



Study on the Economics of Spent Hen Meat Puffed Product

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ABSTRACT

Animal protein is one of the most important food products essential for normal growth of human body. Incorporation of waste protein (Spent Hen) of poultry industry and thus reducing the cost of production of Value added Spent Hen Meat Puffed Product was main motto of the following study (Abdul Latif, 2007). The study explains in detail about economic statistics (MOA, 2009) of production since from the incorporation of spent hen meat and other ingredients required for the production of Spent hen meat puffed product to its final use (Shaaban Abdel, 2004). The present study was aimed at economic study of value added Hot Extruded puffed product by incorporation of spent hen meat emulsion in the flour in various proportions. Spent hen meat emulsion and two flour mixtures (Corn flour and Rice flour) were admixed in 15:85 (T₁), 20:80 (T₂) and 25:75 (T₃) proportions to obtain emulsion based dough to produce hot extruded puffed product. Hot extruded puffed products thus obtained by twin screw hot extruder were rich in protein because of incorporation of spent hen meat which possessed almost 10-15% protein. Puffed product from flour mixture admixed with spent hen meat emulsion in different proportion can be effectively manufactured by using twin screw hot extruder. Puffed products produced were studied for the economic survey comparing other meat products in the meat industry and also tried to adopt the best possible methodology of production of cheapest form of highly Value added puffed products in meat industry (Mustafa Ibrahim, 2003).

Key words: Extrusion, Cooking, Puffed, Swollen.



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INTRODUCTION

The Meat and Poultry Industry Economic Impact study measures the combined impact of the meat processing, poultry processing, hide and skin production and offal production industries (hereafter meat and poultry products). The industry is defined to include not only the production of meat and poultry based products, but meat distribution and retailing. The protein products of animal food contain different amino acids and fats, which are necessary for normal growth of human body. As a result of constant increase in population, the demand (Dhehibi, 2003) increased for animal protein products of various types such as red meat, fish or poultry due to awareness for health and nutrition (Elhawary, 1992). Also, the average per capita income is one of the most important indicators of the progress or failure of States. A study of the demand (Deaton, A 1980) of necessities of life requires high degree of importance. It is an admitted fact that the living standards of members of the community and the spending on a particular commodity or a certain group of food items are heavily influenced by the level of overall spending on the sets of goods and services.

Extrusion is a process in which material is pushed through an orifice or a die of given shape. The pushing force is applied using twin-screw extruder. Extrusion processing of food materials has become an increasingly important manufacturing method, and its application has broadened substantially in the last two decades (Karwe M.V., Food extrusion vol. III). The principle of operation is: raw materials are fed into the extruder barrel and screw(s) pushed toward die and cutter. From transport phenomenon, extrusion process can be a combination of several processes such fluid flow, heat and mass transfer, mixing, shearing, particule size reduction, melting, texturizing, caramelizing, shaping and forming of different types of product (Karwe M.V., Food Process Engineering). Depending on the product, one or many of these processes will take place in an extruder. Economic development is normally accompanied by improvement in country food supply and gradually eliminates the problem of nutrient deficiency. India is number one in livestock population with poultry population of 613 million. Livestock sector contributes approximately 4% to GDP and 27% to agricultural GDP (Kumar, 2008). In addition to providing nutritional security to the poor, it offers employment to millions of people in rural areas. The world production of various kinds of meat is 281.6 MT out of which India's share is 4.19 MT (FAO, 2009). In comparison with other livestock sectors, the poultry industry in India is well organized and progressing towards modernization. The rapid growth of poultry industry during the last four decades has made our country one of the largest producers of broiler. Today poultry is one of the fastest growing segments of the agricultural sector in India and now the world's third largest egg producer and the fifth largest producer of broilers.

Among the various classes of poultry birds, broilers are heavier in body weight and contain high fat (Kondaiah *et al.*, 1993). The availability of culled and spent hens has also increased many folds with rapid development of poultry layer industry. Spent hens are those birds of poultry industry whose egg laying capacity is over. The meat from spent hen is generally tough, less tender and poor in functional properties, because of its increased collagen content and cross linkages (Bailey, 1984). Unfortunately, the toughness prevents spent hens use in whole meat food and reduces the market value in many countries such as Korea, Taiwan, Japan and United state (Sams, 1990., Nowsad *et al.*, 2000 a and b., and Lee *et al.*, 2003). As the egg laying capacity of layer bird is absolute, the farmers have to face a problem discarding spent hen. The disposal of layer hens is one of the main economical and environmental problems of the poultry industry. Egg producer worldwide disposes off 2.6 billion spent hens usually after they have finished their laying cycle (Singh *et al.*, 2001).

Hence, attempt should be made for obtaining better returns by the way of adopting suitable methods for economic utilization of spent hens. Spent hens are usually slaughtered and used in feed production and concentrated stock preparations, or sold for domestic consumption in soups and stews (Ajayah *et al.*, 1992., and Voller- Reasonover *et al.*, 1997). However, a better use of hens at the end of laying cycle, for example in the manufacturing of food products with higher added value, could provide economic profits. Fast food is one of the world's largest growing sector. India's fast food industry grew by 40% and generated a billion dollars in sales by 2005 (MFPI, 2005). In last six years,



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foreign investment in this sector stood at Rs. 3600 million, which is about one-fourth of total investment made in this sector. The snack products, which are mostly available in large amounts in the market (Hamid Mohammed,1996) are made of cereals, which are high in carbohydrates and fat but low in protein. The snack foods cover a wide range of food products. They are consumed as a light meals or a partial replacement for a regular meal. Snack foods could be redesigned to be nutritious, contain ingredients which are attractive to consumers, and meet regulatory requirements (Shukla, 1994). When meat is used in a snack based products it provides some nutritional diet through the products to the consumer. They are many ingenious variations in the processes used by the industry, which serve to increase the range of products manufactured. Utilization of spent hen meat in the snack products will increase the palatability and nutritional value of such foods.

Extruded puffed snacks are usually made from degermed corn or corn grits, wheat, rice or other cereals. There has been a remarkable growth in the varieties and popularity of such products because they are easily affordable, tasty, easy to make and nutritive. These products are flavoured with cheese, spices, onion, garlic or chilly and broadly fall in the fast food category. The popularity of extrusion technologies has increase in last two decades because of the following reasons:

- Extrusion cost operation has lower and higher productivity than other heating and forming processes;
- Costs of extrusion operation are lower than other operations like heating and forming processes in food industry;
- Faster time processing reduces energy consumption.

Blending of flours with meat in place of other vegetable products have not been tried yet in extrusion process. The present study was thus planned to study the economics of puffed products from spent hen meat.

MATERIALS AND METHODS

The present study on economics of hot extruded puffed product from spent hen meat was done in various phases. The materials used and methodology employed during the study are discussed here under.

Source of raw materials for the production of spent hen meat puffed product

Spent hen meat

Approximately 72 weeks old spent hens reared at the Poultry Science Department of Bombay Veterinary College, Parel were procured, slaughtered and dressed according to traditional halal method (Shaaban Abdel,2002). The body fat was removed and deboning of dressed spent hen was done manually removing all tendons and separable connective tissues. Fresh spent hen meat thus obtained was used for further processing immediately.

Ingredients mixture

The ingredients mixture formula for spent hen meat emulsion shown in Table 1 was formulated on the basis of preliminary trials conducted in the Department of Livestock Products Technology, Bombay Veterinary College, Mumbai. Different proportions of ingredients were tried for one kg lot of spent hen meat emulsion in the preliminary trials.

Experimental details

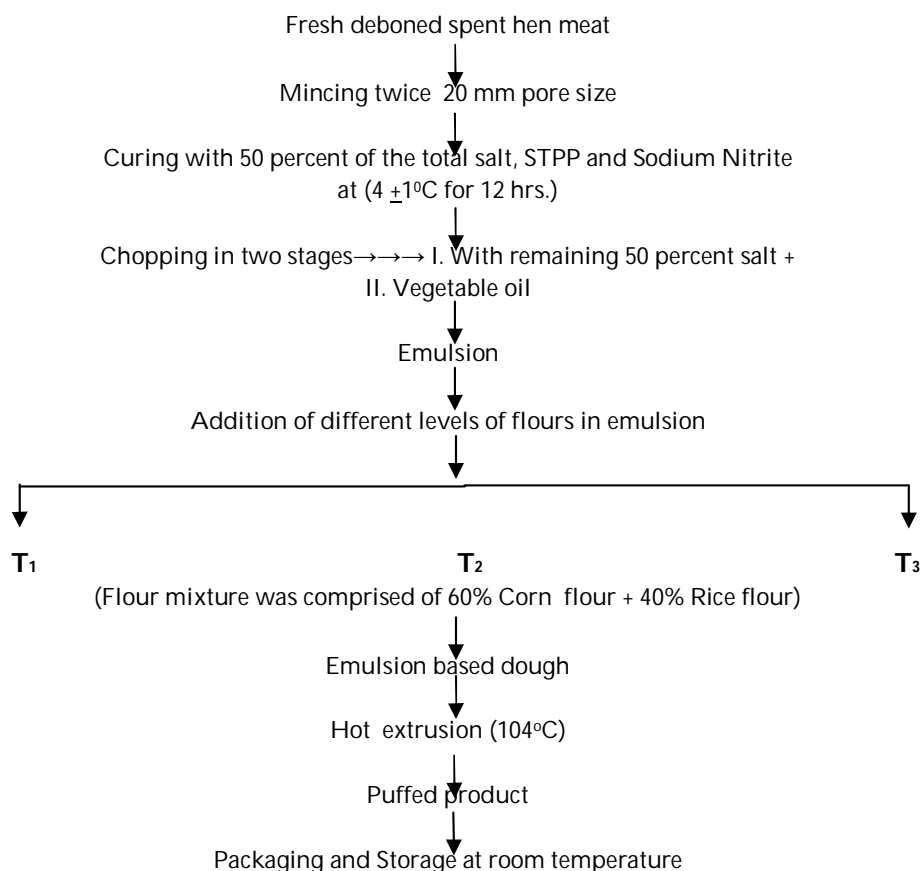
To standardize spent hen meat emulsion based dough suitable for puffed product preparation

The procedure for emulsion based dough from spent hen meat was standardized after several preliminary trials for one kg lot of spent hen meat emulsion based dough.





Modified method for preparation of spent hen puffed product



Where: -

T₁ (15%emulsion 85% flour mixture)

T₂ (20%emulsion 80% flour mixture)

T₃ (25%emulsion 75%flour mixture)

Extrusion of Puffed product

A BTPL laboratory scale twin screw extruder was used in Department of fish processing, Central Institute of Fisheries Education, Mumbai (Fig.1) in the present study. The extrusion cooking was done on a twin screw extruder (BTPL LST EB10). The power of the motor kept at a speed (350 rpm) is 7.6 kW. A full-factorial design (two factors each at three levels and three replicates) was employed. Screw speed was kept constant (350 rpm) during the experiment. Moisture contents of the extrusion feeds were 14.3, 17.5, and 21.0%, respectively. The extruder temperature was set at 104°C where as barrel temperature was maintained 140°C. Feed rate of volumetric feeder equipped with twin screw was set 14gm/min. A 2 mm circular die was used for extrusion. Materials to be extruded (emulsion and flour mixture) were mixed and formed dough and put into feeder hoop to reach the feed for extrusion. The moisture content of the feed analysed for which sampling done before putting to feeder hoop and kept the sample into hot air oven for moisture analysis. Extruded product coming out the sieve (die) was collected in clean tray and sampling is done in two lots and packed in polythene bags among which one for sensory evaluation and another for chemical and microbial analysis.



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Economics of the puffed product

The economics of the puffed product prepared from spent hen meat was also worked out on the basis of present cost of various ingredients and cost of other processing parameters.

Statistical analysis

The data obtained during the experiment were analyzed by Analysis of Variance following standard procedure (Snedecor and Cochran, 1989).

RESULTS AND DISCUSSION

The present study on Economics of hot extruded puffed product from spent hen meat was performed in various phases at the departments of Livestock Products Technology of Bombay Veterinary College and Fish Processing Department, Central Institute Fisheries Education, Varsova, Mumbai. In the initial stages of the experiment stable emulsion from spent he was obtained after altering the process used for emulsion from broiler meat (Omar Ahmed, 2002). The proper dough consistency was determined after several trials on various combinations of different types and levels of flours and spent hen meat emulsion to obtain a proper hot extruded puffed product. Various sieve sizes were also tried in the preliminary study and finally 2 mm diameter sieve size was used for extrusion.

The moisture content of the feed, extrusion temperature and barrel temperature are very important for the manufacture of puffed products. Accordingly on the basis of preliminary trials the moisture content of the feed was maintained in the range of 14 to 22 percent for different treatments under study. The barrel temperature was maintained at 140°C to obtain the extrusion temperature 104°C. The steps / processes used in the preliminary trials were selected on the basis of suitable dough quality which was giving proper hot extruded puffed product. Thus the three treatments (T_1 – 15% emulsion + 85% flour mixture, T_2 – 20% emulsion + 80% flour mixture and T_3 - 25% emulsion + 75% flour mixture)(Fig.2,3,4) as discussed above were finalized and were replicated four times. The results obtained are discussed in the present paper.

The dough obtained for three different treatments were extruded through laboratory scale twin screw extruder at extruder temperature 104°C in 350 rpm speed and 2 mm diameter sieve size separately. Spent hen puffed product (SHPP) thus obtained from each treatments were divided into two lots. The first lot was used for sensory evaluation and zero day analysis. Second lot was aseptically packaged in polyethylene bags and kept in airtight container to monitor the shelf life at regular interval.

Economics of SHPP

There are varieties of puffed products throughout the world which are famous with their typical manufacturing processes. The puffed products are very famous at the urban level in Indian continents which are manufactured by using different flours. Incorporation of spent hen meat in different flours used for puffed product making is one of the thoughts of value addition of spent hen meat. Puffed products are now very famous in a generation of all ages. Looking at the popularity of this food, it was also decided to work out the economics of the spent hen meat puffed product (SHPP) (Fig.5) in the present study. For this purpose cost of spent hen meat emulsion was worked out by considering the existing market prices (Mustafa Ibrahim Abu-Saad, 2003) of different ingredients and the proportion used for the spent hen meat emulsion as depicted in Table 2.

As depicted in Table 3 a cost of one kg spent hen meat emulsion was estimated as Rs. 63.51 (Moschini, G., 1995) by considering the present cost of all the ingredients required for emulsion formulation. While calculating the cost of





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puffed product (SHPP) apart from cost of emulsion, cost of various processing parameters as depicted in Table were considered. From the Table 4 it is clear that the cost of spent hen puffed product (SHPP) after considering all the parameters and after extruding was Rs. 45.65, 48.37 and 51.08 respectively for T₁, T₂ and T₃. The average yield observed in the present study for hot extruded puffed product was 80 percent for all the treatments. The higher cost of T₃ followed by T₂ and T₁ was because of higher proportion of spent hen meat in the formulations.

