of nearly the same dimension or in some cases slightly longer. Walls are of 1.2-1.5 m high from the floor.

Grains, maize, sorghum, oat, millets, wheat and rice are provided as basic ingredients of feed and as because these are easily available. Protein supplements are given in the form of oil cakes, fishmeal and meat meal.

Advantages of Pig Rearing

- Pigs convert inedible feeds, forages, certain grain byproducts obtained from mills, meat by products, damaged feeds and garbage into valuable nutritious meat. Most of these feeds are either not edible or not very palatable to human beings.
- Pig grows fast and is a prolific breeder, farrowing 10 to 12 piglets at a time. It is capable of producing two litters per year under optimal management conditions.
- The carcass return is quite high, that is, 60-80 percent of live body weight.
- With a small investment on building and equipment, proper feeding and sound disease control programme the farmer can profitably utilize his time and labour in this subsidiary occupation.
- The faeces of pigs are used as manure to maintain soil fertility.

Agriculture

The farmers are mainly involved in paddy cultivation as the staple food crop of this region is paddy. They also cultivate other cereal crops like wheat, maize, fox tail millet, etc. vegetables like potato, tomato, brinjal, gourd, cucumber, chilli, etc are cultivated here. Spices like ginger, garlic, cardamom, turmeric, etc are also cultivated in this region.

Horticulture

Horticultural crops like mango, jackfruit, banana, guava, litchi, ber, lemon, etc are cultivated here. Pineapple is the main fruit crop of Tripura and it is cultivated here in large amount and these are very popular nationwide. They also grow flowers like rose, marigold, hibiscus, etc. for local market.

Dairy

Cattles are reared here mainly for the milk purpose. The cattle get their feed from the agricultural field, i.e, the left over after harvesting of crops, etc. The milk is used for making ice cream and other milk products and are sold in the market. There is Gomati cooperative milk producers union limited and other institutions, who buy the milk from them and make milk products. Here indigenous breeds of cattles are found but the farmers have attended some training program on Murrah buffalo, Sahiwal and Jersey, which was organized by the ICAR research complex, North East Hilly region, Tripura. So the farmers are engaged in rearing of exotic cattles also.

Goatery

Goatery is also very common in Tripura. Goats are mainly reared for their skin and meat but here goats are reared mainly for meat and sometime for milk in special purposes. Breeds found here are Assam Hilly breed, Tellicherry, Jamnapari, Black Bengal, etc. Here goats are used for sacrificing purpose also in the worshipping of Goddess "kali" in some temples.

Poultry

For poultry there is no need of extra space. They can utilize the corner of the houses to build Poultry sheds. There is a mixture of broilers, layers and local birds. There is both ducks and hens. Breeds found here are Vanaraja, Giriraja, Gramapriya and mostly indigenous varieties. They lay eggs and the eggs are sold in the market as Rs 5 per egg in case of layers and Rs 10 per egg incase of local hen. They get more income from the local eggs. Poultry meat is also very popular here. Poultry also feed on the left over after harvesting and rice brans. Their droppings are used as fish feed. For this sometime poultry sheds are built over the pond.

Duckery

Here Duckery is also practiced along with poultry. Ducks are reared in ponds and the fish get direct feed from the droppings of the ducks. Mainly indigenous variety and Khaki Campbell are reared here. Duck's meat is also popular in this region.

Fishery

Fishery is popular here as there is one College Of Fisheries under Central Agricultural University, near the village. They cultivate both indigenous and exotic fishes like Magur, Catla, Rohu, Grass carp, Silver carp, etc. They get the seedlings both from the market and also from the Fishery college. Villagers use fishing nets such as Fash jal or kanke jal, laitya jal, fy jal, ber jal, etc. They buy fish feed from outside and also use the feeds that are developed through Integrated Farming System, such as poultry droppings, oil cake, neem cake, etc.

Forestry

They grow forest trees also like neem, bamboo, sal, segun, etc., from which they get wood and some are medicinal also like neem. Neem is also used in making neem cake, which are feed to the cattle and fishes.

Therefore it can be concluded that the people of this village are engaged in Integrated Farming System of Agri-Horti-Silvi-Fishery-Pastoral culture.

Contribution of Different Enterprises of Integrated Farming System in income Generation of the Farmers

Different enterprises of Integrated Farming System undertaken by most of the people of the village are Agriculture, Horticulture, Dairy, Poultry, Fishery, Piggery and Forestry. As most of the people are tribal, the earning from the piggery enterprise is of a great amount. They get a handsome amount of money from all these enterprises and the contribution of each of the enterprises in income generation of the farmers is given below.

Table 3: Distribution of Mean of the enterprises

Sl. No.	Component	Mean
1	Piggery	75,520
2	Agriculture	14,020
3	Horticulture	5,580
4	Dairy and Goatery	10,000
5	Poultry and Duckery	9,520
6	Fishery	12,200
7	Forestry	5,550

It is clear from the Table no. 3 that income generation of farmers from enterprises like Piggery, Agriculture, Horticulture, Dairy-Goatery, Poultry-Duckery, Fishery and Forestryis Rs 75,520;

Rs 14,020; Rs 5,580; Rs 10,000; Rs 9,520; Rs 12,200 and Rs 5,550 respectively. As we have already calculated the average income generation of the farmers through interview method, and which is Rs 1,32,390 annually, the percentage contribution of each of the enterprise is calculated.

Table 4: Percentage contribution in livelihood generation of farmers

Sl. No.	Component	Contribution in income generation (%)
1	Piggery	57.04
2	Agriculture	10.58
3	Horticulture	4.21
4	Dairy-Goatery	7.55
5	Poultry-Duckery	7.19
6	Fishery	9.21
7	Forestry	4.19

Table 5: Socio economic profile of respondents

Items	Category	Frequency	Percentage (%)
Age	Young (18-30)	7	8.53
	Middle age (31-50)	42	51.21
	Old age (above 50)	33	40.24
Education	Illiterate	4	4.87
	Read Only	0	0
	Read & write	16	19.51
	Primary	31	37.80
	Middle school	17	20.73
	High school	14	17.07
	Graduate	0	0
Family education status	Illiterate	2	2.43
	Read only	4	4.87
	Read and write	22	26.82
	Middle school	31	37.80
	High sch ool	16	19.51
	Graduate	7	8.53
Family Size	Up to 5 members	78	95.12
	Above 5 members	4	4.87
Land Holding	No land	0	0
	Less than 1 acre	29	35.36
	1 to 5 acre	45	54.87
	5 to 10 acre	4	4.87
	10 to 15 acre	4	4.87
	15 to 20 acre	0	0
	More than 20 acre	0	0
House Type	Kutcha House	16	19.51
	Mixed House	62	75.60
	Pucca House	4	4.87
	Mansion	0	0
Farm Power	No Drought Animals	14	17.07
	1-2 Drought Animals	43	52.43
	Power Tiller/Tractor	7	8.53
	3-4 Drought Animals	18	21.95
Annual income	Rs 500 00 to Rs 100000	12	14.63
	Rs 100001 to Rs 150000	44	53.65
	Rs 150001 to Rs 200000	10	12.19
	Rs 200001 to Rs 250000	8	9.75
	Rs 250001 to Rs 300000	4	4.87
	Rs 300001 to Rs 350000	4	4.87
Material possession	Low (less than 5)	25	31.25
	Medium (5 to 10)	40	50
	High (11 to 16)	15	18.75

It is clear from the Table No. 4 and Figure No. 1 that the Piggery plays the greatest role in income generation of the farmers by contributing 60.80% of the total income generation. Then the Agriculture sector contributes 10.58% of the income generation. After that comes Dairy-Goatery and Poultry-Duckery which contributes 7.55% and 7.19% of the income generation respectively. Fishery contributes 9.21%, Horticulture and Forestry contributes the negligible amount of 5.45% and 4.19% respectively.

As we have seen that the contribution of Piggery is more in income generation of the farmer, we must undertake some initiatives to boost this economy regarding Piggery. The farmers should be supply with inputs of Piggery from the government such as piglet and feed for the pigs. Proper training should be given on pig rearing. Proper vaccination should be provided to the pigs in order to reduce diseases and incidents of worms, mainly tapeworm.

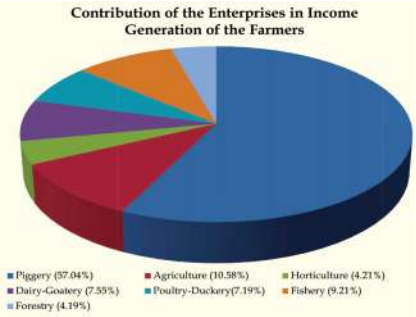

Fig. 1: Percentage contribution of component enterprises of Integrated Farming System approach in income generation of Tribal farmers in Tripura