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Table 1. Ingredients used in formulation for spent hen meat emulsion

Ingredients	Quantity in (%)
Spent hen deboned meat	90.59
Common salt	3
Vegetable oil	6
Sodium nitrite	0.01
Sodium polyphosphate	0.4

Table 2. Composition of dough for hot extruded spent hen puffed product

Treatments	Proportion of emulsion (%)	Proportion of flour mixture (%)	Types of flours
T ₁	15	85	Corn flour (60%)
			Rice flour (40%)
T ₂	20	80	Corn flour (60%)
			Rice flour (40%)
T ₃	25	75	Corn flour (60%)
			Rice flour (40%)

NOTE: T₁ (Dough with 15% emulsion), T₂ (Dough with 20% emulsion), T₃ (Dough with 25% emulsion)





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Table 3. Cost of one kg spent hen meat emulsion

Sr. No.	Ingredients	Qty (gms)	Rate(Rs./kg)	Emulsion cost in Rs/kg
1	Meat	915.9	60	54 .95
2	Salt	20	18	00 .36
3	Oil	60	90	05 .40
4	Sodium nitrite	0.1	642	00 .64
5	STPP	4	540	02 .16
Cost of one kg emulsion				63 .51

Table4. Cost of one kg spent hen meat puffed product (SHPP)

Sr.No.	Ingredients		T ₁		T ₂		T ₃	
			Qty. (g)	Cost (Rs.)	Qty. (g)	Cost (Rs.)	Qty. (g)	Cost (Rs.)
1	Emulsion (Rs./kg)	63.51	150	9.52	200	12.70	250	15.87
2	Corn flour (Rs./kg)	20.00	510	10.20	480	09.60	450	09.00
3	Rice flour (Rs./kg)	20.00	340	06.80	320	06.40	300	06.00
4	Hot extrusion cost (avg. 10 mins. / batch of one kg)	Rs.60/hr		10		10		10
5	Yield (%)	80	800		800		800	
6	Actual cost of SHPP (Rs./kg)		45.65		48.37		51.08	

NOTE: T₁- Dough with 15% emulsion, T₂-Dough with 20%emulsion, T₃- Dough with 25% emulsion



Fig 1. Twin screw extruder (Department of fish processing, Central Institute of Fisheries Education, Mumbai)



Fig.2: Hot extruded puffed product prepared with 15 % emulsion and 85% flour mixture (T₁)





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Fig.3: Hot extruded puffed product prepared with 20 % emulsion and 80% flour mixture (T2)



Fig.4: Hot extruded puffed product prepared with 25 % emulsion and 75% flour mixture (T3)



Fig.5: A sample of dough prepared for the preparation of hot extruded puffed product (SHPP)





Antidiarrheal Activity of Different Forms of *Myrtus communis* Leaves Extract in Experimentally Induced Diarrhea in Rats

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ABSTRACT

This work was performed to value the antidiarrheal activity of different forms of *Myrtus communis* leaves extracts (aqueous, ethanol 70% and methanol 90%) in rats by studying its effect on diarrhea and enteropooling activity induced by castor oil which included some parameters like beginning of diarrhea, weight and frequency of wet feces and total number, weight of defecation and volume of intestinal fluids. The results of this study showed that the extract of *Myrtus communis* leaves have antidiarrheal activity with less potency than reference drug (loperamide) against all parameters, and the methanol 90% extract was potent form than ethanolic 70% and aqueous extract.

Key words: Antidiarrheal, *Myrtus communis*, Leaf extract.

INTRODUCTION

Diarrhea defined as defecation of frequent more watery feces than in normal persons. It is usually a symptom of gastrointestinal disorder (1), which may occur as a result of an infection of the intestine (2), or by non-infectious origins (3). In human, diarrheal disease is an important cause of mortality in kids less than five years old, where the mortality about 525 000 kids annually (4). In veterinary field the diarrhea considers main diseases that cause important financial losses in productive animals especially young, for example young cattle diarrhea is a frequently reported disease and a foremost source of monetary damage to cattle producers. The damage related to calf death due to diarrhea in Norway which produces 280,000 heads annually was valued to be about ten million US dollars (5). According to study performed in Korea, the mortality percent in calf was 53.4% due to diarrhea (6). Also diarrhea considered the main cause of mortality in kids (7).

In general the treatment consists of lost fluid compensation and certain drugs, including antibiotics and antidiarrheal drugs, but these drugs may affect motility, consequently reducing intestinal peristalsis (8, 9). In general, the treatment is aimed to reducing the discomfort and troublesomeness of frequent bowel mobility and frequency of



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fecal passage (10). Drugs like, Loperamide, racecadotril, and muscarinic receptor blockers like atropine as well as another antidiarrheal agents, are good medications for treating diarrhea, but all these medications have some adverse effects, like vomiting by racecadotril and intestinal obstruction and constipation by loperamide (11). Because the unwanted effects of medicines that used in controlling diarrhea the need for alternatives has become urgent. Herbs considered finest alternatives for the cure of such ailments. Medicinal herbs signify a encouraging foundation for the finding of new antidiarrheal agents. These herbs are cheaper and available than conventional medicines. Myrtle is a member of the Myrtaceae family which contains about 145 genres and more than 5500 species (12). Myrtle employed in old-fashioned medicine to treat many illnesses like hypoglycemia, poor appetite, gastrointestinal disorder including diarrhea and peptic ulcer, pulmonary diseases and wounds healing (13,14) additionally, it has good antioxidant and antimicrobial activity (15). This broad action of myrtle due to the fact that the plant rich in bioactive composites e.g. phenolic acids, tannins and flavonoids (16).

This study designed to know the effect of different extracts of myrtle leaves in combating diarrhea that induced experimentally in rats.

MATERIALS AND METHODS

Plant materials

Fresh leaves of myrtle were collected and dried in shade at room temperature then powdered by electrical grinder. Three solvents were used and the extracts were made by putting the powder in distal water, ethanol 70% and methanol 90% for 2 days. After cooling, the mixture of each extract was filtered with gauze then with filter paper, the filtrates were dried by incubator at 40°C and resulted products were cooled at 4°C.

Animals

Albino Wister rats of both sex were purchased from the national center for drug control and research / Baghdad. Animals were kept under standard environment with free access to diet and water and adapted for one week before performing the experiment.

Castor oil induced diarrhea experiment

This method was achieved according to (17) the animals put into equal five groups, 5 rats for each one and fasted for 18hrs with free access to water. The first group administrated loperamide 3mg/kg B.W. and served as positive control, second, third and fourth groups treated orally with aqueous (AE), ethanol 70% (EE) and methanol 90% (ME) at 350mg/kg B.W. while the last one administrated distilled water and kept as negative control. After 1hr of loperamide and extracts administration, all animal received 1ml castor oil orally. Then experimental animals were sited in cages with a white paper lined floor to collect fecal materials, this paper was replaced every 1hr. Onset of diarrhea, number and weight of wet feces and total number and weight of fecal output were recorded up to 4hrs. Then percentages of diarrheal prevention, weight of wet, and total defecation were measurement by using formulas described by (18, 19):

$$\text{Percentage of inhibition (\%)} = \frac{\text{mean number of WFC} - \text{mean number of WFT}}{\text{mean number of WFC}} \times 100$$

WFC is wet feces in control group and WFT is wet feces in test group.





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$$\text{Percentage of wet fecal output (\%)} = \frac{\text{mean weight of wet feces of each treatment group}}{\text{mean weight of wet feces of control group}} \times 100$$

$$\text{Percentage of total fecal output (\%)} = \frac{\text{mean fecal weight of each treatment group}}{\text{mean fecal weight of control group}} \times 100$$

Castor oil induced enteropooling activity experiment

This method done according to (20) and the strategy of animals grouping carried out as mentioned in castor oil induced diarrhea experiment. After 1hr of treatment with loperamide and extracts, all animals including control group received 2ml of castor oil, and 2hr later the animals sacrificed and the small intestine was dissected from pylorus to cecum. The intestinal content were evacuated in graduated cylinder and their volume was measured and the percent of reduction in intestinal fluids was calculated according to the following formula:

$$(T_c - T_t / T_c) \times 100$$

T_c = mean fluid accumulation in control group

T_t = mean fluid accumulation in test group

RESULTS

Castor oil induced diarrhea

The result of this experiment showed that the standard antidiarrheal drug (loperamide) was more powerful in stopping diarrhea as compared with the all prepared *Myrtus communis* extracts, table 1. Loperamide delays beginning of diarrhea 213±0.70m with significant difference (P<0.05) as compared with the other groups. The extracts also delay the beginning of diarrhea with significant difference (P<0.05) between all these forms, where the ME 90% was more potent than EE 70% and AE respectively. Loperamide also was the potent in reducing the number of wet feces 1.80±0.37 with statistical difference (P<0.05) as compared with the other groups and the percent of inhibition was 81.63%. As for the ME 90% the number of the wet feces was 4.60±0.97 with inhibition percent 53.06% and there was significant difference (P<0.05) as compared with control 9.80±0.80 and AE 8.20±0.73 but not with EE 70% 6.60±0.92, while AE was not differ significantly from control and EE 70% groups. In weight of wet feces parameter there was no statistical difference between all forms of extract and control, where the weight was 2.70±0.26, 2.00±0.77, 1.44±0.40 and 1.84±0.46 g for control, AE, ME 90% and EE 70% respectively, while there was statistical difference between loperamide groups as compared with other groups except with ME 90%. The total fecal output was decreased by all prepared extracts, AE 2.60±0.56g, ME 90% 1.90±0.42g, and EE 70% 2.20±0.39g but without statistical difference between these extracts and control 3.00±0.63g, while the loperamide was the potent 1.10±0.25g with significant difference as compared with AE and control groups.

Castor oil induced enteropooling activity

As shown in table 2, the ME 90% was the potent among the different forms of *Myrtus communis* extract in reducing the volume of the intestinal content 2.00±0.37ml with reduction percent 41.52% and the difference was significant (P<0.05) as compared with AE 2.90±0.14ml and control 3.42±0.20ml but not with EE 70% 2.00±0.37ml, and the last one (EE) was differs significantly as compared with control but not with AE. In other words the different forms of extract were reducing the volume of the intestinal fluids significantly as compared with control except for AE, the difference was not significant. The reference drug (loperamide) was the potent significantly in reducing the intestinal fluids volume 1.10±0.07ml as compared with all groups of the experiment with reduction percent 67.83%.



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DISCUSSION

Diarrhea, regardless of the cause its characterized by increase fluids and motility of the intestinal tract which leads to passage of more loose or liquid stools per day. The classical inducer of experimental diarrhea (castor oil) cause releasing of ricinoleic acid which causes inflammation of the intestinal mucosa and thus leads to release of the prostaglandin that increases water and electrolytes secretion and intestinal motility (21). Prostaglandin which synthesized by epithelial cells of intestine plays important role in pathophysiology of diarrhea, so the inhibition of the prostaglandin may contribute in stopping diarrhea. In this study extract reduced diarrheal parameters (Onset of diarrhea, number and weight of wet feces and total number, weight of fecal output and volume of intestinal fluids) with different degrees and less than standard drug (loperamide). This antidiarrheal effect of this extract may be due to its bioactive components like myrtucommulone, flavonoids and tannins, where the myrtucommulone inhibits the biosynthesis of prostaglandin decisive factor in evoking diarrhea (22). Flavonoids revealed antidiarrheal activity against castor oil -induced diarrhea by increasing the colonic fluid absorption in the presence of this oil (23). As well as flavonoids showed antispasmodic effect may be due to blocking of calcium channel (24). Tannins also revealed antidiarrheal effect possibly due to increasing trans-epithelial resistance and impeding the cystic fibrosis transmembrane conductance regulator and calcium activated chloride channels, which play important role in controlling salt and water transport across epithelial tissues (25), or by reducing the intracellular Ca^{2+} inward current or by activation of the calcium pumping system, which induces the muscle relaxation (26).

CONCLUSION

Myrtus communis leaves extract possess antidiarrheal activity and reduced the parameters of diarrhea by using different solvent (water, ethanol 70% and methanol 90%), where the methanolic one was potent than the other two forms.

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Table 1. Effect of different extracts of *Myrtus communis* leaves on castor oil induced diarrhea in rats

Parameters groups	onset of diarrhea (minute)	No of wet feces	% of inhibition	weight of wet feces (g)	% of wet fecal output	total fecal output (g)	% of total fecal output
Control	56.30±0.29 E	9.80±0.80 A	-----	2.70±0.26 A	-----	3.00±0.63 A	-----
loperamide	213.00±0.70 A	1.80±0.37 E	81.63	0.42±0.14 B	15.55	1.10±0.25 B	36.66
AE	80.20±1.58 D	8.20±0.73 AB	16.32	2.00±0.77 A	74.07	2.60±0.56 A	86.66
ME 90%	128.30±2.21 B	4.60±0.97 C	53.06	1.44±0.40 AB	53.33	1.90±0.42 AB	63.33
EE 70%	110.00±2.27 C	6.60±0.92 BC	32.65	1.84±0.46 A	68.14	2.20±0.39 AB	73.33

Different letters refer to significant difference between treated groups at (P<0.05)

Values: Means± S.E

N: 5

Table 2. Effect of different extracts of *Myrtus communis* on castor oil induced enteropooling activity in rats

parameter groups	volume of intestinal fluids (ml)	% of fluids reduction
Control	3.42±0.20 A	
Loperamide	1.10±0.07 E	67.83
AE	2.90±0.14 AB	15.20
ME 90%	2.00±0.37 C	41.52
EE 70%	2.30±0.27 BC	32.74

Different letters refer to significant difference between treated groups at (P<0.05)

Values: Means± S.E

N:5





RESEARCH ARTICLE

Risk Factors in Perforated Appendicitis

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ABSTRACT

Appendectomy is still one of the most commonly performed emergency surgical procedures worldwide. Avoiding delays in the diagnosis in these patients may play a role in reducing observed morbidity. To analyze the clinic-pathological profile and outcomes of patients undergoing emergency appendectomies to determine risk factors influencing perforation. A prospective analytic study that involve 108 patients underwent emergency appendectomies at Al-kindy teaching hospital from (April 2014 to March 2015). The time interval from the onset of symptoms to the time of seeking advice in the emergency room was coded in hours and defined as patient delay. The time from the emergency room visit to the operating room was defined as hospital delay and included time to diagnosis and time waiting for surgery. Appendicitis was categorized into two groups complicated (gangrenous or perforated) and uncomplicated (acute focal, acute suppurative). A comparison between them was made in regard to Gender, Age, clinical presentation, investigations (White blood cells count), patient's delay, hospital delay, Site of appendix, presence of fecolith and immunocompramization. Of all the risk factors studied, six factors predicted appendiceal rupture, age (10-19y), the patient's pre-hospital time delay was the most important risk factor for perforation. The male is slightly more affected than female in a percentage of 55.55% (60male) and 44.44% (48female). Increased White Blood cells count $> 13^9/L$ was seen in 64 (59.259%) of all patients at presentation. In the *perforated* group 28 patients out of 32 had high White blood cells count (87.5%) compared to patients in the non-perforated group 36 (47.386%). The most common site for complicated appendicitis was pelvic 16 out of 32 (50%). The presence of fecolith in the lumen of appendix was considered significant risk factor for perforation 23/32 (71.875%). In our study we have concluded that the acute appendicitis should be considered in the diagnosis of acute abdominal pain, young age group, male gender pelvic position of the appendix, high white blood cells count and high grade fever is found to be the most important risk factors and in suspicious diagnosis U/S and CT scan are the best diagnostic tools that confirm the diagnosis

Keywords: - complicated, uncomplicated, appendicitis.



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INTRODUCTION

The appendix varies considerably in length and circumference, the average length is between 7.5 to 10 cm, the lumen is irregular, being encroached upon by multiple longitudinal folds of mucous membrane lined by columnar cell intestinal mucosa of colonic type (1). While appendicitis is clearly associated with bacterial proliferation within the appendix, no single organism is responsible (2). A mixed growth of aerobic and anaerobic organisms is controversial. Obstruction of the appendix lumen has been widely held to be important, and some form of luminal obstruction, either by a fecolith or stricture is found in the majority of cases (1, 2). A fecolith (sometimes referred to as an appendicolith) is composed of inspissated fecal material, calcium phosphate, bacteria and epithelial debris; Rarely a foreign body is incorporated into the mass. A fibrotic stricture of the appendix usually indicates previous appendicitis that resolved without surgical intervention.

Obstruction of the appendiceal orifice by tumor, particularly carcinoma of the caecum, is an occasional cause of acute appendicitis in middle-aged and elderly patients. Intestinal parasites, particularly enterobius vermicularis (pinworm), can proliferate in the appendix and occlude the lumen (1,2,3). Obstruction of the appendiceal lumen seems to be essential for the development of appendiceal gangrene and perforation. Yet, in many cases of early appendicitis, the appendix lumen is patent despite the presence of mucosal inflammation and lymphoid hyperplasia (1). Occasional clustering of cases among children and young adults suggests an infective agent, possibly viral, which initiates an inflammatory response. Seasonal variation in the incidence is also observed (1). Lymphoid hyperplasia narrows the lumen of the appendix, leading to luminal obstruction (1, 2). Once obstruction occurs, continued mucus secretion and inflammatory exudation increase intraluminal pressure, obstructing lymphatic drainage. Edema and mucosal ulceration develop with bacterial translocation to the submucosa. Resolution may occur at this point either spontaneously or in response to antibiotic therapy.

If the condition progresses, further distension of the appendix may cause venous obstruction and ischaemia of the appendix wall. With ischaemia, bacterial invasion occurs through the submucosa and muscularis propria, producing acute appendicitis. Finally, ischaemic necrosis of the appendix wall produces gangrenous appendicitis, with free bacterial contamination of the peritoneal cavity. Alternatively, the greater omentum and loops of small bowel become adherent to the inflamed appendix, walling off the spread of peritoneal contamination, and resulting in a phlegmonous mass or paracaecal abscess. Rarely, appendiceal inflammation resolves, leaving a distended mucus-filled organ termed a 'mucocoele' of the appendix (1, 2). Acute appendicitis is still the commonest abdominal surgical emergency with a lifetime incidence of 7% (3). Appendicitis is known to be the disease of the younger age groups with only 510% of cases occurring in the elderly population. However, the incidence of the disease in this age group seems to be rising due to recent increase in the life expectancy (2, 3, 4). Furthermore, the often atypical presentation and delay in seeking medical help have been associated with delay in diagnosis and treatment resulting in high morbidity and mortality rates (4,5). The prognosis of uncomplicated appendicitis in both young and old age groups is nearly equal. However, perforation worsens the condition dramatically resulting in higher rates of morbidity and mortality (4, 5).

MATERIALS AND METHODS

Patients

In all patients with a clinical diagnosis of acute appendicitis who were admitted and operated on at Al-kindy teaching hospital the following data were collected: age, gender, white blood cells count, position of appendix, presence of fecolith, and pathological finding from (April 2014 to March 2015). Patients with acute appendicitis were divided in two groups of complicated (gangrenous/perforated) and uncomplicated (acute focal/acute suppurative) based on their pathological reports. Patients underwent routine investigations (white blood cells count, general urine





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analysis) and selective investigations (Pregnancy test, blood urea nitrogen, Random Blood Sugar, erect abdominal X-ray) before operation.

Ethical Consideration

Research approval was obtained from the health authority in Al-Kindy teaching hospital Verbal consent was taken from each patient included in the study. The patients were informed about the study's objective and that collected data was used only for the stated research purpose

Exclusion criteria

Exclusion criteria included the presence of appendicular abscess and phlegmon. Patients treated conservatively. The diagnosis of appendiceal abscess or phlegmon in suspected patients was confirmed either by ultrasonography or at laparotomy.

Operative technique

All patients received intravenous peri-operative prophylactic 3rd generation cephalosporin 50mg/kg and metronidazole 7.5mg/kg before the skin incision and two postoperative doses. If complicated (gangrenous / perforated) appendicitis was encountered at the time of surgery, antibiotics were continued for at least 5 – 7 days. The McBurney incision and muscle-splitting technique was used. Change of muscle splitting (grid iron incision) into muscle cutting (Rotherfordmorison) was used in some cases. Care was taken to avoid contamination of the subcutaneous tissue and adjacent peritoneal cavity during the procedure. Moist packs were used to isolate the cecum and inflamed appendix. Appendectomy was performed with stump ligation. The peritoneum, internal oblique and transversus abdominus and external oblique aponeurosis were sutured by absorbable material in layers. Before skin closure, the wound was irrigated copiously with warm saline. Scarpa's fascia and skin were closed with interrupted vicryl sutures. The skin and subcutaneous tissue were closed primarily by (non-absorbable) silk or polypropylene material.

Statistical analysis

The Statistical Package for the Social Science (SPSS) version 17.0 was used to enter and analyze data. The confidence level at 95% and the P value is significant when equal or < 0.05 mean, standard deviation (SD) and frequency distribution was calculated. Statistics were calculated using chi-square or Z score analysis for categorical variables.

RESULTS

Of all the risk factors studied, the patient's pre-hospital time delay was the most significant risk factor for perforation P value <0.00001 (Table-1). The male to female ratio in the uncomplicated appendicitis group was 1.1:1 and 1.66:1 in the complicated group. According to the clinical features which were collected from the patients the following percentage were obtained (Table-2). Appendicitis most commonly affect patients between the age of (10-19)y, 46 patients in a percentage of (42.59%) as showing in (figure-1). The male is slightly more affected than female in a percentage of 55.55% (60male) and 44.44% (48 female) as showing in (Table -3).

Z score analysis used to calculate P value

Uncomplicated appendicitis was diagnosed in 76(70.37%) patients, and complicated appendicitis in 32(29.629%) patients. Regarding the time delay for treatment and as shown in Table 1, patients in the perforated group had a



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significantly longer Prehospital time delay than those in the non-perforated group (79.6 h and 47.3 respectively) with <0.05 p-value. At the same time, the table did not show a statistically significant difference between the two groups in regard to In-hospital delay (p-value 0.7923) (Table-I). Regarding the clinical presentation, all patients were complaining of abdominal pain. However, the typical migratory pain that starts around the umbilicus and shifts later to the right lower abdomen was described only by 50 (46.296%) patients, 37(48.648%) patients in the non-perforated and 13 (40.625%) in the perforated group. Anorexia was present in 75(69.44%) of all patients but it could not differentiate perforated from non-perforated groups. Nausea and vomiting were present in 60(55.55%) of the patients and were more significantly found in the non-perforated group (Table-4). Of all patients, 43(39.81%) were febrile at presentation ($>38^{\circ}\text{C}$).

Fever was seen more in the perforated group of patients 22(68.75%). Localized tenderness in the right lower abdomen was present in 82(75.92%) of all patients with 57(75%) in the non-perforated compared to 25(78%) in the perforated group. Although rebound tenderness was found in 68(62.962%) of patients, it did not differentiate between both groups (Table-4). Increased white blood cells count $> 13^{\ast}/\text{L}$ was seen in 64 (59.259%) of all patients at presentation. In the complicated group, 28 (87%) patients had high white blood cells count compared to 36 (47%) patients with the non-complicated group. The most common site for complicated appendicitis was pelvic 16/32(50%). The presence of fecolith in the lumen of appendix consider significant risk factor for perforation 23/32(71.875%) as shown in (figure-2).

DISCUSSION

Acute appendicitis continues to be the commonest cause of surgical abdominal emergency. It was often thought to be the disease of the young but as a result of recent increases in lifetime expectancy, the incidence of acute appendicitis also increased in the elderly (1,6,7). The incidence of appendiceal perforation in acute appendicitis is estimated to be in the range of 20-30% which increases to 32-72% in patients above 60 years of age (7-9). The reasons behind this high rate were postulated to be due to the late and atypical presentation, delay in diagnosis and surgical intervention, and to the age specific physiological changes (10-12). In our study, perforated appendicitis was found in (29.629%) patients, a result that lies within the range reported by many other reports (3,12-15).

This study showed that gender predilection was for male more than female for perforation (1.66:1); (62.5%) patients were males and (37.5%) were females. Delay in presentation was found by many authors to be the reason behind the higher rate of perforation seen in the population (1,2,16,17). Our study showed that perforation rate correlated well with delayed presentation (pre-hospital delay $79.6\pm 6\text{hr.}$) but did not correlate with the in-hospital delay (3,18). The triad of right lower abdominal pain and tenderness, fever and leukocytosis is reported to be present in (78.125%) of complicated patients (19). In our study, all patients presented to the hospital with abdominal pain. However, the classical migratory pain of appendicitis was present in only (46.296%) of them. Localized tenderness in the right lower abdomen which is considered to be the most constant diagnostic physical sign for appendicitis (2,19) was present in 82% of cases. Both features (migratory pain and localized tenderness) were seen more often in the un complicated rather than in the complicated group.

This finding may be explained by the fact that patients with perforated appendix would show poor localization of pain as well as more generalized lower abdominal tenderness and guarding (7). Fever ($>38^{\circ}\text{C}$) was present in 39.81% of all patients in this study and was much higher in the perforated group (68.75%), a result which is in agreement with the findings of other studies (3,5,7). WBC was found elevated in 59.259% of all our patients with values higher in the perforated group as 87.5% of cases (20,21). Appendix in pelvic anatomical position (50%) is more liable to perforate (1,2,22) and presence of fecolith (71.875%) is highly correlated to perforation (1,2). When comparing our result with a previous study that was done in the same region 10 years ago (23), we found that the incidence of appendiceal perforation did not decrease over the past ten years in spite of improved health care programs and diagnostic facilities. We think that this failure was due to the underestimation of the seriousness of the abdominal pain in this age group by both the patient and the primary health care (23).





CONCLUSIONS

In our study we have concluded that the acute appendicitis should be considered in the diagnosis of acute abdominal pain. Young age group, male gender pelvic position of the appendix, high white blood cells count and high grade fever is found to be the most important risk factors. In suspicious diagnosis U/S and CT scan are the best diagnostic tools that confirm the diagnosis.

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Table-1: -Show the relation between Pre-hospital &Post-operative ospital delay and complication of acute appendicitis

Variable	Complicated	Noncomplicated	p-value
Mean delay in surgical Treatment			
Pre hospital delay	79.6 ± 62.4 hr	47.3 ± 4.7 hr	<0.00001
Hospital delay	7.1 ± 3.3 hr	15.1 ± 5.3 hr	<0.7923
Post op. hospital stay	5.4 ± 3.3 days	2.2 ± 1.1 days	N.S

*N.S= No Significant

Table-2: - Show the clinical presentation of acute appendicitis

Clinical feature	No.(%)
R.I.F pain	108 (100%)
Tenderness and rebound tenderness	82(75.92%)
Nausea	60(55.55%)
Anorexia	75(69.44%)
Fever	43(39.814%)
Vomiting	60(55.55%)
Change in bowel habit	22(18.9%)

Table-3: - Show the relation of gender and the incidence of acute appendicitis

	Male	Female	Total No. of Patients	P-Value <0.05
Complicated(Perforated) Appendicitis	20	12	32	0.0455
Noncomplicated Appendicitis	40	36	76	0.00001
Total No. of Pt.	60	48	108	





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Table-4: - Show the clinical presentation, white blood cells count in relation to the study group

Variables	Total 108(100%)	Perforated 32(29.629%)	Non perforated 76(70.37%)	P-value <0.05
Migrating pain	50(46.296%)	13(40.625%)	37(48.684%)	N.S
Anorexia	75(69.44%)	22(68.75%)	43(56.578%)	N.S
Nausea & vomiting	60(55.55%)	18(56.25%)	42(55.26%)	N.S
Tender right lower abdomen	82(75.92%)	25(78.125%)	57(75%)	N.S
Rebound tenderness	68(62.962%)	23(71.875%)	45(59.21%)	N.S
Fever > 38°C	43(39.814%)	22(68.75%)	21(27.63%)	<0.05
WBC count	64(59.259%)	28(87.5%)	36(47.368%)	0.00001

*Z score used to calculate Pvalue. *significant p value <0.05

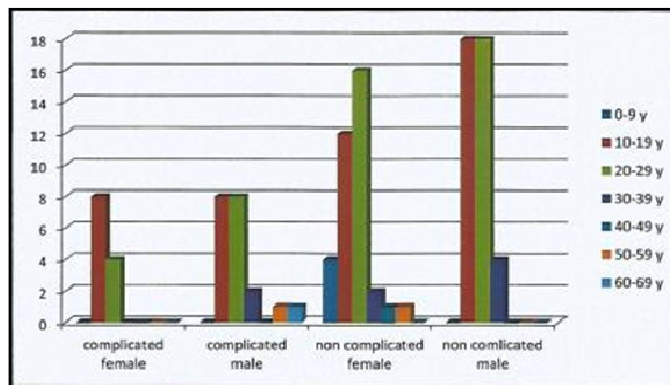


Figure -1: - Show the age group in decade, gender and study groups

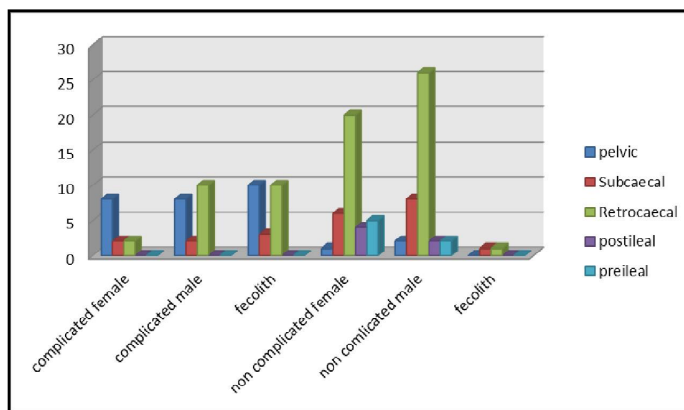


Figure-2: -Show the relation between Anatomical position of appendix and fecolith and acute appendicitis





RESEARCH ARTICLE

Doppler Assessment of the Fetal Cerebral Hemodynamic Response to Mild or Moderate Maternal Anemia

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ABSTRACT

Fetus depends completely on his mother for nutrition therefore anemia of the mother will affect intrauterine growth and development of the fetus. The aim of this study was to evaluate the fetal vascular adaptation to mild and moderate maternal anemia. Prospective and intervention. The study carried out in the obstetrics and gynecology department in Al-Zahra Teaching hospital, Al-Kufa University. Najaf, Iraq. The study started from April to September 2011. A total collected cases of anemia had 30 cases, 7 refused to participate, 11 had been designed as mild anemia (maternal hemoglobin level >9 g/L), and 12 had also designed as moderate anemia (maternal hemoglobin level <9 and > 6 g/L). Significant. Below certain level of hemoglobin content, there could be a direct relationship between the maternal hemoglobin content and fetal PO₂.

Key words: - Doppler assessment, fetal, hemodynamic response, maternal anemia.