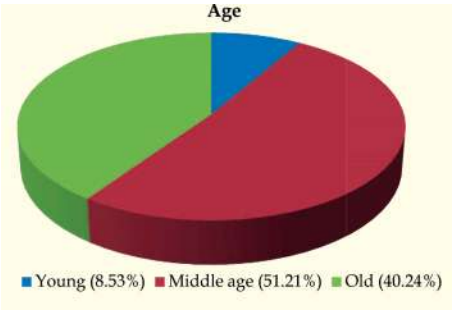

Fig. 2: Distribution of age

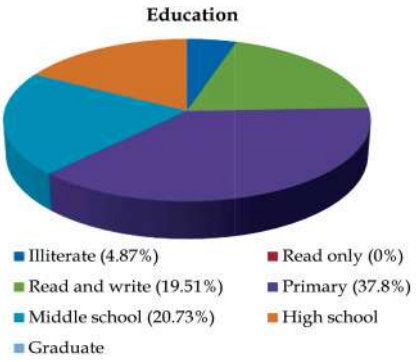

Fig. 3: Distribution of education

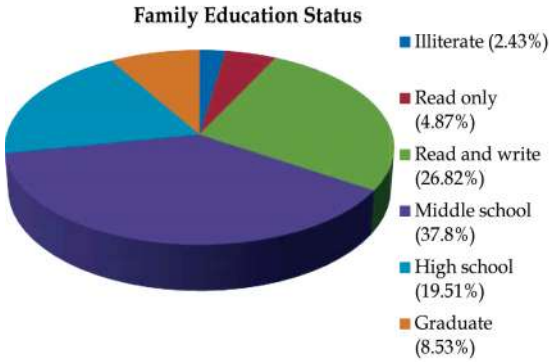

Fig. 4: Distribution of family education status

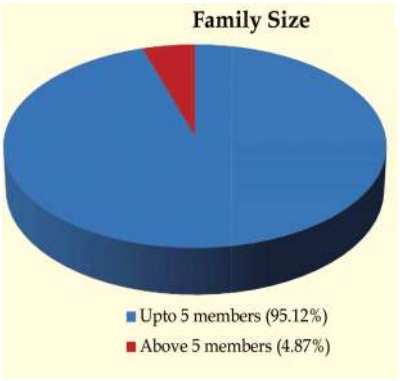

Fig. 5: Distribution of family size

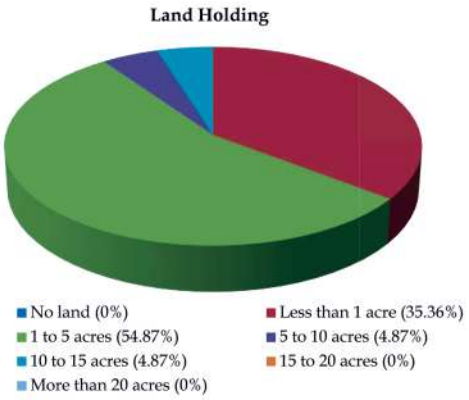

Fig. 6: Distribution of land holding

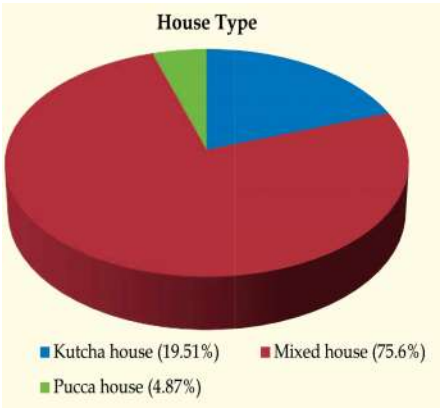

Fig. 7: Distribution of house type

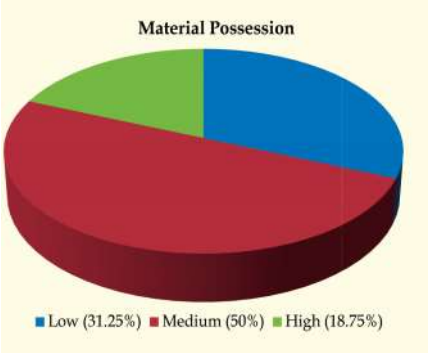

Fig. 8: Distribution of material possession

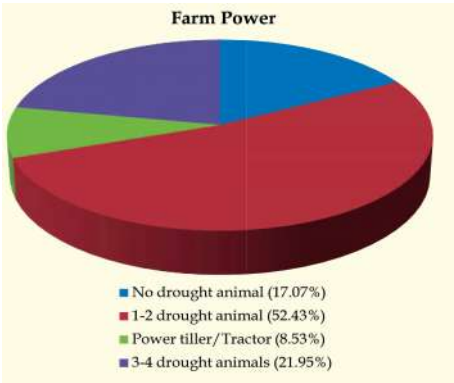

Fig. 9: Distribution of farm power

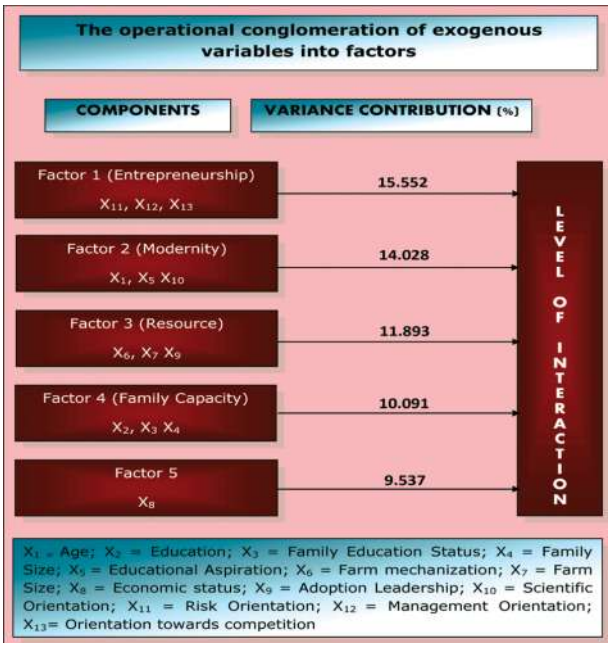

Fig. 10: Distribution of annual income

It is clear from the Table No. 5 and Figure No. 2 to 10 that among 82 respondents or farmers, who were selected randomly, 8.53% of them are young, that is, in between 18 to 30 years of age, 51.21% of them are middle aged, that is, in between 31 to 50 years of age and rest 40.24% of them are old, that is, they are above 50 years of age. Again, 4.87% of farmers are illiterate, 19.51% can read and write, 37.80% received primary education, 20.73% finished middle school and rest 17.07% of them finished high school. In case of family education status, 2.43% of farmer's family members are illiterate, 4.87% of farmer's family members can read only, 26.82% of farmer's family members can read and write, 37.80% of farmer's family members finished middle school, 19.52% of farmers' family members finished high school and the rest 8.53% of farmer's family members received graduation degree. In case of family size, 95.12% of the farmers have family size upto 5 members and 4.87% of them have family size of more than 5 members. Then, 35.36% of the farmers have land size less than 1 acre, 54.87% of them have land size in between 1 to 5 acres, 4.87% of them have land size in between 5 to 10 acres and rest 4.87% of them have land size in between 10 to 15 acres. It has also seen that, 19.51% of the farmers reside in kutcha houses, 75.60% of them reside in mixed houses and rest 4.87% of them reside in pucca houses. In case of Farm power, 17.07% of the farmers have no drought animals, 52.43% of them have 1 to 2 drought animals, 21.95% of them have 3 to 4 drought animals and rest 8.53% of them have power tiller and tractor. Then the Annual income of 14.63% of farmers lie between Rs 50000 to Rs 100000, 53.65% of them have annual income in between Rs 100001 to Rs 150000, 12.19% of them have annual income in between Rs 150001 to Rs 200000, 9.75% of them have annual income in between Rs 200001 to Rs 250000, 4.87% of them have annual income in between Rs 250001 to Rs 300000 and rest 4.87% of them have annual income in between Rs 300001 to Rs 350000. Then at last, 31.25% of farmers have low material possession, 50% of them have medium material possession and rest 18.75% of them have high material possession. Material possession includes materials like radio, cycle, television, color television, bike, car, etc.

It is clear from the Table No. 6 and Figure No. 11 that all the 13 Independent variables have been divided into 5 different factors which has been renamed. Here, Factor 1 consisting of the variables Risk Orientation (x_{11}), Management Orientation (x_{12}) and Orientation towards competition (x_{13}), has been renamed as Entrepreneurship and they together contribute to 15.552% of variance. Factor 2 consisting of the variables Age (x_1), Educational Aspiration (x_5) and Scientific Orientation (x_{10}), has been renamed as Modernity and they together contribute to 14.028% of variance. Factor 3 consisting of the variables Farm Mechanization (x_6), Farm Size (x_7) and Adoption Leadership (x_9), has been renamed as Resource Factors and contribute to 11.893% of variance. Then

Table 6: Factor Analysis - Conglomeration of 13 variables into 5 factors.

Factors	Variables	Factor Loading	Percentage of Variance	Cumulative (%)	Factors Renamed
Factor 1	Risk orientation (×11)	0.487	15.552	15.552	Entrepreneurship
	Management orientation (×12)	0.578			
	Orientation towards competition (×13)	0.673			
Factor 2	Age (×1)	0.356	14.028	29.580	Modernity
	Educational aspiration (×5)	0.625			
	Scientific orientation (×10)	0.685			
	Farm mechanization (×6)	0.579			
Factor 3	Farm size (×7)		11.893	41.473	Resource
	Adoption leadership (×9)	0.647			
Factor 4	Education (×2)	0.467	10.091	51.564	Family capacity
	Family educational status (×3)	0.473			
	Family size (×4)	0.402			
Factor 5	Economic status (×8)	0.673	9.537	61.00	-

the Factor 4 consists of variables Education (x_2), Family Educational status (x_3) and Family Size (x_4) and has been renamed as Family Capacity, which together contributes to 10.091% of variance and last of all, as the Factor 5 consists of only 1 variable, that is, Economic Status (x_8) it has not been renamed but it alone contribute to 9.537% of variance.

All the Independent variables have been grouped into different factors and have been renamed because of the convenience of further study in this field.

Conclusion

Integrated Farming System as an approach is flourishing comprehensively and robustly in the economy of Tripura. Huge pile of tribal livelihood and income is generating from it and a belligerent Entrepreneurship has been resulted there with. Integrated Farming System has also got unique property to use residues or leftover of one enterprise for the sake of another enterprise. As an economic approach, Integrated Farming System ushers the prospects of rural and tribal livelihood by incorporating many enterprises both vertically and horizontally and minimize the risk of complete loss in case of crop failure because one enterprise can compensate the failure of another enterprise. Livelihood and income generation of tribal people through Integrated Farming System has been studied within a very short span of time and the collection of information based on the responses obtained from the farmers have to be relied upon and on the basis of the information obtained, the entire analysis with the help of standard statistical techniques have been done. The present study includes two basic aspects of Income and Livelihood generation of the farmers.

Along with different agricultural enterprises contributing to the income generation through Integrated Farming System, there are other non agricultural components also, such as Age, Education, Family size, Farm power, etc… which consists of Socio-economic status of the farmers, which also influence the Integrated Farming System and income generation of the farmers.

It has also been revealed that, as the Socio-Economic status of the farmer increases, their income generation increases because they can add more enterprise in the farming system. Most of the farmers are middle aged and it is the best period to undertake any new and economic venture and Integrated Farming System is obviously a new approach.

It has also been seen that based on the culture and values of the tribal people of Tripura, most of the tribal farmers are engaged in Piggery and it contributes to the highest livelihood generation because pork is most popular in tribal belt

So, lastly we can conclude that by increasing Piggery based Integrated Farming System and by increasing knowledge base of the farmers through proper education and training program, income, attitude and livelihood generation can be improved because without proper knowledge no farming

system can persist for a longer period. For this the Government of Tripura has already taken some initiatives.

Therefore, income generation of tribal people through Integrated Farming System approach in the North eastern hilly state Tripura, is a complex process, wherein resources like Age, Education, Family Size, Risk Orientation, Farm Size, etc., plays a pivotal role and all these contributory factors need to be customized and configured so that the livelihood and income generation can be improved and sustained.

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Original Article

Opinion of Youth that the News Reflects Actual Crime Trends

Swati Singh*, Mithilesh Verma**

Abstract

However, the majority of youth is aware about media and understood that media play positive perception towards youth crime. The vast information through media the youth has encouraged protection from crime. The news media aware the youth from crime. News media play a positive role in Delhi rape case and through media its interpretate in whole world and aware the girls from crime. Critical to linking the consumption of crime-related media with punitiveness is effectively arguing that media representations are framed in a way that promotes and encourages punishment. Media create awareness in people from victims. Sometime media present unbiased news so it is media responsibility that they go beyond the crime and present actual image of crime. Youth were daily sometime listening the news aware about crimes which are falling in society.

Keywords: Youth; Opinion; Crime; Reflect; Trends.

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Introduction

Media coverage could contribute to a speedy resolution of the case. The case has shaken our conscience. We are now much more concerned about protection of women. Such cases deserve media coverage and that is something media has done. In a way media has been successful in bringing the change in the mindset of the people for better." The public want the government to make an example of these criminals and take a stand against sexual assault and violence against women, and they are hoping that the case can work as a deterrent for the future.

Methodology

The study entitled 'Role of media on youth crime' was carried during 25 Dec, 2013 to 25 Feb, 2014 involving 40 students in each college and each University selected thus in overall 80 male and 80 female students selected, total 160 students were selected for the study. The survey was conducted in 2 different colleges and 2 different University in Lucknow and Kanpur districts. These areas shall present different segment of youth. Dependent and independent variables namely age; castes, religion, education, family income, and father's qualification, father's occupation, mother's qualification and mother's occupation etc. were used. The collected data were subjected to statistical analysis for which statistical tools, percentage, weighted mean, Rank and correlation coefficients were used.

Results

The distribution of respondents according to education level, 13.8% of respondents were educated up to B. Tech. whereas 41.2% respondents were

educated up to B.BA. 38.1% respondents were educated up to M. Tech and 6.9% male respondents were up to M.B.A. qualification. Education and knowledge of respondents affect the attitude towards the media role on youth crime.

20.5% of respondent's mother's occupation were doing service whereas 10.6% respondents' mother's occupation were attached in business. 67.5% respondents' mothers were housewife while only 1.2% of respondent's mother's were involved in other occupation.

The distribution of respondents according to family size. 46.8% respondents were belong to large family size whereas 44.4% respondents were belong to medium family size. 8.8 % respondents were belong to small family size .Now a day's large family system disintegrates in small family system.

Table 1: Distribution of respondents according to education N=160

Education	Frequency	Percent
B. Tech	22	13.8
B.B.A.	66	41.2
M. Tech	61	38.1
M.B.A.	11	6.9
Total	160	100.0

Table 2: Distribution of respondents according to mother's occupation N=160

Mother occupation	Frequency	Percent
Service	33	20.5
Business	17	10.6
Housewife	108	67.5
Other	2	1.2
Total	160	100.0

Table 3: Distribution of respondents according to family size N=160

Family size	Frequency	Percent
Small(up to 2 members)	14	8.8
Medium(3 to 4 members)	71	44.4
Large (5 and above members)	75	46.8
Total	160	100

Table 4: Distribution of respondents according to views that news reflects actual crime trends

S. No.	News media reflect actual crime trends	Yes	No	Total Mean Score	Rank
1.	Youth crime is special status in news	88.8	11.3	1.89	I
2.	Media create protection from victims	70.6	29.4	1.71	VIII
3.	News media play a key role to break the girls exploitation	85.0	15.0	1.85	III
4.	Social media influence the youth	88.8	11.3	1.89	I
5.	Media activity assist the youth crime	76.9	23.1	1.77	VI
6.	Media represent the different form of youth crime.	76.9	23.1	1.77	VI
7.	Entertainment media portray realistic image of young people.	75.0	25.0	1.75	VII
8.	Positive ways portray young people through media,	88.1	11.9	1.88	II
9.	Positive image of young people present in recent time.	70.0	30.0	1.70	IX
10.	Media support to break the crime against girls in recent time.	78.8	21.3	1.79	V
11.	Negative image of young people daily-life.	76.9	23.1	1.77	VI
12.	Internet influences the youth daily-life.	80.6	19.4	1.81	IV
13.	Media present the actual or accurate news.	66.9	33.1	1.67	X

The news reflect actual crime trends. 88.8% youth thought that youth crime is special status of presenting in news value and social media influence youth with mean score 1.89 & rank I followed by 88.1 per cent youth thought that media portray young people in positive ways with mean score 1.85 & rank II . 85.0% youth viewed that news media play a key role to break the girls exploitation with mean score 1.85 & rank III further 80.6% respondent agree that internet influence their life with mean score 1.81 and rank IV. We can see that 78.8% respondent said media support to break the girls crime mean score 1.79 and rank V where as 76.9% respondent agree media activity represents the crime against youth, Media present different form of youth crime and they think that sometime media represent that negative image in news with mean score 1.77 and rank VI. 75.0% respondent have understand that entertainment media portray realistic images of youth with 1.75 & rank VII followed by 70.6%

respondents have understand that media create awareness from victims with mean score 1.71 and rank VIII. We found that 70.0% respondents viewed that positive images of young people are presenting in recent time news with mean score 1.70 and rank IX where as 66.9% respondent have agree that media represents the actual news with mean sore 1.67 and rank X.

Conclusion

Media play positive perception towards youth crime. The vast information through media the youth has encouraged protection from crime. The news media aware the youth from crime. News media play a positive role in Delhi rape case and through media its interpretate in whole world and aware the girls from crime. Critical to linking the consumption of crime-related media with punitiveness is effectively arguing that media representations are framed in a way that promotes and encourages punishment. Media create awareness in people from victims. Sometime media present unbiased news so it is media responsibility that they go beyond the crime and present actual image of crime. Youth were daily sometime listening the news aware about crimes which are falling in society.

Recommendations

1. Media present young people increase their knowledge of crime to local prevention programmes through which youth could aware about victims of crime.
2. The news media should be report crime as a series of individual events without adequate attention to its overall context. Media has a role in supporting youth and preventing youth crime.
3. Youth should aware context for crime in regular listening the news.

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Review Article

Concept Note on Management Practices to Improve Performance of Buffalo in India

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Abstract

India is enriched in its livestock resources with a total livestock population of 512.05 million out of which buffalo alone comprises of about 22.23% (108.702 million). Among total buffalo population in our country only approximately 53 millions are the breedable females. Farmers especially in northern India un-doubtly, prefer the keeping of buffaloes as predominant milch animal since it is a triple purpose (milk, meat and draught) animal as compared to that of dual purpose cattle. They are reared mainly for milk production with meat as an adjunct. Buffalo bulls are also a important source of draught power. Buffalo meat have a good dietary value i.e. it is lean and contains less saturated fat compared to beef and pork. Buffalo plays a significant role in Indian economy because it contributed more than 56% of total milk produced in India and about 30% of total meat production in the country. However despite this potential and growth, the sector is not well integrated.

Keyword: Draught Power; Economy; GDP; Milch; Triple Purpose.