INTRODUCTION

Doppler of the umbilical artery circulation is normally a low impedance circulation, with an increase in the amount of end-diastolic flow with advancing gestation (1,2). Umbilical arterial Doppler wave forms reflect the status of the placenta circulation, and the increase in end-diastolic flow that is seen with the advancing gestation is the direct result of an increase in the number of tertiary stem villi that takes place with the placental maturation (3,4). Diseases that obliterate small muscular arteries in placental tertiary stem villi result in a progressive decrease in end-diastolic flow in the umbilical artery Doppler waveforms until absent and then reverse flow during diastole is noted (5,6). Reversed diastolic flow in the umbilical arterial circulation represents an advanced stage of placental compromise and is associated with more than 70% of placental arterial obliteration (7,8,9,10). The notation of absent or reversed end-diastolic flow in the umbilical artery is commonly associated with severe intrauterine growth restriction and



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oligo hydroamnios (11,12). Doppler waveforms of the umbilical arteries can be obtained from any segment along the umbilical cord (13). The middle cerebral artery is the most accessible cerebral vessel to ultrasound imaging in the fetus, and it carries more than 80% of cerebral blood flow (14). The cerebral circulation is normally a high-impedance circulation with continuous forward flow throughout the cardiac cycle (15). This is the reverse of flow within the umbilical cord toward the placenta. In the presence of fetal hypoxia, central redistribution of blood flow occurs, resulting in an increased blood flow to the brain, heart, and adrenals, and a reduction in flow to the peripheries and placental circulations. This blood flow redistribution is known as the brain sparing effect reflex and plays a major role in the fetal adaptation to oxygen deprivation (15,16,17). Middle cerebral artery Doppler waveforms, obtained from the proximal portion of the vessel, immediately after its origin from the circle of Willis, have shown the best reproducibility (17).

Although middle cerebral artery Doppler evaluation often used to assess fetal wellbeing in the fetus with suspected intrauterine growth restriction, more recently, middle cerebral artery velocity has been used in assessing the degree of anemia in fetuses with hemolytic disease due to RH isoimmunization and parvovirus B19 infection (18). Pregnancy is associated with physiological changes at the level of the uterine vasculature, resulting in a progressive decrease in impedance with the advancing gestation. This maternal adaptation to pregnancy is thought to result in from the trophoblastic invasion of the maternal spiral arterioles in the first half of pregnancy. The invaded maternal spiral arterioles are rendered maximally dilated and minimally responsive to the sympathetic and parasympathetic systems. This adaptation is intended to ensure a sustained increase in blood flow to the uterus during pregnancy (19, 20). The uterine circulation can be assessed by Doppler velocimetry of uterine arteries, each uterine vessel can be demonstrated by color Doppler as it crosses over the hypogastric artery and vein just before it enters the uterus at the uterine-cervical junction.

Pulsed Doppler velocimetry of the uterine artery should be obtained immediately after the vessel crosses the hypogastric artery and before it divides into the uterine and cervical branches. The presence of a notch in the waveform and an increase in the impedance index after 22 weeks of gestation characterizes an abnormal uterine circulation. A substantial risk of complication is noted in pregnancies that show an abnormal uterine circulation in the late second and third trimester. Pregnancy complication includes fetal growth restriction, preeclampsia, preterm delivery and nonreassuring fetal status in labour (21-23). Distribution of fetal blood flow (between the placental and cerebral regions) is determined with C/U resistance ratio, which is the ratio between the cerebral index (CRI) and umbilical resistance index (URI). This parameter is always more than 1.1 during normal pregnancy, but decrease in the case of hypoxia because of the URI increase (increase in placental resistance) and CRI decrease (cerebral vasodilatation) (24,25).

In severe intrauterine growth restriction associated with hypoxemia, there is an increased impedance to blood flow in the umbilical and the fetal renal arteries. At the same time, vasodilatation of the fetal middle cerebral artery occurs resulting in the so called brain sparing effect (compensatory flow or adaptation changes). These physiological adaptations have been demonstrated by changes in Doppler indices of the middle cerebral artery. Alteration of the placental vascular bed as induced by pregnancy –induced hypertension triggers a redistribution of the fetal cardiac output in favor of the brain because of vasodilatation at this level such cerebral vasodilatation has been related to fetal PO₂ decrease (26-29).

MATERIALS AND METHODS

The study designed as prospective one, carried out in the Obstetrics and Gynecology Department in Al-Zahra Teaching Hospital, Kufa University. Najaf, Iraq. The study started from April to September 2011. A total collected cases of anemia had 30 cases, 7 refuse to participate, 11 had been designed as mild anemia (maternal hemoglobin level >9 g/L), and 12 had also designed as moderate anemia (maternal hemoglobin level <9 and > 6 g/L). Both groups of patients were investigated and treated for 10 days' group 1 received oral iron daily; group 2 received one unit of red



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blood cell. The same maternal and fetal investigations were performed after 10 days. Informed consent has been obtained from each patient to participate in the study.

Measurement of hemoglobin

A venous sample of 0.02ml of blood was put in EDTA (ethylene diamine tetra acetic acid) tube, then added 5ml of drabken solution, wait for 5minutes then result read by Hb meter.

Monitoring of the growth and fetal circulation

Ultrasound and color Doppler scanning by Siemens AcusonX500 were carried according to a well-defined protocol done by Dr.faez. A. S.Kadhim, MD Radiology using three probes (transabdominal, transvaginal and superficial probes) with 3.5 MHz: Doppler investigation consisted of uterine, umbilical and middle cerebral artery recording at admission and 10days after treatment; Echography for fetal biometry (biparietal and abdominal diameter, femur length) was performed at admission only. Amniotic fluid index was measured by (laying the patient in supine position; A linear, curvilinear, or sector transducer can be used. Divide the uterus into four quadrants using the maternal sagittal midline vertically, and arbitrary transverse line approximately halfway between the symphysis pubis and the upper edge of the uterine fundus. The transducer must be kept parallel to the maternal sagittal plane and perpendicular to the maternal coronal plane throughout. The deepest unobstructed and clear pocket of amniotic fluid is visualized, and the image frozen. The ultrasound calipers are manipulated to measure the pocket in a strictly vertical direction. The process is repeated in each of four quadrants and the pocket measurements summed=AFI. If the AFI is less than 8 perform; evaluation three times and average the values) at admission and 10 days after treatment (18). FHR recording (cardiotocography) was performed at admission, 10 days after treatment and at the delivery.The FHR was considered to be abnormal in the case of low (<110beats/min) or high (>160beat/min)heart rate, low modulation, or variable decelerations. Apgar score at 5 minutes was considered abnormal when the score was less than 7. Normal delivery was defined as at term delivery without any sign of perinatal asphyxia or maternal complications (30).

RESULTS**Group 1**

Consisted of 11 pregnancies (mean maternal hemoglobin level 99 +/- 0.9 g/L) [range 90-113g/l].

Group 2

Consisted of 12 pregnancies (mean maternal hemoglobin level 79 +/-0.60g/L) [range 60-89g/l], maternal and perinatal data shown in (table-1) and (table-2) At admission the cerebral and cerebral/umbilical Doppler indexes, amniotic index, and biometry were lower in group 2. The uterine index was normal in both groups. An abnormal fetal heart rate was found in group 2 only (1%). At day 10, maternal hemoglobin level and amniotic index increased more in group 2 than in group 1. The cerebral index and the cerebral-to-umbilical resistance ratio increased only in group 2. The abnormal fetal heart rate disappeared in group 2 only one fetus in group 2 had growth restriction who had Apgar score less than 7 at 5 minute.Uterine and umbilical RI was normal at admission and at 10 days after in both groups.Middle cerebral artery RI was significantly lower in group2 at admission but became normal after the treatment.The pregnant women were admitted between 30 and 36 weeks of gestation, parity &maternal age are similar in two groups.



**Maysoon Mahde Saleh****DISCUSSION**

Anemia affects primiparous and multiparous women to a similar extent, and there was no correlation with age, gestational age at admission, or delivery date (1). The fetal Doppler examination that was performed at admission showed that moderate maternal anemia group 2 induced significant hemodynamics changes at the cerebral, but neither at the uterine nor at the umbilical level. The cerebral vasodilatation in group2 was confirmed by the cerebral resistance level that was lower than normal, resulted in an increased cerebral blood flow, which probably maintained the fetal oxygen supply (31). For quantifying the fetal hemodynamic response, in the presented study C/U ratio cut off value, which is usually quite constant (C/U=1.1) during normal pregnancy and allows for the quantification of the blood flow redistribution. More over this ratio was found to be more powerful for the prediction of fetal growth, retardation, hypoxia, at least for fetuses at <34 weeks of gestation and in pathological pregnancies with fetal hypoxia, in the current case there was no sign of placental alteration, as in pathological pregnancies, so the blood flow redistribution probably was related to maternal anemia and subsequent reduction in fetal PO₂ (Fetal umbilical artery flow velocity waveforms and placental resistance: clinical significance after treatment oxygen carrying capacity improved (32). In group 2 the C/U values were below the normal range <1.1 which confirms that the fetus had to adapt by increasing blood flow redistribution towards the brain.

Such adaptation was confirmed by the increase of both the cerebral index and the C/U ratio after maternal red blood cell transfusion (Fetal blood velocity waveforms in normal pregnancies (33). The increase in cerebral resistance after the transfusion without significant change in umbilical or uterine resistance confirms that maternal anemia does not create placental dysfunction and that the situation can be restored quickly by blood transfusion to the patient. In group 1, the C/U values were within the normal range, which means that the blood flow distribution between the brain and placenta was normal, despite the maternal hemoglobin content being significantly lower compared to normal. While in the presented study there was significant changes (34). The amniotic index was reduced in group 2 compared to group 1 at admission and recovered after transfusion, even though it remains lower in group 2 (35). After transfusion in group 2 the group average amniotic fluid index rise, and there was no abnormal fetal heart rate in either groups, the sequence of changes in Doppler and biophysical parameters as severe fetal growth restriction worsens (36).

Besides the amniotic fluid index, abnormal fetal heart rate is related to fetal hypoxia as well, which may suggest that, below certain level of hemoglobin content, there could be a direct relationship between the maternal hemoglobin content and fetal PO₂ (36). In the present study, there was no access to the duration of maternal anemic period. On the other hand, it was demonstrated that the fetal cerebral vasodilatation during a period of several weeks under hypoxia does not protect against cerebral organic damage (36). Thus, because of moderate maternal anemia triggers a marked fetal cerebral vasodilatation, the hemoglobin content if below 80 g/l has to be restored as soon as possible to suppress the cerebral vasodilatation (31). In group 2, the transfusion restored the maternal hemoglobin content up to the level of group 1 at admission and suppressed the fetal blood flow redistribution by cerebral vasodilatation (31).

The absence of fetal blood flow redistribution for maternal hemoglobin levels above 90 g/l suggests that, the oxygenation of the fetus was still satisfactory. The placenta is a huge reservoir of maternal blood; therefore, even if the maternal blood oxygen content is lower than normal, there is enough oxygen passing through the placenta (37). Finally, it seems that the maternal anemia is for the fetus an acute but reversible aggression that can be prevented as soon as it is detected by means of maternal blood assay.

CONCLUSION

Close monitoring of the fetal umbilical and cerebral circulation by Doppler examination in anemic pregnancies allows the measurement of the amplitude of the fetal vascular response and the fetal recovery as well. Hemoglobin





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content below 90 g/l associated with marked fetal hemodynamic adaptation and must be treated with acute red blood cell transfusion. Maternal hemoglobin above 90 g/l is not sufficient to trigger fetal blood flow redistribution and can be treated with oral iron intake.

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Table 1. General maternal & fetal parameter

Parameter	Group 1 Mild Anemia	Group 2 Moderate Anemia	P value
Age(y)*	28.7	28.3	N.S
Parity*	2.1	1.8	N.S
Gestational age at admission(wks.)*	32.6	32.5	N.S
Fetal biometry at admission (%)*	59.39	33.39	
Delivery(wk.)*	37.2	37.3	N.S





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Fetal weight(g)*	2024.444	2054.3	
IUGR (%)	0	10	N.S
Premature (%)	0	0	N.S
Abnormal FHR at delivery(%)	0	10	N.S
Apgar Score at5min			N.S

N.S=Not significant

***Data given as mean**

Table 2.Perinatal data at admission & after 10days

Parameter	Group 1 Mild Anemia	Group 2 Moderate Anemia	P value
Abnormal FHR at admission(%)	0	1(10%)	N.S
Abnormal FHR at day(10%)	0	1	N.S
Hb at admission(g/l)*	9.77	7.99	N.S
Hb at day10(g/l)*	10.66	8.82	N.S
Amniotic index at admission(mm)*	20.3	18.06	N.S
Amniotic index at day10(mm)*	21.47	20.6	N.S
UtRI at admission	normal	normal	N.S
UtRI at day10	normal	normal	N.S
URI at admission*	0.5212	0.52616667	N.S
URI at day10*	0.74414286	0.7535	N.S
CRI at admission*	0.7555	0.756166667	N.S
CRI at day10*	0.863625	0.873888889	N.S
C/U ratio at admission*			
C/U ratio at day10*			

N.S=Not significant

***=Data are given as a mean**





RESEARCH ARTICLE

Knowledge and Adoption of Indigenous Weather Forecasting Practices by the Farmers

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ABSTRACT

The present research study has been conducted in Akot Panchayat Samiti in Akola district of Maharashtra state to assess the knowledge and adoption of indigenous weather forecasting practices by farmers. As the population of veteran farmer who passes indigenous knowledge not going to last long, a major cause of loss of indigenous knowledge is disruption of traditional channels of oral communication. Such research studies are urgent, because a great deal of knowledge is rapidly being lost. And hence it will help in keeping proper record in the form of indigenous knowledge inventory. The result will be useful to educational institute, state agricultural department and central department of agriculture etc.

Key words: - adoption, indigenous technology knowledge

INTRODUCTION

Farmers in distress prone districts of Vidarbha region are facing the hardships of impacts of climate change and non-effectiveness of traditional knowledge of weather forecasting is further adding fuel into their distress. Farmers believed that under changing climate many of indigenous weather forecasting knowledge are not worth doing as they did earlier. (1) suggested climate change policy research for adaptation should seek to input community's knowledge such that the technologies developed was able to deliver better food and health practices more efficiently and within the context of community practice. Underlying the importance of farmers knowledge of weather forecasting in Vidarbha region, there is urgent need to assess the farmer's indigenous technology knowledge under change climate, the changes they observed compared to their ITK about their weather forecasting they had witnessed





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during their younger age and how they are using ITK to the noticed changes so that policy could be framed amalgamating ITK with the modern weather forecasting knowledge for better adaptation to climate change.

MATERIALS AND METHODS

Locale of the Study

The present study was carried out in Akot Panchayat Samiti of Akola district in Maharashtra state. This area was selected purposively because tribal communities viz. Aandh, Korku and Gond are predominant and hold ITK in this region.

Selection of Tahasil's

Out of seven tahasil's in Akola district, selection of Akot tahasil has been done.

Selection of Villages

The list of villages in Akot Panchayat Samiti was obtained from the concerned taluka agriculture officer considering maximum tribal population. A list of 15 villages was prepared in consultation with agriculture officer

Selection of Beneficiaries

For identification and documentation of indigenous weather forecasting practices, 50 old farmers, above 60 years of age and who was able to give information about ITK's were interviewed for documentation of ITK's. These 50 farmers were selected randomly from first five most tribal populated villages among the selected 15 villages. Ten farmers were selected from each selected village for identification and documentation of ITK's. Another sample of 150 farmers was drawn from 15 selected villages by adopting proportionate random sampling method for their knowledge and adoption about weather forecasting practices.

Research Design & Data Collection

An exploratory research design was used for the present study. Interview schedule was prepared and pre-tested. Data were collected in face to face situation. The interview with the beneficiaries was conducted at their resident or place with comfort situation.

Identification and Documentation of Indigenous Weather Forecasting Practices

For identification and documentation of indigenous weather forecasting practices, 50 old farmers, farming women and key informants was contacted and interviewed and group discussion was also held with them for identification and documentation of indigenous weather forecasting practices they know. A list of all indigenous weather forecasting practices may or may not be followed by the farmers was prepared and on that basis, indigenous weather forecasting practices were identified. After identification of indigenous weather forecasting practices, they were translated into statements for getting its qualitative and quantitative characterization; observation method was also followed to identify ITK and its nature wherever possible. The identified ITK information was documented thereafter for situation specificity and congruity to local situations.