Introduction

Indian economy mostly depends on agriculture as agriculture sector alone contributes almost 18.00 % of the total GDP. Moreover, as per estimates of department of animal husbandry (2011-12), the contribution of livestock sector to total GDP was 4.11% and to total GDP from agriculture sector was 23.80 %, thus, it is obvious that livestock sector plays an important role in Indian economy. India is enriched in its livestock resources with a total livestock population of 512.05 million (19th Livestock Census, 2011-12) out of which buffalo alone comprises of about 22.23% (108.702 million), out of which only approximately 53 millions are the breedable females. Buffaloes constitute about one third of the total cattle and buffalo population but contribute more than 56% of the total milk production of the country, which is estimated to be over 131 million tons (department of animal husbandry, 2011-12). Farmers especially in northern India undoubtly, prefer the keeping of buffaloes as predominant milch animal since it is a triple purpose (milk, meat and draught) animal as compared to that of dual purpose cattle. They are reared mainly for milk production with meat as an adjunct. Buffalo bulls are important source of draught power. Buffalo meat is of good dietary value; it is lean and contains less saturated fat compared to beef and pork. In India, buffalo contributes 30.00% of total meat production (Murphy and Prince Davadaso, 2003). Presently, the buffalo contributes 1.42 million metric tons of meat to the meat pool of India, which comes out to be 45.74% of global buffalo meat (FAO, 2007). Moreover, there is a great preference for buffalo milk in consumers as compared to cattle milk, basically due to higher fat percentage. Buffalo breeds

on an average have a lactation yield of 1800 (1500-2500) liters within a lactation length of 305 days.

Though, buffaloes are considered one of the most disease resistant livestock species yet many of the diseases have been noted to affect their health, production and reproduction performance and it have been observed that on account of low fertility and poor health condition the country is suffering from an annual loss of about 20-30 million tons of milk. The buffalo is a difficult breeder because of its inherent susceptibility to environmental stress, which causes anoetrus and sub-estrus. These two conditions are responsible for a prolonged intercalving period resulting in great economic losses for the dairy industry. The productive and reproductive efficiency of animals are complementary to each other. Low reproductive efficiency in general and in the buffalo in particular remains a major economic problem globally and its incidence is higher in our country. The main interest of the animal breeder is to achieve more young ones in a lifetime, reduced mortality, and healthy and superior young ones. To achieve this goal, normal reproductive tools to augment reproductive efficiency (fertility), means to overcome reproductive constraints and remedies are needed.

Normal Reproduction in Buffaloes

The age of puberty in buffalo is 36 to 42 months in India. It is somewhat late as compared to other countries like Italy, where the age at first calving is 36 months on average. The estrus cycle length is 21 days with heat duration of 12-24 h. The ideal buffalo produces a calf every 13 to 14 months.

The factor which most strongly influences age at puberty is nutrition level. Buffalo exhibit seasonality in reproductive activity. The reproductive cycle of buffalo is as follows

Age of puberty:	36-42 months
Length of estrous cycle:	21 days.
Duration of heat:	12-24 hrs.
Time of ovulation:	10-14 hrs after end of estrous.
Period of maximum fertility:	Last 8 hrs of estrous.
Gestation period:	310 days.
Period of involution of uterus:	25-35 days.
Favourable Breeding season:	September to February.

Breeding Systems in Buffaloes

Natural Mating

Generally in dairy buffaloes, natural mating is used. In certain states, better awareness the buffalo bull and of the dam's milk yield are used in breeding. But for the most part there is no consideration of pedigree and any potent entire male available at estrous is used for breeding. This practice has caused a great deterioration in performance of the buffalo and the destruction of breed characteristics.

Artificial Insemination

Both fresh and short- duration stored extended liquid semen as well as frozen semen is being used for insemination of buffaloes. This service is provided on nominal payment by state department of animal husbandry and other agencies like BAIF and NDDB. The network project on buffalo development of ICAR arranges breeding with the use of frozen semen of known pedigree; Murrah, Nili-Ravi, Surti, Bhadwari, Pandharpuri and the swamp buffaloes of Assam.

Although the density of good breeds of dairy type river-buffaloes is higher in the hot and hot-humid parts of tropical India, the problem of low fertility in summer is also more serious. Some of the main reproductive problems of economic importance are:

Delayed Maturity

Delayed maturity in both male and female buffaloes is common throughout India. This is due to negligence of calves during their growing period. Buffaloes have potential to gain at rates of 400-800 gm daily after about 4-6 months of age and can attain 300-450 kg body weight suitable for breeding at about 24 months of age. But in the majority of dairy buffaloes calving occurs at 4-6 years of age. This is due to an inadequate supply of feed and nutrients during the growing phase.

High Incidence of Silent Estrous and Short Duration Estrous

This is more serious problem during the hot and humid-hot months. Due to these reasons, heat is often missed, and tethered females or females grazing without potent males in the herd remain unbred. It is an important factor contributing to the long intercalving period.

Non-Availability of Proven Sires and Good Quality Semen of Proven Buffalo-Bulls

It is another serious issue which becomes a cause of either missing of an estrus cycle or breeding of buffaloes with a poor quality of semen. This problem sometimes also arises because of irregular supply of quality semen or liquid nitrogen to the A.I. centers and state veterinary hospitals.

Occurrence of Venereal Diseases Causing Infertility and Sterility

These problems are encountered in both sexes, and the cause of their spread is the use of bulls for natural service. In recent years these problems have shown an increasing pattern because of increased use of artificial insemination in remote villages with the help of improperly trained inseminators. In some places, such persons present themselves as veterinary doctors though they have no education on clinical training. These persons may cause severe damage to livestock health and the wealth of the country.

Poor Heat Sign

Silent heat in the buffalo is one of the most important unsolved impediments to efficient breeding. It occurs in the hot seasons. A combination of estrus detection methods may be necessary for identification of animals in heat.

Anoestrum

Post-partum anoestrus in some buffaloes that have calved during cool season, i.e. the normal breeding season; have a shorter post-partum estrus interval than those that calve during last breeding season (February through July).

Poor Nutrition

Adequate nutrition is prerequisite for proper functioning of the reproductive system in animals. Underfeeding, overfeeding; protein and vitamin deficiency and imbalance of trace elements may also be one of the probable cause of various reproductive anomalies.

A poor body condition score at calving adversely affects fertility, characterized by prolonged post-partum intervals, reduced conception rates, and more services per conception. A very low protein diet can cause cessation of estrus.

Approaches for Improving Reproductive Efficiency

During the last two decades, farm animal reproduction has entered into the area of a new biotechnology revolution which includes artificial insemination; induction and synchronization of estrus (manipulation of breeding cycle); super ovulation embryo transfer; cryopreservation; embryo resource development; sexing; transgenesis; cloning chimera production; and early pregnancy diagnosis. Some of these technologies have immense potential to revolutionize world animal production and reproduction efficiency in the twenty-first century.

Artificial insemination is considered as one of the most effective ways of rapidly accelerating significant genetic improvement programmes, but A.I. is not successfully practiced in buffalo because of –

a. Difficulties in estrous detection.
b. Difficulties in semen preservation.
c. Lack of certified semen programmes.

Reproductive Performance of Buffaloes

Reproductive efficiency is determined by many different processes, which result from interaction among genetic and environmental factors. The processes involved singly or in concert, include age of puberty/maturity, pattern of estrous cycle and estrous behaviour, length of breeding, ovulation rate /litter size, lactational anoestrous period, post-partum anoestrus intercalving period, and reproductive life span.

The reproductive efficiency in buffalo is so alarmingly low that it poses a very serious threat of economic loss to animal husbandry professionals of India. In such a scenario, an ample scope exists for increasing the reproductive efficiency by modification in the traditional methods of breeding, feeding, management and disease control.

Reasons for Poor Reproductive Performance

Effect of Climate

Environmental attributes play an important role in production and reproduction performance of farm animals all over the world. Season affects the breeding efficiency in the case of buffaloes. There is a tendency to have better performance during the cool months; 70-80% of conceptions in buffaloes occur between July and February months. Buffaloes are sexually activated by decreased day length and temperature. A lower number of services per conception are needed during the July-February breeding season than the March-June breeding season.

Poor Thermal Tolerance

Buffaloes have poorly developed heat tolerance system. During the summer they have to be protected from the extreme heat by allowing them wallowing, bathing, mist cooling and fogging; also in winter,

they have to be protected from extreme cold, which may predispose them to many diseases.

One of greatest source of failure in A.I. is the inability to recognize estrous display, more precisely time of ovulation. The identification of accurate time of ovulation is essential for timed A. I.; as it increases the rate of conception. With frozen semen, the need to inseminate close to ovulation is even more imperative because of the limited survival of spermatozoa. It is possible to extend the life of spermatozoa and package them in such a way as to retain them in the reproductive tract in a viable state for several days. Efforts are being made for micro-encapsulation of spermatozoa, which will help in prolonged survival of spermatozoa.

There is an urgent need to start registration of all A.I. bulls by a national society or an All India Animal Breeder Association (AIABA) and to initiate a certified semen programme. Strengthening practical training in animal reproduction for veterinary students and better training of inseminators is also essential.

1. Insemination should be done during the latter half of the period of heat.
2. In heifers, the first heat should be avoided to make the animal more receptive.
3. Buffalo should be calm and quiet (stand still) at the time of insemination
4. The Best site for insemination is the mid cervix and the body of the uterus
5. Concept of twice A.I. per estrus may be followed for increased rate of conception

Induction and Synchronization of Estrous

Its main objective is to control the estrous cycle and regularizing it. It would provide a means for circumventing the problem of estrous detection for timed A.I. programme. For a satisfactory pregnancy rate in an embryo transfer programme, the embryo must be placed in an environment that simulates the one from which it was removed. So synchronization of estrous in the donor and recipient in each experiment is considered essential to obtain the best result.

Induction and synchronization of estrous can be achieved by two alternate approaches. The first is by artificially extending the luteal phase (by using progestatimal compound) and second by inducing device of the corpus luteum (by using prostaglandins and analogues.).

Progestogens with some possible adjustment in PMSG and or FSH are used for anticipated lower response. Presently PGF2 a is widely used to manipulate the early breeding of post-partum buffaloes and pubertal heifers. It is also used in a double dose schedule (10-11 days interval) for those animals, which do not have functional CL at the first injection.

Superovulation (Multiple Ovulation)

Superovulation is one of the major reproductive technologies for rapid genetic improvement of livestock.