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Scientific Base of ITK for Preliminary Validation

Identified ITK's was referred to different agricultural scientists of Dr. PDKV, Akola for preliminary validation of the identified ITK, on the basis of the available knowledge and expertise, the scientific base for various ITK's identified was prepared. The rationality of respondents was also recorded with the help of key informants and old farmers at the time of documentation and later on during data collection from the second group of sample.

Extent of Knowledge

For the present study, it has been operationally defined as the body of understood information possessed by an individual farmer about indigenous weather forecasting practices. English and English (1961) defined knowledge is a body of understood information possessed by an individual. A teacher made knowledge test on the identified indigenous weather forecasting practices prevalent among farmers was developed and administered to the farmers. Their responses were elicited on two point continuum i.e. Yes/No or Correct/Incorrect including no reply and numerical score of one and zero was assigned, respectively. Thus the total knowledge score was worked out and finally this raw score was converted in to knowledge index. Finally index was computed to measure the knowledge in quantitative terms with the help of following formula.

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

On the basis of Mean + 1 Standard deviation the farmers were categorized as low, medium and high

Extent of Adoption

For the present study, it has been operationally defined as the extent of adoption of identified indigenous weather forecasting practices by farmers. A teacher made adoption test on the identified indigenous weather forecasting practices was developed and administered to the farmer. Their response were elicited on two point continuum i.e. adoption and no adoption, with the score of one and zero respectively. Keeping in view the nature of present study, the adoption of particular identified ITK practice by the farmer was computed on the basis of respondent perception about the ITK practice given on response continuum viz.worth doing and sometimes come true. The response was considered as adoption of particular ITK practice, if farmer response was obtained on these options. To assess the non adoption of particular identified ITK practices by the farmer, their perceptions about particular practice on response continuum was recorded viz.not considered and forecasting failing and were considered as non adoption Thus the total adoption score was worked out and finally this raw score was converted into adoption index with the help of following formula.

$$\text{Adoption index} = \frac{\text{Actual obtained adoption score}}{\text{Maximum obtainable adoption score}} \times 100$$

On the basis of Mean + 1 Standard deviation the farmers were categorized in three categories low, medium and high



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RESULTS AND DISCUSSION

Practice-Wise Knowledge of Indigenous Weather Forecasting Practices

Practice-wise knowledge of respondents about indigenous weather forecasting practice has been presented in Table 1. It was noticed by the researcher that knowledge of predicting weather was high in tribal community (korku) dominated village. Five most popular knowledge prevailing among farming community in forecasting weather were regarding, If the crowd of locust or ants are seen then there is sign of heavy rainfall to come (96.67%), If sparrow rub their body with soil then there is possibility of rain on the same day or other day (98.67%), If wind blow from east to west then there are chances of rains within 2 days (96.33%), If mosquito starts noise early morning (96.67%), it indicates chances of rains within two days. If bird 'cuckoo' goes over farm area and uttered the word *perte vha- perte vha* (start sowing) (96.00%), then rains are expected and sowing should be started. Rains come from south-west (from Balapur side) then sowing should be started (97.33%), Heavy golden yellow flowers on Amaltas or (Cassia fistula) tree, then rains are expected in a month (69.33%). (2) also observed in his study on respondents perception on climate change that respondents have indigenous knowledge of little drizzling rains with cloudy atmosphere during day time and clear sky at night indicates drought like situation, crow if lay their eggs in upper part of the tree indicate less rainfall. Whereas, if place eggs in middle portion of the tree indicate good rainfall, severe hot summer than the normal indicates heavy rains in the rainy season if the bird 'titwa' laid eggs in the river basin then the chances of floods will be minimum and no floods in that particular area. The traditional beliefs recorded at serial no 13, 28, and 40 above (Table 1) are in line with the observations of (2) and (4) reported that the tree Amaltas or Golden Shower or Tree (Cassia Fistula) is a unique indicator of rain. It bears bunches of golden yellow flowers in abundance about 45 days before the onset of monsoon.

From Table 2, it is observed that majority of the respondents (56%) had medium level of knowledge about indigenous weather forecasting practices, followed by 29.33 per cent respondents had low level and 14.67 per cent respondents had high level of knowledge about indigenous weather forecasting practices. Therefore, it is inferred that most of the respondents had medium level of knowledge about indigenous weather forecasting practices. The finding of present study goes corroborates to the findings of (5) who concluded that majority of respondents had moderate level of knowledge about indigenous agricultural practices

Practice-Wise Adoption of Indigenous Weather Forecasting Practices Has Been Given in Table 3

It was noticed by the researcher that adoption of indigenous weather forecasting practices was highly adopted in tribal community (korku). Five most popular indigenous weather forecasting practices adopted by farming community in present study were regarding, If frog from well and ponds croaks loudly and in chorus then there is sign of severe rainfall to come (58.00%), If sky appears likes cotton bolls scattered during rainy season, it indicates rains in 03 days (53.33%), If sparrow rub their body with soil then there is possibility of rain on the same day or other day (47.33%), If wind blow from east to west then there are chances of rains within 2 days (44.67%), If mosquito starts noise early morning (37.33%), it indicates chances of rains within two days. If bird 'cuckoo' goes over farm area and uttered the word *perte vha- perte vha* (start sowing) (14.67% adopted the practice, while remaining 95.31% perceived this practice failing in recent years), then rains are expected and sowing should be started. Rains come from south-west (from Balapur side) then sowing should be started (54.00%), Heavy golden yellow flowers on Amaltas or (Cassia fistula) tree, then rains are expected in a month (28.67%).

The finding of the present study more or less fall in line with findings reported by (2) in his study on farmer's perception on climate change found that if crow place eggs in middle portion of the tree it indicates good rainfall. 28.00% surveyed respondents opined that this forecasting sometimes come true. He further observed that if bird 'cuckoo' goes over farm area and uttered the word *perte vha- perte vha* (start sowing) (39.00% noticed failing in





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recent years), then it is an indication of onset of monsoon. Little drizzling rains with cloudy atmosphere during day time and clear sky at night indicates drought like situation (22.00%, believed, it sometimes came true). From the Table 4, it is observed that majority of the respondents (64.66%) had medium level of adoption about indigenous weather forecasting practices followed by 18.67 per cent of respondents had high level of adoption about indigenous weather forecasting practices and (16.67%) had high level of adoption of indigenous weather forecasting practices.

Therefore, it is inferred that most of the respondents had medium level of adoption about indigenous weather forecasting practices. The finding of present study go to corroborates the finding of (5) who concluded that majority of respondents had moderate level of adoption about indigenous agricultural practices and (5) who reported that relatively higher proportion of respondents (69.16%) had moderate level of adoption followed by 24 per cent of farmer with high level of adoption of indigenous agricultural practices.

CONCLUSION

The finding of the present investigation revealed that majority of the respondents possessed medium level of knowledge about indigenous weather forecasting practices. The study suggest that the systematic efforts on the part of extension agency are required to promote indigenous weather forecasting practices by imparting knowledge to them in the areas under the guidance of subject matter specialists. The valuable indigenous knowledge may be provided through publications of agriculture department and agricultural University. The adoption of indigenous agricultural practices revealed that majority of the respondents had medium level of adoption. It was thus implied that the adoption of indigenous weather forecasting practices should be made effective from productive point view.

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Table1. Knowledge of Respondents about Indigenous Practices of Weather Forecasting In Study Area

Sl. No.	Indigenous weather forecasting practice	Frequency (n = 150) (Percentage) (Responded Yes)
1	If the sky becomes reddish and 'ravan kate' appears in the sky	136 (90.67)
2	If dragonfly flies nearer to the ground surface during evening hours	119 (79.33)
3	If the crowd of locust or ants are seen	145 (96.67)
4	If Sparrow rub their body with soil	148 (98.67)
5	If ring like structure appear around the moon having star gathering around the ring	107 (71.33)
6	If wind blow from east to west	146 (96.33)
7	Twelve pots representing 12 'nakshatra's are filled with water and kept in row randomly. There after bull are allowed to drink the water. The bull touches or	45 (30)





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	drinks water from the respective pot.	
8	If sky appears likes cotton bolls scattered during rainy season	143 (95.33)
9	If cuckoos drink water stored in animal footprint	81 (54.00)
10	If bird cuckoo goes over the farm during the onset of monsoon and uttered 'perte vha'	144 (96.00)
11	Squirrel if stare continuously towards sky and busy in gathering nuts	24 (16.00)
12	If there was severe hot summer than the normal.	35 (23.33)
13	Little drizzling rains with cloudy atmosphere during day time and clear sky at night	71 (47.33)
14	If the bird 'titwa' or Toodi or lapwing bird laid eggs in upper part of the field or If lay eggs in lower portion of the field	25 (16.67)
15	If the bird 'titwa' or Toodi or lapwing bird lay eggs in the river basin.	13 (8.67)
16	If frog from well and ponds croaks loudly and in chorus	128 (85.33)
17	If a dog starts to whine for no reason,	23 (15.33)
18	If there is full blossom of pods on Babul(Acacia nilotica subsp. indica) tree in a particular year	136 (90.67)
19	If cows lie down and refuse to go to pasture.	44 (29.33)
20	Crown built nest on tree in three portion	121 (80.67)
a	Top portion of tree	
b	Middle portion of tree	
c	Bottom portion of tree	
21	Lightning fall in north pole of the earth	111 (74.00)
22	If bird starts sudden tweeting and started returning to their nests	110 (73.33)
23	If rains occur in 'rohini nakshatra' (Before monsoon) rainfall occur	101 (67.33)
24	If wind started blowing from east to west and cloud blow from west to east	114 (76)
25	If large number of snakes are seen during summer season	34 (22.67)
26	If thundering of clouds occurs in 'magha nakshatra'	77 (51.33)
27	If thundering of clouds occurs in 'aadra nakshatra'	88 (58.67)
28	2-3 rains in 'paushya nakshatra'	52 (34.67)
29	Rains come from south-west (from Balapur side)	146 (97.33)
30	Dense fog in early morning	(88) 58.67
31	Peacock florist its plumage	75 (50.00)
32	Dark and black clouds during winter	98 (65.33)
33	If rainbow appears in the eastern direction	51 (34.00)
34	Dried appearance of Neem tree(Azadiracta indica) during summer season	30 (20.00)
35	If sparrow took bath in pond	87 (58.00)
36	If ox takes long breathing.	143 (95.33)
37	If mosquito starts noise early morning	145 (96.67)
38	If big mosquito start biting in evening hours	139 (92.67)
39	Heavy blossom on Bamboo tree	50 (33.33)
40	Heavy golden yellow flowers on Amaltas or (Cassia fistula) tree	104 (69.33)





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Table 2. Distribution of Respondents According to Their Level of Knowledge

Knowledge level	knowledge Index range	Frequency (n = 150)	Percentage
Low	Up to 45	44	29.33
Medium	45.1 to 77.5	84	56.00
High	77.6 and above	22	14.67
	Total	150	100.00

X = 61.91

SD = 16.04

Table 3. Distribution of Respondents According to Practice Wise Adoption of Indigenous Weather Forecasting Practice

Sl. No	Indigenous practice of weather forecasting	Rationale behind the practice	Adoption	Perception about adopted practice		Non adoption	Perception about non adopted practice	
				* WD	* SCT		*NC	*FF
1	If the sky becomes reddish and 'ravan kate' appears in the sky	There is possibility of rainfall within two days	73 (48.67)	14 (19.17)	59 (80.83)	77 (51.63)	13 (16.88)	64 (83.12)
2	If Dragonfly flies nearer to the ground surface during evening hours	Indication of high rainfall	40 (26.67)	4 (10.00)	36 (90.00)	110 (73.33)	32 (29.09)	78 (70.91)
3	If the crowd of locust or ants are seen	Sign of heavy rainfall to come	10 (6.67)	3 (30.00)	7 (70.00)	140 (93.33)	71 (50.71)	69 (49.29)
4	If sparrow rub their body with soil	There is possibility of rain on the same day or other day	71 (47.33)	11 (15.49)	60 (84.51)	79 (52.67)	2 (2.53)	77 (97.47)
5	If ring like structure appear around the moon having star gathering around the ring	There is possibility of rains within 2 days	63 (42.00)	18 (28.57)	45 (71.43)	87 (58.00)	44 (50.57)	43 (49.43)
6	If wind blow from east to west	There is possibility of rains within 2 days	67 (44.67)	19 (28.36)	48 (71.64)	83 (55.33)	4 (4.82)	79 (95.18)
7	Twelve pots representing 12 'nakshatra's are filled with water and kept in row randomly. There after bull are allowed to drink the water. The bull touches or drinks water from the respective pot.	The bull touches or drink water from the respective pot represents nakshatra indicates the good amount of rainfall in particular 'nakshatra's	14 (9.33)	7 (50.00)	7 (50.00)	136 (90.67)	111 (81.62)	25 (18.38)
8	If sky appears likes cotton bolls scattered during rainy season	There are chances of rains within 3 days	80 (53.33)	12 (15.00)	68 (85.00)	70 (46.67)	5 (7.14)	65 (92.86)
9	If cuckoos drink water stored in animal footprint	This is an indication to start sowing	7 (4.67)	2 (28.57)	5 (71.43)	143 (95.33)	70 (48.95)	73 (51.05)





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10	If bird cuckoo goes over the farm during the onset of monsoon and uttered 'perte vha'	Rains are expected and sowing should be started	22 (14.67)	9 (40.91)	13 (59.09)	128 (85.33)	6 (4.69)	122 (95.31)	
11	Squirrel if stare continuously towards sky and busy in gathering nuts	Chances of rainfall and severe winter respectively	7 (4.67)	2 (28.57)	5 (71.43)	143 (95.33)	126 (88.11)	17 (11.89)	
12	If there was severe hot summer than the normal.	Chances of heavy rains in rainy season	6 (4.00)	1 (16.67)	5 (83.33)	144 (96.00)	115 (79.86)	29 (20.14)	
13	Little drizzling rains with cloudy atmosphere during day time and clear sky at night	It indicates drought like situation	18 (12.00)	3 (16.67)	15 (83.33)	132 (88.00)	78 (59.09)	54 (40.91)	
14	If the bird 'titwa' or Toodi or lapwing bird laid eggs in upper part of the field or If lay eggs in lower portion of the field	It indicates high rainfall and low rainfall respectively.	6 (4.00)	2 (33.33)	4 (66.67)	144 (96.00)	125 (86.81)	19 (13.19)	
15	If the bird 'titwa' or Toodi or lapwing bird lay eggs in the river basin.	Chances of floods will be minimized and no floods in that particular area.	6 (4.00)	2 (33.33)	4 (66.67)	144 (96.00)	135 (93.75)	9 (6.25)	
16	If frog from well and ponds croaks loudly and in chorus	An indication of severe rainfall	84 (56.00)	19 (22.62)	65 (77.38)	66 (44.00)	24 (36.36)	42 (63.64)	
17	If a dog starts to whine for no reason,	Expected a storm.	9 (6.00)	2 (22.22)	7 (77.78)	141 (94.00)	127 (90.07)	14 (9.93)	
18	If there is full blossom of pods on Babul(Acacia nilotica subsp. indica) tree in a particular year	In that year rainfall is better and also mung and wheat yield will be better	71 (47.33)	11 (15.49)	60 (84.51)	79 (52.67)	11 (13.92)	68 (86.08)	
19	If cows lie down and refuse to go to pasture.	A storm to blow up soon	11 (7.33)	3 (27.27)	8 (72.73)	139 (92.67)	106 (76.26)	32 (23.74)	
20	Crow built nest on tree in three portion		68 (45.00)	20 (29.41)	48 (70.59)	82 (55.00)	28 (34.15)	454 (65.85)	
	a	Top portion of tree							It indicates rainfall is less in that year
	b	Middle portion of tree							It indicates rainfall is good in that year
	c	Bottom portion of tree							It indicate rainfall is severe in that year
21	Lightning fall in north pole of the earth	An indication of rainfall within in 1-2 days	66 (44.00)	20 (30.30)	46 (69.70)	84 (56.00)	39 (46.430)	45 (53.57)	





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22	If bird starts sudden tweeting and started returning to their nests	There is possibility of hailstorm	31 (20.67)	11 (35.48)	20 (64.52)	119 (79.33)	40 (33.61)	79 (66.39)
23	If rains occur in 'rohini nakshatra' (Before monsoon) rainfall occur	Sowing should be started.	44 (29.67)	17 (38.64)	27 (61.36)	106 (70.33)	49 (46.23)	57 (53.77)
24	If wind started blowing from east to west and cloud blow from west to east	Chances of rainfall within 1 to 2 hours.	71 (47.33)	14 (19.72)	57 (80.28)	79 (52.67)	36 (45.57)	43 (54.43)
25	If large number of snakes are seen during summer season	Good rainfall season expected.	8 (5.33)	1 (12.50)	7 (87.50)	142 (94.67)	116 (81.69)	26 (18.31)
26	If thundering of clouds occurs in 'magha nakshatra'	Then rainfall come in next five 'nakshatra'	18 (12.00)	5 (27.78)	13 (72.22)	132 (88.00)	74 (56.06)	58 (43.94)
27	If thundering of clouds occurs in 'aadra nakshatra'	Then in next five 'nakshatra' rainfall is sure	31 (20.67)	6 (19.35)	25 (80.65)	119 (79.33)	62 (52.10)	57 (47.90)
28	2-3 rain in 'paushya nakshatra'	Reduce the chances of rains during the kharif	39 (26.00)	6 (15.38)	33 (84.62)	111 (74.00)	98 (88.29)	13 (11.710)
29	Rains come from south-west (from Balapur side)	Start sowing	81 (54.00)	27 (33.33)	54 (66.67)	69 (46.00)	4 (5.80)	65 (94.20)
30	Dense fog in early morning	Indicates the rains are over	56 (37.33)	9 (16.07)	47 (83.93)	94 (62.67)	64 (68.09)	30 (31.91)
31	Peacock florist its plumage	Possibility of rainfall	43 (28.67)	5 (11.63)	38 (88.37)	107 (71.33)	75 (70.09)	32 (29.91)
32	Dark and black clouds during winter	Chances of heavy infestation of pest and diseases	71 (47.33)	20 (28.17)	51 (71.83)	76 (52.67)	52 (65.82)	27 (34.18)
33	If rainbow appears in the eastern direction	Chances of less rains	19 (12.67)	7 (36.84)	12 (63.16)	131 (87.33)	98 (74.81)	33 (25.19)
34	Dried appearance of Neem tree(Azadiracta indica) during summer season	Chances of drought in rainy season	8 (5.33)	2 (25.00)	6 (75.00)	142 (94.67)	120 (84.51)	22 (15.49)
35	If sparrow took bath in pond	There will be withdrawn of rains for few days during the rainy season	41 (27.33)	11 (26.83)	30 (73.17)	109 (72.67)	64 (58.72)	45 (41.28)
36	If ox takes long breathing.	Rainfall appear nearby(50to100km)	61 (40.67)	11 (18.03)	50 (81.97)	89 (59.33)	6 (6.74)	83 (93.26)
37	If mosquito starts noise early morning	Chances of rains within two days	56 (37.33)	16 (28.57)	40 (71.43)	94 (62.67)	8 (8.51)	86 (91.49)
38	If big mosquito start	Chances of rains	52	13	39	98	12	86





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	biting in evening hours	within two days	(34.67)	(25.00)	(75.00)	(65.33)	(12.24)	(87.76)
39	Heavy blossom on Bamboo tree	Indication of severe drought and rat nuisance	13 (8.67)	3 (23.08)	10 (76.92)	137 (91.33)	100 (72.99)	37 (27.01)
40	Heavy golden yellow flowers on Amaltas or bahava (Cassia fistula) tree	Indicates rains within month	43 (28.67)	9 (20.93)	34 (79.7)	107 (71.33)	46 (43)	61 (57)

* FF: Forecasting failing * WD: Worth doing * SCT: Sometimes come True * NC: Not considered
 Figures in brackets indicates percentage

Table 4. Distribution of Respondents According to Their Level of Adoption

Adoption level	Adoption Index range	Frequency (n = 150)	Percentage
Low	Up to 16	25	16.67
Medium	17 to 41	97	64.66
High()	42 and above	28	18.67
	Total	150	100.00

X = 28.91

SD = 12.22





RESEARCH ARTICLE

Tamil Nadu Banana : A Case Study on Post Production and Marketing Part II: Harvesting, Processing, Value Addition and Marketing

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ABSTRACT

The case study was instrumental to make the farmers to own the ideas scouted from field end, while the scientist and experts were exposed to multiple manifestations of the of single issue due to climate change, biotic stress borne out of natural disasters like, polluted water, drought and mixed seasons. Harvesting was the key parameter which decides the post – harvest life of the produce. It varied with variety, distance to market and consumer preference. Harvesting was the key parameter which decides the post – harvest life of the produce. It varied with variety, distance to market and consumer preference. Since the propagation was predominantly through suckers, the shooting and harvesting was not even in most of the cases. Tissue Cultured plants, when planted at the same orientation, the time of shooting and direction of shooting coincides and hence there was a greater uniformity in the crop. The development of effective cold chain storage and transportation services is critical to develop India's banana export market as well as to reduce the post-harvest loss occurring in the domestic market. By allowing the bananas to be kept fresh for longer, increased availability of cold chain storage would enable far more effective coordination of the supply of India's bananas with market demand, boosting the reliability of the supply and reducing wastage.

Key word: Banana, parameter, maturity, harvesting, experts.



**E.Vadivel**

INTRODUCTION

Unlike the first three editions of Banana Festivals held at Chennai, Coimbatore and Trichy, the fourth edition of Banana Festival organised by CII and TN Banana Producers Company Ltd at Madurai was unique in that the floor was stage managed by resource farmers rather than experts in view of the fact that the real time field issues were highlighted and deliberated. The case study was instrumental to make the farmers to own the ideas scouted from field end, while the scientist and experts were exposed to multiple manifestations of the of single issue due to climate change, biotic stress borne out of natural disasters like, polluted water, drought and mixed seasons. The set of post-production process viz., method of harvest, harvest maturity for different markets, minimal filed processing and value addition of banana, thus necessitated new set of technology to retain the quality of product. Eg. Micro nutrient management in polluted soil and water conditions; a single issue becomes multiple, complex and kaleidoscopic, leading to imbalanced uptake and deterioration in fruit quality. In such situations, the solutions developed in the laboratory with assumptions like good quality irrigation water and unpolluted normal soil, do not address the problems faced by the farmers. The case study provided direct linkage between the experts and lead farmers; it helped the experts to understand the real time field issues faced by the farmers.

Objectives

- To understand the dimension and magnitude of processing, value addition and packaging systems at the farm level as influenced by all post- harvest operations.
- To develop strategies for promotion of the branding and marketing approaches for commercialization of banana in TN.

MATERIALS AND METHODS

In Tamil Nadu, banana is cultivated in major clusters viz., North West Zone, Central Zone and South Zone. A total of 350 stakeholders responded in the study. Apart from the farmers, the processors, traders, exporters, researchers, academicians, wholesalers, retailers etc were also involved in the study. Data were collected through the questionnaire developed for the purpose, whetted by scientists of TNAU and NRC-B., Informal interviews were held with resource farmers, officials, bank executives; The fields were visited by the consultant team to understand the special operations. Digital and video documentation was made on the interviews, field visits etc. The processing units were visited and the details documented in detail. North west cluster was characterized by canal and well irrigation where 'Ney Poovan ' was grown predominantly for bulk marketing in Pune; Central cluster was unique in that several varieties like Poovan, Karpooravalli, Nadan, Nendran, hill banana and Rasthali were grown repeated for domestic market. Southern cluster was dominated by ethnic varieties and export varieties like grand naine and cavendish; Thevariables included the harvest maturity, method of harvest, post-harvest handling of bunches, different varieties value addition to different varieties, bi products and consumer preference.

Source and Type of Information

Primary data were collected through field visits and personal interviews from the farmers and others with well-structured interview schedules. Secondary data were gathered through other published media and official web sites. (Jaffer and Namasiyayam 2005). The details gathered were updated in spread sheet for easy retrieval and analysis. The tables and charts were drawn to get the logical conclusions on specific issues of high light.



**E.Vadivel**

RESULTS AND DISCUSSION

Harvesting

Harvesting was the key parameter which decides the post – harvest life of the produce. It varied with variety, distance to market and consumer preference. Since the propagation was predominantly through suckers, the shooting and harvesting was not even in most of the cases. Tissue Cultured plants, when planted at the same orientation, the time of shooting and direction of shooting coincides and hence there was a greater uniformity in the crop. (Alagumani 2005)The care during small, large, shooting and shot stages determines the shelf life of the fruit after harvest.

Harvest Maturity

Harvest maturity was generally decided by visual means. But this did not ensure uniformity in harvest. Bananas for table purpose is generally harvested at mature green stage (90% - 95%) maturity. But when they were sent to distant markets, harvesting was advanced. Sometimes during the market glut season, the commission agents did not procure the crop from the farmers (Debnath et al 2001) So the farmers were forced to take the produce to market by their own. During such occasions, harvesting was done only after one or two fingers turn into yellow colour. This becomes the main factor affecting the shelf life of the produce. In Grand Naine, when the fruit was to be exported, harvesting was done at 70% maturity. The hands were stored in cold rooms for 15 – 20 days and ripened on need basis.

Method of Harvest

There was no significant difference in the harvesting method adopted all over Tamil Nadu for the conventionally grown banana. The bunch was harvested as whole. A cut was given on the peduncle; 1 – 2ft above the first hand. Care was not taken to prevent the dripping of the sap over bunches. This leaves black blotches over the fingers, bringing down the quality and visual appearance. Grading of bunches is generally not done at the field level. One or two undesirable bunches in a lot brings down the market price of the whole lot. (Selvakumar, 2000)

Post – Harvest Handling of the Bunches

After harvesting, the bunches were immediately loaded on to the contractor's truck for transporting it to the market. Dried or fresh banana leaves are used for bedding and bunches are arranged over them. This method causes a lot of mechanical damages to the fruits. Improper ventilation in this method of transportation induces faster ripening of fruits. Bunches are auctioned in the market and this predominantly happens in an open place without proper flooring or bedding. The severity of mechanical injuries was higher during this phase. After the auction, the bunches reach the end consumers through a lot of channels like Supermarkets, Small & medium grocery stores, petty shops, street vendors etc.

Plastic Crates for Transportation

Bananas could be transported and stored effectively in plastic crates. Transportation through crates ensures proper aeration and minimal mechanical damage to the fruits. But this method is only adopted in Grand Naine owing to its higher value and transportation in containers to foreign countries.



**E.Vadivel****Value Addition at Field Level**

Value addition did not mean only the post -harvest process but also to those practices that were carried out in the field level which add more value to the produce. Few of the value adding activities that can be followed in the field level are mentioned below.

Off – Season Production

- Producing the crop in the offseason though has a lot of constraints, can fetch a premium price in the market adding more economical value to the crop.

Using TC Plants

- Tissue culture plants have a massive advantage over the conventional method of production.
- The quality and the quantity of the yield are considerably higher, enabling export of the produce to various countries across the world.

Organic or Natural Way of Farming

- Such production practices, when adopted professionally resulted in the production of highly nutritious, safe and chemical residue less crop.
- Since the awareness among the customers for organic produces is increasing now-a-days, they are sure to fetch a premium.
- Besides, the keeping quality, flavor, aroma are supposed to improve significantly.

Adoption of Hi - Tech Practices

- Adopting practices such as bunch covering, foliar sprays to improve the bunch quality, INM & IPM practices for minimal usage of fertilizer and pesticides to conserve the environment, adopting modern method harvesting and packing etc add more value to the crop by means of higher returns as well as very good quality of the produce.

Processing and Value Addition of Fruits

Though processing of banana has a lot of scope, the fresh consumption market in our country is very massive that only a very few products are consistently produced under the processed category. Processed products such as chips, jams, jelly, banana flower pickle have consistent markets, out of which, chips account to the majority (Surendranathan et al 2003) there are several processing units in Tamil Nadu those produce and export banana chips to various countries. They are highly concentrated around Coimbatore, Madurai and Chennai. Apart from the fruit, the pseudo stem also give revenue to the farmers through value addition activities. Value addition such as fibre extraction for the production of yarn, fabric, apparel and handi-crafts are being followed in the southern clusters.

Banana Fibre and Fibre Products

After the harvest of bunches, the pseudo stem of banana was generally used for composting or ploughed back into the land or burnt. But pseudo stems can be used for the extraction of fibre, which would provide an additional income to the farmers. The outer brown and green sheaths are removed and the inner clear white sheath of the pseudo stem is used for the extraction of the fibre. The banana fibre is composed of cellulose – 62%, lignin - 29%, hemi cellulose - 3%, pectin - 2%, miscellaneous - 4% (Source-Banana Expert System – TNAU / ICAR). Banana fiber is



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used in manufacturing of handicrafts, home decorative items, hand - made papers, apparels etc. Paper made out of banana fiber is being exported to various countries in the world.

Secondary Products of Banana

Banana pseudo stem, flower and leaves yield secondary income to the farmers apart from fruits. Leaves used for serving purpose should be long and wide. All the varieties cannot be used for leaf production. The preferred varieties for leaf production were Nadan, Poovan, Karpooravalli and Mondhan. Other varieties like Ney Poovan, Rasthali, Nendran and red banana were not preferred because of the extra length, width and less tenderness.

North-Western Cluster

Ney Poovan was the predominantly grown variety. Fruit was the economic part. Looking into pseudo stem; it was chopped in the field and allowed to decompose to become organic input for the plants. Regarding flower, they were also left in the field as that of pseudo stem or they were ground and fed to goats and cattle since it promotes secretion of milk.

Southern Cluster

In the Southern cluster farmers are cultivating Nadan for leaves. The leaves are cut from the plant and packed as bundle containing 200 leaves. The cost involved in picking leaves and for packing a bundle was Rs.150. The price of the leaves vary accordingly to the season. Apart from Nadan, this cluster had other varieties like Poovan, Karpooravalli, Nendran, Mondan, Matti, Cavendish types, Peyan. Among these varieties Nendran and poovan were dominant for fruits. The leaves from the poovan were picked until 4 months of a ratoon when leaves have high demand and the plant was a cut at the bottom allowing new ratoon crop. And the leaves were harvested before removing the crop from the field. This additional ratoon was followed especially for leaves in southern cluster. The flowers fed as Cattle and Goat feed. The pseudo stem was chopped and used as organic input at the base.

Central Cluster

In the central cluster Poovan and Karpooravalli were the dominant varieties suitable for leaf purpose. Here after second ratoon, the plants were allowed for leaves and after 3-4 months they were removed. In the Tanjore region of central cluster, the Banana is cultivated predominantly for leaves. Poovan and karpooravalli were the major varieties here. As like plants allowed for fruits, here plants were allowed for leaves at ratoons. In this cluster, the pseudo stem was cut by one foot from the upper, lower side and taken for extraction. The first two layers are rough and they are discarded. The third, fourth and consecutive layers were taken for preparing twines until it reached the core stem. The core was taken out and cut into pieces and loaded for market. In the case of flower, they were cut after complete bunch was formed and then packed in a sack and loaded to market.