Reduction of Unproductive Period

It may be attained by applying various methods of reducing the interval from calving to conception I.e. service period and decreasing number of services per conception.

Oral Prostagen (Chlormadinone acetate, melangestrol acetate) for a 14-day period, starting on the 21st day after calving is generally found to be effective in reducing interval between parturition and conception.

Short-term progesterone (PRID/ CIDR) and progestagen (ear implant) for 7-10 days also stimulates breeding activity regardless of whether the animal is cyclic or anoestrous. FSH in conjugation with progesterone enhanced the follicular development in the post-partum period. Progesterone plus estradiol treatment resulted in synchronized wave emergence with normal luteal activity in post-partum anoestrous animals.

Embryo Transfer Technique

The embryo transfer technique permits exploitation of superior female genotype, giving more off-spring from the same genetic donor than would arise under normal conditions of breeding. Embryo technologies are also used to resolve several reproductive enigmas, viz. uterine sufficiency; maternal reorganization of pregnancy; embryo-utero-relationship.

Heat Detection Technique

Wall charts, breeding wheels, herd monitors and individual buffalo records are estrous detection aids. These systems are the least expensive. The key to successful use of these management aids is accurate recording of every heat beginning with the first after calving and their daily use to identify those buffaloes that are due to return to estrus.

Mount Detection Involves Two Methods

1. Pressure sensitive devices.
2. Paint stick or paint on tail head.

Heat Detector Animals (Teasure Bulls)

Sexually active animals are used to detect buffalo in heat. They are fitted with chin ball markers.

Use of Dogs

Dogs can be trained to detect odour associated with estrus in buffalo.

Use of Milk Progesterone Assay

With the help of RIA, milk progesterone concentration can be determined. Progesterone level of < 200 pg/ml indicates an animal is in estrus.

Use of Pedometry

These are sensors which measure the activity of animals. It is based on the hypothesis that the activity of animals is increased during heat.

In-Vitro Fertilization

In-vitro fertilization is also most important tool to increase the reproductive performance/efficiency in buffalo. Addition of heparin and caffeine in the medium used in *in-vitro* fertilization system helps in inducing capacitation and acrosome reaction in buffalo spermatozoa.

Enzyme Immunoassay

Measurement of progesterone and to a lesser extent, of estrone sulphatehas found practical application as a method of improving reproduction in farm animals. For instance, diagnosis of (non) pregnancy and confirmation of (non) estrus is possible on the basis of progesterone concentration in body fluids. Progesterone determination in plasma or milk can serve as valuable diagnostic tools in buffaloes for accurate estrus confirmation and hence correct timing of A.I. and diagnosis of pregnancy and nonpregnancy 20-24 days post A.I. and also for identifying cystic ovarian disorders.

Use of Biostimulation

Biostimulation may be described as the effect of the male on estrus and ovulation through genital stimulation and priming pheromones. Biostimulation plays important role in reproduction such as hastening sexual maturity, induction of ovulation, and reduction of post-partum anoestrus.

Biostimulation modulates the following reproductive activities, and it has been used for augmenting the reproductive efficiency in recent years –

1. Induction and synchronization of estrus.
2. Age at onset of puberty.
3. Postpartum estrus.
4. Silent heat.
5. Ovulation rate.

Management Issues

Three main constraints important in management of buffaloes are:

1. Summer stress
2. Winter stress at high altitude
3. Inadequate quantity of non-polluted, wholesome water for drinking and wallowing.

Summer Management

- Keep buffaloes in airy, cool and comfortable place. Keep animals under shady trees and sprinkle water on their surroundings.
- Provide fresh and cold drinking water.
- Supply fresh green fodder.
- Make provision for night feeding.
- Grazing should be done only on green pasture in morning and evening hours.
- Mineral mixture and salt should be supplied daily.
- A deworming schedule should be followed with spraying for ecto-parasites.
- Avoid overcrowding.
- Sheds should be properly ventilated.

Winter Management

- Protect buffaloes from extreme cold.
- Provide proper bedding to the animals.
- Increase sources of energy for breeding stock through high-energy diets.

Maintenance of hygienic conditions on buffalo farms and in dairy buffalo stalls is less expensive. Health problems of buffalo may be widespread or

localized. Provision of a dry place for resting, timely disposal of dung and urine, daily washing/ wallowing, sprinkling of phenyl lotion on water, occasional application of flaked lime power and use of gunny bag soaked in saturated solution of washing soda at entrance particularly during the spread of viral disease like F.M.D. are considered useful in providing reasonably satisfactory protection against many diseases. Regular and timed vaccination schedule must be followed.

Managemental Practices for Better Reproductive Efficiency

- Proper heat detection.
- Maintaince of accurate record of heat.
- Routine checking of adult females for heat.
- Treatment of the females with abnormal uterine discharge during estrus.
- Checking female for pregnancy diagnosis after 45-60 days of natural service.
- Isolation of the diseased animals from the healthy herd.
- Following the vaccination programme.
- Provision of balanced nutrition.
- Good housing systems.

Conclusions

Prompt and careful managerial practices must be adopted to reduce the infertility and anoestrus problems in buffaloes. Environmental modification through provision of shade, splashing of water, misting, fogging during heat stress and proper bedding, housing and dietary manipulation during extreme winter significantly reduces the adverse effect of climatic variable and promotes survival of fundamental stock. Proper heat detection method, application of new reproductive technology, deworming, vaccination, balance ration & area specific mineral mixture supplementation to buffalo at their different stages of life also play a significant contribution in improvement of buffalo reproduction as well as in our country GDP.

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Review Article

Neutraceuticals: New Approaches in Veterinary Medicine

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Abstract

Nutraceuticals are the normal food substances which possess medicinal value in addition to their nutritive value. Usage of nutrients in the treatment of disease conditions is an age old practice. Due to the development of resistance to the antibiotics in therapy new approaches have been made to explore rich Indian flora to come up with alternatives to the modern medicine. Nutraceuticals are the one which in combination or alone can be used the treatment of various disorders in veterinary medicine. The commonly used neutraceuticals such as prebiotics, probiotics and antioxidants like curcumin are used generally to improve growth as well as health conditions of the animals.The application of the neutraceuticals as the therapeutic agents in modern medicine will reduce the amount of the antibiotic as well as the risk of development of side effects.

Keywords: Neutraceuticals; Curcumin; Prebiotics; Colostrum.

What are Neutraceuticals

The term "nutraceutical" consists of two words – "nutrient" (a nourishing food component) and "pharmaceutical" (a medical drug). The term Neutraceuticals was coined by *Stephen De Felice* in 1989, founder and chairman of the Foundation for Innovation in Medicine, an American organization located in Cranford, New Jersey.

The Greek physician Hippocrates (known as the father of medicine) said "let food be your medicine". The philosophy behind neutraceuticals is to focus on prevention of various diseases conditions.

The term Nutraceuticals is used to describe any product derived from food sources with extra health benefits in addition to the basic nutritional value found in foods. They can be considered non-specific biological therapies used to promote general well-being, control symptoms and prevent malignant processes.

India, China and Brazil are developing nations which show huge potential for the nutraceuticals market.

Classification of Neutraceuticals

The definition of neutraceuticals and related products generally depends on the source. They can be classified on the basis of their natural sources, pharmacological conditions, as well as chemical constitution of the products. Most often they are grouped in the following categories:

a. Dietary supplements
b. Functional foods
c. Medicinal foods
d. Farmaceuticals

Dietary Supplement

It represents a product that contains nutrients derived from food products, and is often concentrated in liquid, capsule, powder or pill form. Although dietary supplements are regulated by the FDA as foods, their regulation differs from drugs and other foods. Example: vitamins, minerals, herbs, or other

botanicals, amino acids, and substances such as enzymes, organ tissues, glandulars, and metabolites.

Functional Foods

It is a category which includes whole foods and fortified, enriched or enhanced dietary components that may reduce the risk of chronic disease and provide a health-benefit beyond the traditional nutrients it contains. Example: Fortified omega fatty acids, probiotics fortified foods, iodinated salts

Medicinal Foods

It is formulated to be consumed or administered internally, under the supervision of a qualified physician. Its intended use is a specific dietary management of a disease or condition for which distinctive nutritional requirements are established by the medical evaluation (on the basis of recognized scientific principle). Example: Pumpkin seeds, Papaya

Farmaceuticals

These are medically valuable components produced from modified agricultural crops or animals. The term is a combining of the words "farm" and "pharmaceuticals". Proponents of this concept are convinced that using crops (and possibly even animals) as pharmaceutical factories is much more cost effective than conventional methods, with higher revenue for agricultural producers. Example: Transgenic crops

Applications of Neutraceuticals

Nutraceuticals are becoming increasingly popular within the veterinary profession. They have been described by the North American Veterinary Nutraceutical Council as a "non-drug substance that is produced in a purified or extracted form and administered orally to provide agents required for normal body structure and function with the intent of improving the health and well-being of animals".

These products are widely available and can be purchased in many forms, including capsules, tablets and powders, and are often included in animal feeds. A number of nutraceuticals are currently being used in the prevention and treatment of common diseases in animals including cardiovascular disease, osteoarthritis, periodontal disease, cognitive dysfunction and cancer, with clinical trials providing evidence of their efficacy in a variety of animal species [1].