Banana Supply Chain

The peculiarity of the Indian banana market was that only a very small quantum of the produce gets transported within the country. Almost all the produces are consumed in the respective zone (North, South, Central & Eastern). Apart from the producer and consumer, various players such as pre – harvest contractor, commission agent, whole seller & retailer are majorly involved in the supply chain. The supply chain for the export market is different. It involves improved packing, processing and cold chain infrastructure.



**E.Vadivel****Packing and Branding**

Packing of banana for table purpose was not practiced at the field level in Tamil Nadu. Various factors inhibiting the packing systems for banana are: The volume produced is large. Labour requirement for packing adds cost; Cost realization of the produce after packing is less target market that consumes packed produce is insensitive. Though all the crop that was produced could not be packed, a sizeable quantity of speciality bananas such as Poovan, Ney Poovan, Nendran, Karpooravalli, and Hill banana could be packed and marketed. Vacuum packing of banana is followed predominantly for Grand Naine followed by Nendran and few other varieties. The hands were arranged inside corrugated boxes lined with LDPE liner. The banana hands were arranged using cushioning foam materials to avoid mechanical damage. They were then vacuum packed and sent to the stores. More than 90% bananas exported are branded in the global market. Since almost all the production of our country was consumed internally, the awareness on branding in banana is yet to make an impact in the market. Branding will ensure premium prices for the product, thus earning more profits to the farmers besides assuring the best quality produce to the consumer.

Marketing of Banana

Nearly 130 developing countries produce nearly 98% of world production was grown in developing countries. Developed countries are in the importer domain. Yet, the production, exports and imports of bananas are densely concentrated in a few countries. The 10 countries accounts for more than 75% of total banana production in the world. The irony is that *India alone accounts for nearly 29% of the world's banana production* and China, Philippines, Brazil and Ecuador collectively contribute nearly 30 % of the world production.

In 2010, world production of bananas reached 102 million tonnes, representing an increase of almost 50 percent from the 65 million tonnes in 2000 and more than doubles the production in 1990. (Annual Report 2015-16, MoA&FW) During 2012, the production was 101.9 million tonnes with more than 24% coming from India alone. In India's point of view, the production has gone down by 16.8% compared to that of 2010.

Domestic Scenario

The highest production was achieved during 2010. The crop was cultivated in an area of 830.5 thousand ha and total production was around 29,779.91 thousand tons with a highest average productivity of 65.8MT/Ha in Tamil Nadu. There is a decreasing trend in the production during 2011 and 2012, with the production coming down in Tamil Nadu and Maharashtra due to monsoon failure for the past two years. In the other three major growing states like Gujarat, Andhra Pradesh and Karnataka, increase in production was observed.

India though is the largest producer, exports only 0.1% of its production, which is around 0.3% of the banana traded worldwide. There is huge post harvest loss accounting to even 30% of the production going as waste. Unlike the rest of the world's major bananagrowing areas, which are dominated by large-scale commercial farms, the Indian banana industry is based on large numbers of small, independent farmers, typically cultivating less than 3 acres. (Srinivasamoorthy et al 2007). For an export model to thrive under these conditions it must offer clear benefits, not just to the new customers abroad, but also to the local economy and the growing local communities. The Indian banana trade is therefore a good example of the potential opportunities, and the challenges, involved in boosting export production in emerging economies.

If India can bridge the gap between its production and crops loss mainly due to inadequate infrastructure like cold chain (reefer vehicles and ripening facilities), theoretically a volume of 25 million tones of banana can be exported from the entire banana industry to the global market earning a huge foreign exchange



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CONCLUSION

India is one of the largest producers of perishables in the world. It ranks 1st in the production of milk and 2nd in the production of vegetables as well as fruits. But there is no proper storage & cold chain infrastructure to preserve these produces in our country. The value of crop losses and livestock losses due to inadequate cold chain was estimated to be nearly ₹ 4500 crores at 2009 (2009, CIPHAT). Currently, a maximum of up to 20–30% of banana produced in our country is estimated to go as waste due to the poor cold chain infrastructure available in the country. Establishment of uninterrupted cold chain network from the field to the shipping point would ensure minimized crop losses thereby increasing the farm productivity. If the post-harvest losses that occur during the handling of the produce can be reduced through the improvement in cold chain and other infrastructure facilities, up to 20 million tons of additional volume of bananas could be made available for the domestic and global consumption (Transport Corporation of India)

The development of effective cold chain storage and transportation services is critical to develop India's banana export market as well as to reduce the post-harvest loss occurring in the domestic market. By allowing the bananas to be kept fresh for longer, increased availability of cold chain storage would enable far more effective coordination of the supply of India's bananas with market demand, boosting the reliability of the supply and reducing wastage. Cold chain transportation services, such as refrigerated trucks and containers, dramatically reduce waste in transit. These services need to be supported by an adequate power supply in rural areas. Ripening chambers can be constructed near the markets where the fruits can be ripened prior to sending it to the retailer. This will ensure the movement of produce based on the demand thereby reducing a lot of wastage. To lower the cost of these services and at the same time help to optimize transport times, dedicated export corridors can be established, with an unbroken cold chain from the packing facility to the retail stores (domestic market) or exports.

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Distribution of World Banana Production

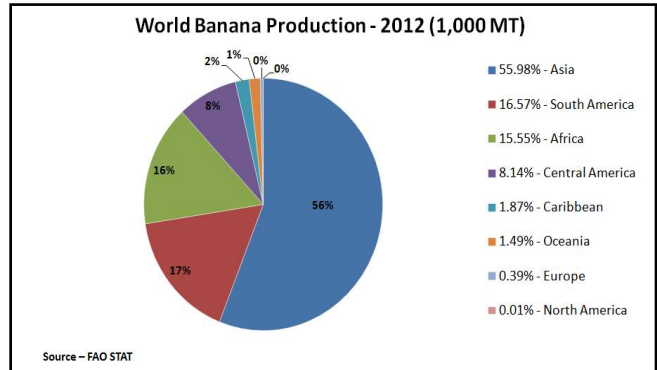
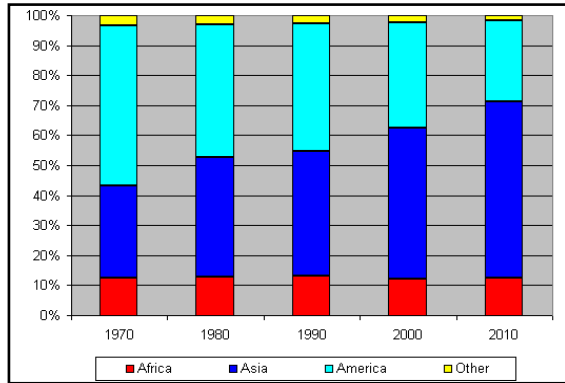


Figure 1

Figure 2

Source – UNCTAD

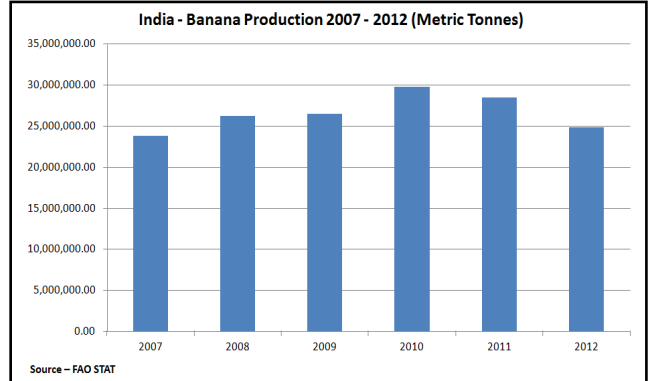
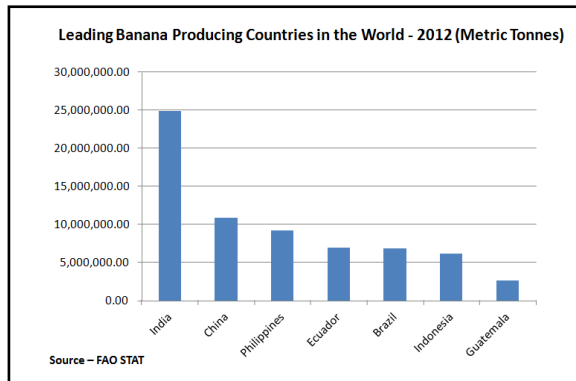


Figure 3

Figure 4

Source – FAO STAT

Source – FAO STAT

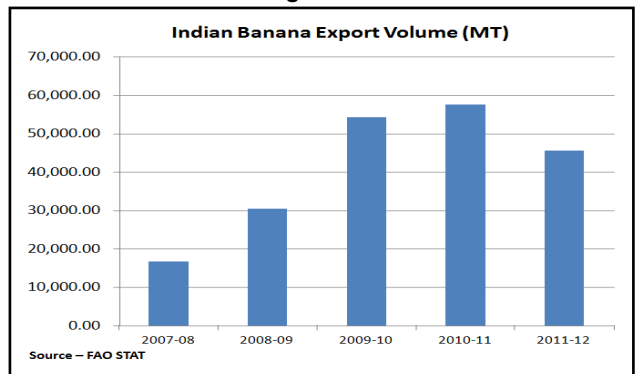
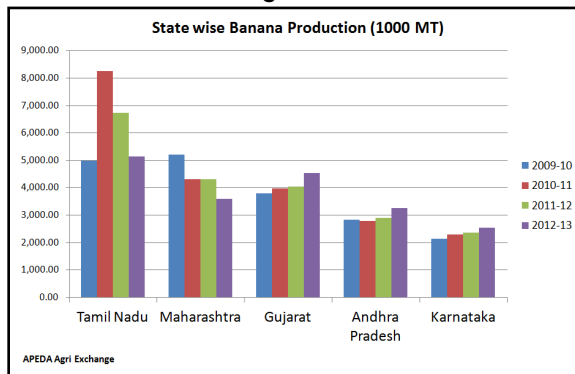


Figure 5

Figure 6

APEDA Agri Exchange

Source – FAO STAT





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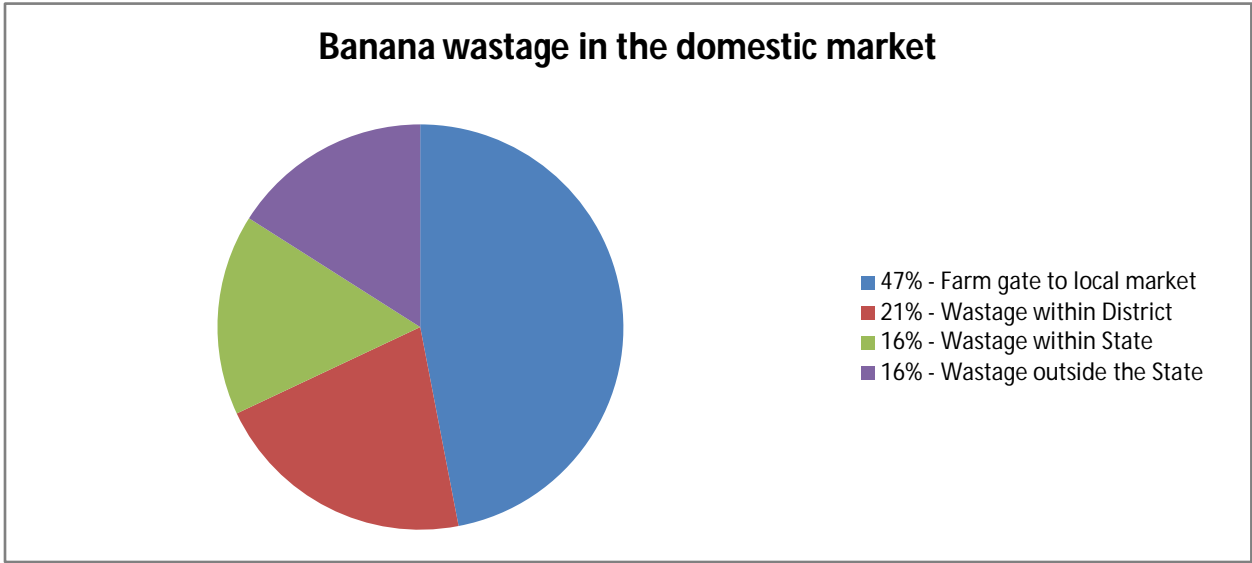


Figure 7. Banana wastage in the domestic market





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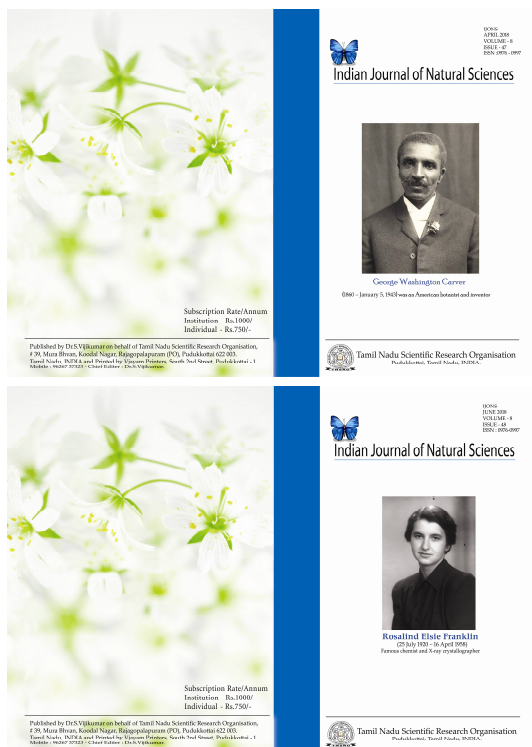
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RESEARCH ARTICLE

Isolation and Molecular Identification of *Mycoplasma* from the Respiratory Tract of Sheep in South Karnataka

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ABSTRACT

Mycoplasma infections are known to exist in respiratory tract of sheep in India. They cause significant impacts but there are very few reports on the isolation and their molecular identification in south Karnataka. The present study was conducted to isolate and molecular characterization of mycoplasma from the respiratory tract of sheep. A total of 180 samples were subjected for conventional methods for isolation and molecular confirmation of mycoplasma. The typical fried egg colonies were noticed on the solid media and the different types of mycoplasma identified based on polymerase chain reaction were *M. arginini* (06), *M. agalactiae* (03), *M. ovipneumoniae* (32) and *M. capricolum* spp. *Capricolum* (02).

Key word: Polymerase chain reaction, *Mycoplasma* infections.

INTRODUCTION

Mycoplasma organisms belong to the class mollicutes comprises of five species and subspecies namely *Mycoplasma capricolum* subsp. *capripneumoniae*, *M. mycoides* subsp. *Capri* and *M. capricolum* subsp. *capricolum* (*Mcc*) can infect lungs of small ruminants and induce respiratory disease. *Mycoplasma* infections cause indirect economic losses as a result of emaciation, delayed market weight and infertility, owing to the sub-acute or chronic pneumonia especially in small ruminants, which are of great importance in rural development. A major health problem of small ruminants is pneumonia/pleuropneumonia (Hiraet *al.* 2015). Diagnosis of mycoplasmosis using different diagnostic tests has drawbacks due to usage of antibiotics, inhibitors in the clinical sample and lack of specificity in biochemical tests



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differentiating the members of the *Mycoplasma mycoides* cluster (Hotzelet *et al.*, 1996). Conventional methods for the diagnosis of mycoplasmosis are based on culture and serological tests, such as the complement fixation test, enzyme linked immunosorbent assay and immunoblotting. These methods are time-consuming, less sensitive, expensive and nonspecific. Recently, PCR has been employed for the laboratory diagnosis of some veterinary mycoplasmas (Azizi *et al.*, 2011).