Some of the commonly used neutraceuticals are discussed below:

Curcumin

Curcumin, a polyphenol obtained from *Curcuma longa,* commonly called as turmeric, is one of nature's most potent anti-inflammatory agent. Turmeric and its derivatives have a great deal of pharmacological activity [2]. Curcumin is a powerful antioxidant and has greater effects in preventing free radical damage compared with vitamin C, vitamin E, and superoxide dismutase [3]. Numerous experimental studies have demonstrated that curcumin produces exceptional anti-inflammatory effects [3,4]. Curcumin's anti-inflammatory activity is comparable with potent anti-inflammatory drug like cortisone and phenylbutazone in models of acute inflammation [5]. The adverse effects of such as gastric ulceration, hepatotoxicity and nephrotoxicity produced by the steroidal and non stero-idal agents can be minimized with the usage of Curcumin. Animals can be fed with curcumin in their ration upto 3 g/kg body weight without any significant adverse effects [6].

Colostrum

Colostrum is the first lacteal secretion obtained from the mammary gland during the first 5-7 days after calving. It is rich in immunoglobulins, vitamins and growth factors.Colostrum is used as a nutraceutical for animals of all ages to increase resistance to infection and disease caused by a wide range of pathogens, including bacteria, viruses, parasites, and fungi. Colostrum obtained from one species can be safely used in another species especially bovine colostrum. The components of colostrum responsible for nutraceutical activity are similar in structure and function among different species [7-9]. It is used as a neutraceutical in various species such as horses [10], pigs [11], sheep [12], cats [13] etc. Research studies have shown that colostrum and its components are effective against a wide range of common pathogens, including rotavirus [14], Cryptosporidium spp. [15, 16], Staphylococcus aureus [17], Candida spp. [18], Clostridium spp. [19, 20], Shigella spp. [21], Streptococcus spp. [22], and Escherichia coli [23]. Feeding of colostrum reduces gastrointestinal tract infections and it also improves the absorption of iron. Colostrum should be fed to the animals immediately after birth or within 36-48 hours as the immunoglobulins in colostrum are not absorbed into the blood stream of animals older than 36-48 hours if given orally.

Silymarin

Silymarin is a complex mixture of polyphenolic molecules obtained from *Silybum marianum* (Milk thistle). Silymarin is having antioxidant, anti-inflammatory, antifibrotic and hepatoprotective properties.

In-vitro and in-vivo studies suggest silymarin can protect the liver from a wide variety of toxins, including acetaminophen, ethanol and aflatoxin, as well as from viral, ischaemic and radiation-induced injury.

The cows fed with silymarin (10 g per day) showed a quicker onset of the peak of milk production, which was one week sooner than in the control group, and with better overall milk yield [24]. Silymarin can be used in chickens to prevent the toxic effects of AFB1 originating from contaminated feed. Silymarin increased hatchability in chickens and turkeys. It also prevented excessive adiposis in birds.Hepatoprotective effects of silymarin were also proved bybiochemical [25] and histopathological examinations [26, 27]. It is available commercially to UK veterinarians as a combined product with SAM-e.

Probiotics and Prebiotics

Probiotics are micro-organism which provides beneficial effects on health and condition of the animals.Example: Lactobacilli, Bifidobacterium families. Probiotics bacteria like *lactobacilli* are naturally found in fermented foods like sauerkraut and yogurt.Prebiotics are non-digestible foods that make their way through our digestive system and help good bacteria grow and flourish. Example: Fructo-oligosaccharide. The symbiotic fermented milk containing probiotics and a prebiotic may contribute to improve the intestinal health and may have a positive effect on the humoral and cell-mediated immunity of hostanimals [28].

Advantages of Neutraceuticals

Neutraceuticals have attracted considerable interest due to their potential nutritional, safety and therapeutic effects. They could have a role in a plethora of biological processes, including antioxidant defenses, cell proliferation, gene expression, and safeguarding of mitochondrial integrity.Therefore nutraceuticals may be used to improve health, prevent chronic diseases, postpone the aging process (and in turn increase life expectancy), or just support functions and integrity of the body. They are considered to be healthy sources for prevention of life threatening diseases such as diabetes, renal and gastrointestinal disorders, as well as different infections.

A wide range of nutraceuticals have been shown to impose crucial roles in immune status and susceptibility to certain disease states. They also exhibit diseases modifying indications related to oxidative stress including allergy, Alzheimer's disease, cardiovascular diseases, cancer, eye conditions, Parkinson's diseases and obesity. Based on the research in veterinary science neutraceuticals can be used in treatment of various disease conditions. These neutraceuticals are readily available and easy to administer without any recognizable side effects.

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Review Article

Advances in Paneer

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Abstract

Paneer is an important indigenous product which is obtained by heat treating the milk followed by acid coagulation. It has been a delicacy from ancient times which can be used in the preparation of a variety of culinary dishes and snacks. Paneer is a rich source of animal protein and is characterized with marble white color, sweetish, mildly acidic taste, nutty flavor, spongy body and closely knit and smooth texture. Conventional method of paneer has various limitations viz. wastage of milk solids, variation in quality of paneer, lack of mechanization in manufacturing, etc. Another constraint in large scale manufacturing of paneer is short shelf life. To meet ever growing demand of paneer and to overcome these limitations, myriads of studies has been done by researchers to develop new techniques for manufacturing paneer and to promote its hygienic production. Various technological innovations in paneer manufacture and methods of shelf life extension have been reviewed in this article. Paneer being an established product offers a great prospective for value addition.

Keywords: Paneer; Mechanization; Value Added Paneer; Shelf Life Extension.

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Introduction

Paneer is an acid coagulated product of the casein component prepared from milk. It has been a delicacy from ancient times till today for preparation of certain curries and can be eaten raw as well. Historically, the origin of *paneer* can be traced to the nomads of southwest Asia who were the first to develop various kinds of cheeses. Technically, *paneer* can be defined as a product obtained through heat and acid coagulation of the casein component of preferably standardized buffalo milk, entrapping through complex physico-chemical interactions almost all the fat, a part of denatured whey proteins and colloidal salts, as well as a part of the soluble milk solids (in proportion to the moisture content retained) (Aneja, 2007); or coagulating buffalo or blend of cow or buffalo milk and pressing the coagulum (Chandan, 2007) & resembles unripened cheese prepared either from whole milk or skim milk (Chopra and Mamtani, 1995).

According to PFA (2010), *paneer* can be defined as "the product obtained from cow or buffalo milk or a combination thereof by precipitation with sour milk, lactic acid or citric acid. It shall not contain more than 70% moisture and milk fat shall not be less than 50% expressed on the dry matter. The milk fat of skim milk *paneer* shall not exceed 13.0% of the dry matter". Bureau of Indian Standards (BIS 1983) imposed a maximum of 60% moisture and minimum of 50% fat in dry matter for *paneer*.

Nutritive Value

Paneer is a rich source of animal protein available at a comparatively lower cost and forms an important

source of animal protein for vegetarians. Over and above its high protein content and digestibility, the biological value of protein in *paneer* is in the range of 80 to 86 (Shrivastava and Goyal, 2007). In addition, *paneer* is a valuable source of fat, vitamins and minerals like calcium and phosphorus. It has a reasonably long shelf life under refrigeration.

Present Status of Paneer Manufacturing

In India, around 4-5% of the total milk produced is being converted to *paneer* (Nayak and Bector, 1998, ICMR 2000; Chandan 2007). India's annual production is estimated at 0.2 million tonnes of *paneer* (Aneja *et al*., 2002) having market value around Rs. 18×10^9 annually (Aneja, 2007) exhibiting a growth of 13% in 2003-04 (Joshi, 2007; Shrivastava and Goyal, 2007). Method of production of *paneer* is well known to every household where milk is heated and coagulated using citric acid or lime (source of citric acid) or any other mild acid. The coagulum thus obtained is pressed for two hours or so after which the pressed mass is kept under chilled water and thence can be utilized for various purposes. Though the method of production remains the same at industrial level but the scale and process classification on the basis of automation varies. Under optimum conditions 22-24% yield can be obtained which mathematically resolves to 63-67 per cent recovery of milk solids in *paneer* (Chandan, 1996).

The production of *paneer* has largely been confined to the unorganized dairy sector which employs traditional, inefficient methods of manufacture. As reported, *Paneer* may contain as high as 70% moisture which is conducive for microbial growth. Studies carried out on microbial quality of *paneer* have indicated that it is often contaminated with *Staphylococcus aureus* and Coliforms (Kumar and Sinha, 1989; Rajorhia, *et al.,* 1984). In a market survey carried out in India, covering state of Punjab, Chandigarh; *paneer* samples were collected to isolate and identify bacterial pathogens/contaminants therein. Fifty eight samples of *paneer* bought at random were cultured on several media and predominant organisms like *Staphylococcus* species, aerobic spore bearers, *Klebsiella pneumoniae, Campylobacter jejuni, Acinetobacter species* and *Streptococcus species* were isolated. The viable bacterial counts obtained ranged from 3×10^2 to 9.7×10^{10} cfu/ml. Authors expressed that contamination by pathogenic bacteria could be an important factor of gastrointestinal illnesses in the consumers. Also, micro flora can get entry into the *paneer* during various steps of manufacturing. Similar data was cited and reported by (Table 1) (Vaishnavi *et al.,* 2001). Due to ever growing demand of *paneer* and to promote the hygienic production during manufacturing, researchers were encouraged to develop new techniques for manufacturing *paneer*. Different manufacturing conditions, variants of *paneer* and mechanization process have been reviewed by Pal and Agrawala (2007).

Table 1: Microbial quality (cfu/g) at different stages of *paneer* production

Sample	Aerobic plate count	Coliforms
Milk	1.8×10^7	ND
Citric acid solution	ND	ND
Coagulated milk	$>10^7$	7×10^2
Chilled water	2.0×10^4	ND
Paneer	6.0×10^3	3.0×10^3
Handwashings of food handler (1)	$>10^7$	2.5×10^3
Handler (2)	$>10^7$	3.0×10^3

ND= not detected
Source: Anon, 2000

Table 2: Compostion of traditional and ultrafitered (UF) *paneer*

Parameter	Full fat	Low fat	Skim milk	UF paneer
Fat	23.41	8.60	0.20	7.20
Protein	18.33	21.56	25.83	15.92
Lactose	2.40	-	-	5.30
Ash	1.90	-	-	2.21
Total solids	46.04	38.28	35.42	30.63
Yield	20.00	16.30	14.10	25.00

Source: Gupta, 2006

Conventional Method of Paneer Manufacture

Although *paneer* can be made from variety of milk such as cow, buffalo or mixed milk, buffalo milk is preferred over other types. In traditional production of *paneer*, buffalo milk (6% fat; 9% SNF) is boiled in a vessel. To coagulate the milk while still hot, a suitable

coagulant (lime/alum/citric acid) is added, with slow stirring. Formation of clear whey is an indicative of complete coagulation. Stirring is stopped, as the coagulum tends to coalesce. After the formation of large lumps is complete, contents of the vessel are poured over a muslin cloth to separate the coagulum from whey. The coagulum so obtained is slightly pressed to facilitate formation of *paneer* blocks of suitable size, followed by their immersion in chilled water to impart them a distinctive texture. The cooling results in reabsorption of some water and this treatment presumably impart the characteristic springy and rubbery body to *paneer*. It displays integrity of texture and retains its shape and form during the frying or cooking of culinary dishes. It is usually wrapped in parchment paper, or loosely packed into polythene pouches. Alternatively, *paneer* blocks are floated in chilled water troughs at retail points and sold (Aneja *et al*., 2002)

A process for industrial scale production has been developed, using the available cheese/casein/tofu manufacturing equipment. Significant R&D at the National Dairy Development Board (NDDB), National Dairy Research Institute (NDRI) and several agricultural universities has resulted in the optimization of processing variables and the same has been depicted in *Figure 1.*

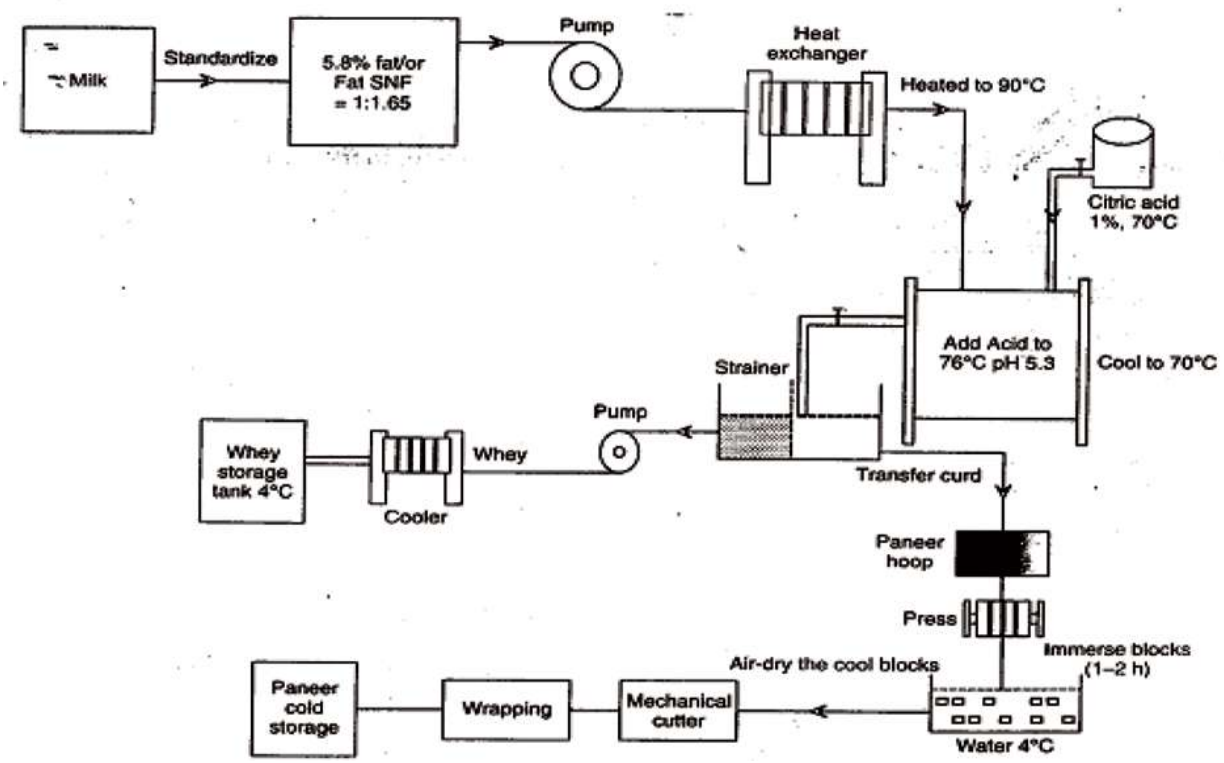

Fig. 1: Schematic presentation for the manufacture of *paneer*

Conventional approach of *paneer* making suffers from various limitations viz. wastage of milk solids in the form of whey, variation in quality of *paneer* from batch to batch, absence of 'in-process' quality control, lower shelf life, lack of mechanization in manufacturing, packaging operations, and many more.

Technological Advances in Manufacturing Paneer

Various technological modifications have been introduced in manufacturing of *paneer* to produce uniform quality, improved shelf life, increased yield and a nutritionally better product. Sachdeva and Singh (1987) gave a small-scale method for producing *paneer*, an acid coagulated Cottage cheese-type product, involved heating buffaloes' milk (6% fat) to 82°C for 5 minutes followed by cooling to 70°C and adding 1% citric acid, draining and pressing the obtained curd in moulds for 15-20 min. The curd was then cut, cooled in chilled water (5°C) for 2-3 h and packed in paper. According to authors, for minimum possible industrial scale production, good quality *paneer* could be obtained by the following certain modifications like heating milk to 90°C with no holding; elimination of cooling to 70°C by adding

a stabilizer, e.g. 0.15% pregelatinized potato starch; use of cheaper acids, soured whey or acid-producing bacteria, e.g. *Lactobacillus acidophilus* for coagulation; standardizing pH to 5.30-5.35; use of a 2:1 mixture of buffaloes' and cows' milk; and vacuum packaging to improve shelf-life. In another study, Sachdeva *et al*. (1993) developed the process of *paneer* making which involved standardization and heating of milk followed by concentration of milk solids using membrane processing- Ultra filtration (UF). The concentrated mass thus obtained contained about 40 percent total solids (TS), was cold acidified to get the desired pH. Till this point, the product was flowable and could be easily dispensed into the containers with automatic dispensing machines. The filled containers were then dispensed subjected to texturisation by microwave heating in a domestic microwave oven. This could also be achieved in a continuous process by using microwave tunnels. Such tunnels comprises of a series of magnetrons under which the product moved continuously on the conveyer belts. The resulting product showed typical characteristics of a normal *paneer*. In another approach, an in-package process was developed using UF process for manufacturing long shelf life *paneer* like product (Rao, 1996) wherein standardized buffalo milk was concentrated partly by vacuum concentration and partly by employing UF to a level of total solids desired in the final product. After packing in moralized polyester pouches, product was formed by a texturising process at 115ÚC, which also led to sterilization. The process permitted greater product yield (35%) due to retention of whey solids compared to 15% obtained by conventional batch process. Ewes' milk can also be employed for *paneer* making by coagulating the same using 2.0% strength of citric acid heated upto 90ÚC (Pal *et al*., 2008).

Texture plays an important role in acceptance of any product. Various technological upgradations have been attempted to produce good quality *paneer* using skim milk. Processes like UF has advantage of higher yield and softer structure of *paneer* made from skim milk which is normally very hard and rubbery. In a study, concentration of standardized milk (2% fat, 9.2% SNF) to 27% TS using ultrafiltration for the manufacture of *paneer* resulted in a greater proportion of whey proteins bound to the casein network than the *paneer* made from non-concentrated milk, giving 95% TS recovery on the basis of ultrafiltrate (Kanawjia and Singh 2000). Similar findings were reported by Rao and Mathur (1990). Addition of certain additives has also been reported to improve the sensory quality of *paneer* made from skimmed milk. Incorporation of small amounts of fermented skim milk and salts improved the nutritional and sensory qualities of reduced fat *paneer* (Chawla *et al*., 1987; Sanyal and Yadav, 2000). Salt added at a rate of 0.75% can increase the yield of reduced fat *paneer* by 19.59% above that of control (Sanyal *et al*., 2004). Similarly, concentration of skim milk up to four times by UF along with the addition of 2.5% starter culture and 0.5% salt can reduce the hardness of *paneer* (Sivakumar *et al*., 2005).

Kanawjia and Rizvi (2000) employed Microfiltration (MF) technology for selective fractionation and concentration of standardized cow milk and addition of calcium chloride ($CaCl_2$) @ 0.15% in the MF retentate resulted in an improved organoleptic and textural properties of resultant *paneer*. In another study, MF was employed to concentrate skim milk and the retentate thus obtained was blended with different fat sources viz. butter oil, cooking butter and plastic cream and blend thus obtained was homogenized to prepare a good quality *paneer* (Kanawjia and Rizvi, 2003).

Gupta and Pal (1995) concentrated milk by reverse osmosis (RO) to 25% (1.5X) and 33% (2X) TS. *Paneer* prepared by RO concentrated milk was reported to be 2-3% higher in yield on original milk amount basis as compared to control with comparable sensory attributes. Pal et al. (2002) prepared *paneer* with nanofiltration (NF) concentrated cow milk wherein milk was concentrated 1.5X and 2X at 50^0 C. *Paneer* prepared from NF concentrated milk was reported to have reduced hardness, compactness and drying characteristics compared to control. NF also reduced the salt content of cow milk upto 74% in 1.5 X concentration without affecting the other characteristics.

Continuous process of *paneer* making has several advantages over batch process as this permits a uniform and consistent quality of *paneer.* In a study it was observed that continuous process of *paneer* making enhanced the shelf life of *paneer* from four to ten months due to hot packaging**.** The yield of product was also higher by about 10 per cent over all conventional processes. It might be due to the capture of the fine particles which otherwise would normally be lost with the whey. Pilot studies on the UF process indicated excellent scope for scaling up of operation on industrial scale. Also, such from such operations provides the same sensorlogical properties as conventional *paneer* for example market study results revealed the consumer acceptability of UF *paneer* similar to that of the traditional *paneer*. Also, the chemical composition of UF *paneer* was similar to the traditional *paneer* (Table 2). A continuous *paneer*-making system was also designed at National Dairy Research Institute, Karnal by Agrawala *et al*. (2001)

which employed twin-flanged apron conveyor cum filtering system for obtaining the desired moisture content and textural attributes.

In another study conducted by Das and Das (2009), an impact type device was designed for continuous production of *paneer* in which channa was kept in cages made from special type screen and cages were subjected to impact force. Total amount of energy imparted to *chhana* during impacts was correlated with reduction in moisture, increased hardness and the solid lost through whey from pressed *chhana* which was found to follow first order rection kinetics which was further confirmed with the prototype of an impact type device.

Alternate technologies like *paneer* manufacturing by centrifugal process has also been developed at the Indian Institute Technology (IIT), Kharagpur, by Aggarwal (1996). In this method of *paneer* production, buffalo milk was preferred over cow-milk, owing to its intense softness to withstand deep fat frying and common cooking operations. Traditionally, *paneer* is made by pressing the curd and cooling the pressed curd in chilled water and texture of *paneer* was observed to be affected by various factors viz. the initial thickness of curd, applied pressure, duration of pressing and the time of chilling the pressed curd. In centrifugal process, pressing and chilling of curd can be done by the centrifugal method which considerably reduced the time required for production.

Shelf life Extension of Paneer

Paneer has relatively shorter shelf life of not more than 1 day at room temperature in tropical countries owing to higher moisture content. Bhattacharya et al. (1971) reported that *paneer* could be stored for only 6 days at 10^0C without much deterioration in its quality, though the freshness of the product got vanished after 3 days. Spoilage of *paneer* is mainly due to the surface growth of microorganisms and in this arena researchers are trying to develop ways to curb the growth of microorganisms to improve the shelf life of *paneer*.

Salt along with potassium sorbate has been known widely to preserve the quality of *paneer*. Several workers have reported significant improvement in shelf life of *paneer* when it is dipped into salt solution. Sachdeva and Singh (1990) reported an improved keeping quality with better palatability when *paneer* cubes were immersed in 5% brine solution. In another approach, use of 0.1% sorbic acid in milk along with irradiation of product @2.5KGy was reported to improve the shelf life of *paneer* to 30 days at ambient temperature (Singh *et al*., 1991) whereas Deshmukh *et al*. (2009) reported increase in yield of *paneer* with the use of acidified and cultured whey. Pal *et al*. (1993) studied the improvement in the shelf life of low-fat *paneer* cubes by parafinning. This technique improved the shelf life by over 10 days. Hot (60ÚC for 5 min) and cold (8-10ÚC for 6-10 hrs) diffusion of *paneer* cubes with sodium chloride and potassium sorbate followed by microwave drying was reported to extend the shelf life of *paneer* (Singh and Rai, 2004).

Heat sterilization was also reported to enhance the shelf life of *paneer* to a considerable extent. In a study, Kanawjia and Singh (2000) brined *paneer* packed in tins was sterilized in autoclave at 1 kg/cm^2 for 15 min. and such heat sterilized *paneer* was reported stay well for 4 months at room temperature. Use of concentration by thermal evaporation under vacuum or ultrafiltration followed by acidification to desired pH (5.4) and in-package thermal texturisation at 115^{0}C led to sterilization of *paneer*, resulting in shelf life of about 3 months at room temperature (Rao 1996, Kanawjia and Khurana 2006).

In a study conducted by Uprit and Mishra (2004) on textural kinetics of *paneer* wherein the effect of different variables such as temperature of salt solution, conc. of salt, time of exposure etc. was studied in soya fortified *paneer* during salting treatment revealed that with the progression of salting treatment, hardness showed the decreasing trend following the zero order reaction kinetics whereas chewiness showed the reverse trend showing higher chewiness following second order reaction. The increase in values was more prominent at higher temperatures compared to lower temperature. Similar observations were earlier reported by Desai *et al*. (1991). The results obtained for hardness were in accordance to observation made by Rao and Patil (2006) in a research experiment for controlling a_w and pH during *paneer* processing using hurdle technology. A ready to eat *paneer* curry was prepared having a water activity of 0.95 and a pH of 5.0 and potassium sorbate content of 0.1%, and canned at a F value of 0.80 (lethality). The product was stored at 15, 30 and 45°C. During storage, observations indicated that textural attributes such as Cohesiveness and chewiness increased, but hardness decreased. These changes were attributed to continued changes in texture initiated by frying of *paneer* and canning process. These were also linked to Maillard browning which progressed during storage as measured by hydroxymethyl furfural content. These changes were found to be slower vis-à-vis those observed in the product, which was sterilized at conventional F value of 15.0 (control).

Contrary to heating, freezing at zero and sub-zero temperature also serve as important method of shelf life extension. Blast freezing is in exceptional demand in his horizon. Blast freezing refers to the process in various industries whereby objects are quickly frozen by subjecting them to cryogenic temperatures. Blast freezing is used in the food industry to quickly freeze perishable food items. In this case, food items are subjected to temperatures well below water's melting/freezing point (32°F or 0°C), causing the water inside the foods to freeze in a very short period of time without forming large crystals, thus avoiding damage to cell membranes. This rapid freezing is done by submerging the sample in liquid nitrogen or a mixture of dry ice and ethanol. Punjrath *et al*., 1997 used blast freezing (-21^{0}C) to enhance the shelf life of *paneer* blocks to more than 1 year at -19^{0}C.

The effect of various modified atmosphere (MA) (100% N_2, 50% N_2+50% CO_2, 100% CO_2) and different packaging materials viz., P1 (PET/PE) and P2 (PET/PE/Metellosin/PE) was studied on the quality of *paneer* stored at 30 ± 1°C by Karthikeyen *et al*., 2006. Results revealed that chemical, microbiological, rheological and sensory qualities of fresh *paneer* packed under various MA in P1 and P2 packaging materials did not differ significantly from control samples. During storage at 30 ± 1°C, *paneer* under 100% CO_2, had significantly lower acidity, soluble nitrogen (SN), free fatty acids (FFA), coliforms, standard plate count (SPC) and yeast and mould count (YMC), and had higher pH, hardness, springiness, cohesiveness, chewiness, higher flavour, body and texture and total scores than control. The interaction effect between gas and packages was found to be non-significant for all the parameters during the storage period. The control *paneer* samples and the modified atmosphere packaged *paneer* showed a shelf life of 1 and 2 day, respectively, at 30 ± 1°C.

Market Status

In India, the potential growth of indigenous products is still to be and till date major part is confined to local players which process the commodity at small scale and unorganized level without maintenance of hygiene standards which often results in undesirable outbreaks of various microbial-borne illnesses. Recently some major players have entered into this market and with the result *paneer* now can be seen in many shelves of the superstores. *Paneer* is currently marketed by many brands such as Amul, Britannia, Mother Dairy etc. and among them Amul is the national brand leading its sales year by every year. Since the product is available in tamperproof sealed poly- pouches, the quality of Amul Fresh *Paneer* does not get much affected and can be stored in the refrigerator for 15 days whereas Frozen *Paneer* can be stored for 180 days. The same is easy to use as it can be cut, fried and grated as per the choice. AMUL frozen *paneer* manufactured by Amul Dairy commissioned country's first fully-automatic *paneer* plant having manufacturing lines of capacity upto 30 tones/day and was established on 1st Nov'2009. With over 50 per cent share in organized market, Amul is presently the only national brand that sells *paneer*, the dairy product that counts for an estimated Rs 1,000 crore business combining both organized and unorganized players where the share of organized players stands at around Rs. 150 crore. Mother Dairy *paneer* is vacuum packed and is available in 100g, 250g and 1 kg pack. 200 g vacuum packed *paneer* from Britannia is also available in market and confers a shelf life of 5 days at refrigerated temperature.

Conclusion

Paneer is an important indigenous nutritious and wholesome dairy product. It is of great value in diet because it is a rich source of high quality protein, fat, minerals and vitamins. *Paneer* is used as a base material for the preparation of large number of culinary dishes and it is a popular food product at the common household level as well as in ever increasing organized food chains. Most of the *paneer* is produced in unorganized sector in very small quantities using conventional methods. Myriads of work have been done in scaling up the production of *paneer*. Use of mechanized and semi-mechanized systems viz. membrane processes, centrifugal method, in-package texturisation needs to be undertaken for larger production of *paneer* at industrial level. This will not only result in uniform quality of *paneer* with better yield but will also improve the microbial status of *paneer*. Shelf life is again a limitation for large scale production of *paneer*. Use of various methods viz antimicrobials, biopreservatives, heat sterilization techniques, blast freezing, modified atmosphere packaging etc. can improve the shelf life of product many folds.

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