MATERIALS AND METHODS

In this study, a 24 sheep flocks were selected and a total of 180 nasal swabs were collected which had the history of respiratory tract infection and the symptoms suggestive of mycoplasmosis. Culturing was done in the tubes containing PRM medium as described by OIE manual. The tubes which showed change in color and turbidity were further subcultured and in liquid medium and inoculated to PPLO agar which was further incubated at 37 °C for 72 hours. The plates were examined for the growth of colonies and the colonies were purified as described by Awan *et al.*, 2004. The purified isolates were subjected to PCR using the primers P3/P5 (*M. large Colony*), P4/P8 (*M. capricolum capricolum*), P4/P6 (*M. mycoides Capri*) as described by Kumar *et al.* (2011), MagF/MagR (*M. agalactiae*), LMF1/LMR1 (*M. ovipneumoniae*), MAGF/GP4R (*M. argini*) as described by Yleana *et al.* (1995), McAuliffe *et al.* (2013), and Ayseet *et al.* (2013) respectively. Genomic DNA was extracted from all the samples which exhibited the symptoms of growth in liquid and solid media and subjected to PCR procedures to detect the presence of *Mycoplasma* species using commercially available DNA extraction kit (Cat. No: MAGSPIN-49) from Aps labs, Puna.

RESULTS AND DISCUSSION

Out of the 180 samples processed, 43 samples showed the colonies suggestive of mycoplasma on the solid media. Three types of colonies were noticed in the present study which consisted of central nipple and granular periphery identified as *Mycoplasma agalactiae* (Plate 1), vacuolated and very big size colonies were identified as *Mycoplasma ovipneumoniae* (Plate 2) and typical fried egg (nipple shaped) colonies were identified as other mycoplasma. Colony morphologies of different species are shown in the photographs (Plate 3).

However, the colony morphologies observed in the present study were not consistent throughout the study. The morphology of the colonies varied depending upon their time requirement of growth and the utilization of the nutrients. The unique feature of the organism to grow into the different depth of the agar had determined the shape of the colony. The colonies as observed in the first 3-4 days differed from that of 7th day and entirely different after 10th day. The variety of changes in the morphology of colony is attributable to their ability to utilize the nutrients and the depth to which they grow.

Colonies which exhibited central nipple glinse and granular periphery were identified as *Mycoplasma agalactiae* and later confirmed by PCR (Plate 1). Colonies which were vacuolated and big in size were identified and confirmed as *Mycoplasma ovipneumoniae* (plate 2). The results are in line with the observations of Shahidet *et al.* (2016) who noted that *M. ovipneumoniae* produced a typical centre-less colonies. The colonies observed were small, medium, large without particular order, round in shape, raised and centreless. Also DaMassa *et al.* (1992) documented that *Mycoplasma ovipneumoniae* displays an unusual morphology on solid medium containing agar. The colonies do not show the "fried egg" appearance, rather, the colonies on such agar appear granular. On media with lower agar concentrations, the normal appearance is re-established.

Colonies which appeared as typical fried egg (nipple shaped) were identified as other species confirmed by PCR (Plate 8). The morphology of colonies varied with the medium used for isolation, the mycoplasma species, its passage level and age of culture (Lefevre *et al.*, 1987). Overall 23.88% of the samples were detected positive by PCR for different species of *Mycoplasma* out of 180 samples collected. The observed frequency of different *Mycoplasma*



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species by PCR was *M. ovipneumoniae* 32 (74.41%), *M. arginini* 06 (13.95%), *M. agalactiae* 03 (6.97%) and *M. capricolum* 02 (4.65%). The results of molecular confirmation of mycoplasma isolates, primers and the amplicon size are given in the Table 01.

The PCR has the advantage of the ease of use, standardization, rapid availability of results and more suitable for processing large number of specimens (Dardeer *et al.*, 2006). Although culture of the organism is still widely used, it is time consuming and laborious. The PCR offers advantages in sensitivity and speed compared to traditional methods for mycoplasma identification (Lin *et al.*, 2008). The polymerase chain reaction was carried out to confirm the different species of mycoplasma in the present study. Polymerase Chain Reaction is a sensitive and rapid diagnostic procedure for the early diagnosis of *Mycoplasma* infection (Shahidet *et al.*, 2016).

Shahidet *et al.* (2016) have isolated and detected *Mycoplasma ovipneumoniae* through PCR from the nasal swab samples and from pneumonic sheep lungs. The effort made in the present study to detect *Mycoplasma ovipneumoniae* was successful in 32 nasal swab samples. *Mycoplasma ovipneumoniae* specific 16S rRNA gene sequences were identified by PCR using primers LMF1/ LMR1. All 32 samples yielded amplified product of 360bp which is similar to the results reported by Azizi *et al.* (2011).

Mycoplasma arginini was less frequently isolated in the present study as compared to *M. ovipneumoniae*. *M. arginini* species-specific primers MAGF/GP4R were used in the present study for confirmation of the isolates. The primers yielded amplified product of 545bp which was in agreement with the findings of Ayseet *et al.* (2013). In spite of *M. arginini* being less important in pneumonia of sheep and goats; it is frequently isolated from their respiratory tract (Dardeer *et al.*, 2006). The primers MagF/MagR were used for the identification of *M. agalactiae* by PCR which are specific primers for this species. The results of the present study revealed the presence of *M. agalactiae* specific band at 360 bp in three of the isolates which agreed with the results reported by Yleanaet *et al.* (1995). Recovery from nasal swabs is lower as compared to lung/milk samples.

Madanadet *et al.* (2001) reported that *M. capricolum* subsp. *capricolum* is present in geographically different parts of the world but its occurrence is very low. *Mycoplasma capricolum* subsp. *capricolum* principally affects goats, although subclinical and clinical cases have occurred in sheep and in exceptional cases, in cattle and wild goats (Bergonieret *et al.*, 1997). Similar to their findings two isolates (4.65%) were identified as *Mycoplasma capricolum* subsp. *capricolum* and confirmed by the PCR using oligonucleotide primers MCCPL1-I/MCCPL1-R which yielded single bands of expected size 195bp. Ayseet *et al.* (2013) reported that *Mycoplasma* species like *Mycoplasma mycoides* subsp. *capri*, *Mycoplasma capricolum* subsp. *capricolum* and *Mycoplasma bovis* and *Mycoplasma agalactiae* have reportedly been isolated from the respiratory mucosa and lungs of sheep and lambs. However, in contrast to their findings only *Mycoplasma capricolum* subsp. *capricolum* and *Mycoplasma agalactiae* were recovered from the respiratory tract of sheep that too in very small numbers.

CONCLUSION

Conventional methods for the diagnosis of mycoplasmosis are based on culture and serological tests, such as the complement fixation test, enzyme linked immunosorbent assay and immunoblotting. These methods are time-consuming, less sensitive, expensive and nonspecific. PCR offers easy and quick way of identifying the mycoplasma when compared to the conventional methods.

Conflict of Interest

None declared





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Table 01 Results of molecular confirmation of Mycoplasma isolates

SI.No	Species	Primers used	Amplicon size	No. of isolates
1	<i>M. ovipneumoniae</i>	LMF1/ LMR1	360bp	32
2	<i>M. arginini</i>	MAGF/ GP4R	545bp	06
3	<i>M. agalactiae</i>	MagF/ MagR	340bp	03
4	<i>M. capricolum</i>	P4/ P8	195bp	02





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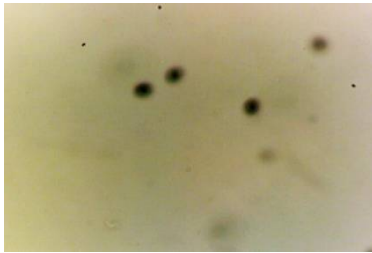


Plate 01: *Mycoplasma agalactiae* colonies with central nipple and granular periphery

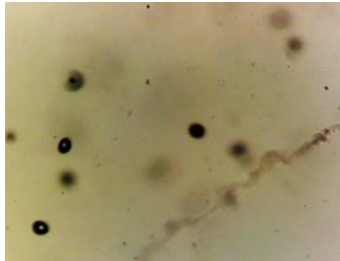


Plate 02: Vacuolated and bigger size colonies of *Mycoplasma ovipneumoniae*

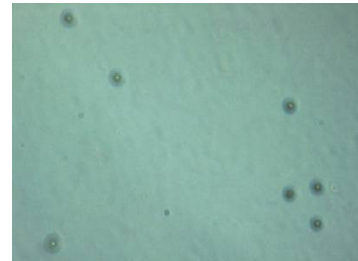


Plate 03: Mycoplasma colonies with typical fried egg appearance

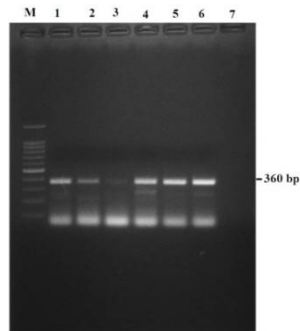


Plate 04: PCR amplified product (360 bp) for 16S rRNA of *M. ovipneumoniae* using primer LMF1/LMR1. M- Marker DNA ladder

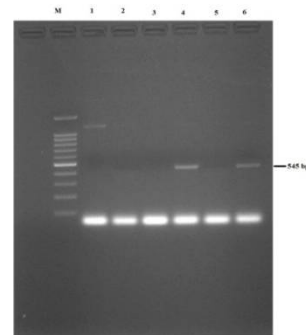


Plate 05: PCR amplified product (545 bp) for 16S rRNA of *M. arginini* using primer MAGF/GP4R. M- Marker DNA ladder

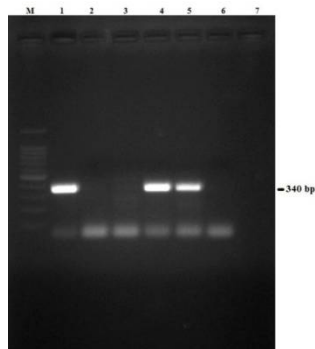


Plate 06: PCR amplified product (340 bp) for 16S rRNA of *M. agalactiae* using primer MagF/ MagR. M- Marker DNA ladder

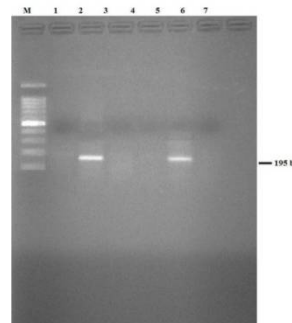


Plate 07: PCR amplified product (195 bp) for 16S rRNA of *M. capricolum* using primer MCCPL1-I/MCCPL1-R. M- Marker DNA ladder





RESEARCH ARTICLE

Correlates of Selected Characteristics of Bishop's Weed Growers with their Knowledge and Technological Gap in Bishop's Weed Cultivation

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ABSTRACT

A wide gap exists between the available techniques in bishops weed cultivation and its actual application by farmers which is reflected through poor yield in the farmer's field. There is tremendous opportunity for increasing the production of bishop's weed by adopting the improved technologies. There is so many appropriate technologies generated at agricultural universities and research station but the productivity of bishop's weed is still very low due to lack of transfer of technology from the point of its development to the point of its utilization. Correlation pin points the selected characteristics of farmers important for minimizing the technological gap in bishops weed cultivation for increasing the productivity.

Keywords- bishop's weed, correlation, technological gaps

INTRODUCTION

The area under bishop's weed in Akola district is increasing day by day. The average yield of bishop's weed in Akola district is comparatively very low than other districts of Maharashtra. The various recommended practices and other scientific techniques of bishop's weed production are not followed significantly by the cultivators, as a results per hectare yield of bishop's weed have not reached to its maximum level. Correlation Productivity of bishop's weed can be enhanced by adopting the improved practices recommended by the National Research Centre on Seed Spices, Tabiji, Ajmer and agriculture universities (1)





MATERIALS AND METHODS

Locale of the Study

The present study was carried out in Akola district of Maharashtra state of western Vidarbha region.

Selection of Tahasil's

Out of seven tahasil's in Akola district, selection of Akola, Akot and Telhara Panchayat Samiti has been done because of larger area comes under bishop's weed crop and farmers experience in bishop's weed cultivation.

Selection of Villages

The study was conducted in ten villages of Akola, Akot and Telhara Tahsils of Akola district, where the maximum number of bishop's weed growers are cultivating bishop's weed crop commercially as per the recommendation of Agriculture Development Office of Zilla Parishad due to higher hectares area under this crop in these tahsils.

Selection of Beneficiaries

Gram Panchayat of selected villages were consulted for making a list of respondents who are cultivating bishop's weed from last 3 years. 10 numbers of respondents from each selected village, those growing bishop's weed from last 3 years were selected randomly. Thus 100 respondents were selected for the present investigation.

Research Design & Data Collection

An exploratory research design was used for the present study. Interview schedule was prepared and pre-tested. Data were collected in face to face situation. The interview with the beneficiaries was conducted at their resident or place with comfort situation.

Coefficient of Correlation

The data were processed and analyzed on ARIS Computer Centre, Dr. PDKV, Akola, besides mean and standard deviation the coefficient of correlation (r) were worked out to find out relationship between selected characteristics of farmers with their knowledge and technological gap. The calculated ' r ' values were compared with table ' r ' value at $n-k-1$ degree of freedom for significance. The calculated value of ' r ' was considered to be significant if it was greater than the table value at 0.01 and 0.05 level of probability at $n-k-1$ degree of freedom

RESULTS AND DISCUSSION

Relationship of Selected Characteristics of the Respondents with Their Knowledge

The correlation coefficient of knowledge with personal and socio economic, situational, psychological and communication variables of the respondents has been depicted in Table 1. On critical examination in Table 1 reveals that among selected variables, soil type, area under bishop's weed crop, irrigation facilities, sources of information and extension contact were positively and significantly correlated with knowledge at 0.01 level of probability, whereas, land holding and annual income was positively and significantly correlated with knowledge at 0.05 level of probability. Age was negatively and significantly correlated with knowledge at 0.05 level of probability while economic motivation and scientific orientation were found negative but significantly correlated with knowledge at



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0.01 level of probability. Therefore, the null hypothesis was rejected for these 10 characteristics stating that there exists significant relation between these characteristics and knowledge possessed by farmer about recommended bishop's weed cultivation practices. Education and socio-economic status as these variables showed non-significant relationship with knowledge. The null hypothesis for these two variables is therefore accepted.

The above results indicated that the bishop's weed growers having good, regular soil type, extension contacts, young age, medium land holding, moderate sources of information, high level of scientific orientation, high level of economic motivation, source of irrigation available and area under crop will tend to develop deeper insight and possess more amount of knowledge with respect to recommended cultivation practices of bishop's weed crop. It is quite logical that the variable higher education and moderate socio-economic status had no influence on acquisition of knowledge and it might be due to that formal education of bishop's weed growers and moderate socio-economic status did not affect the knowledge about recommended bishop's weed cultivation practices.

Similar findings were reported by (3) that age, scientific orientation, economic motivation, land holding and irrigation facilities significantly related with knowledge. Gedam (1) reported that education, land holding, socio-economic status, economic motivation and sources of information were significantly correlated with knowledge.

Relationship of Selected Characteristics of the Respondents with Technological Gap

The correlation coefficient of technological gap with personal and socio-economic, situational, psychological, communication variables and knowledge of respondents have been depicted in Table 2. It could be seen from Table 2 that among selected variables land holding, annual income, socio-economic status, soil type, area under bishop's weed crop, irrigation facilities, sources of information, extension contact, scientific orientation, economic motivation and knowledge were negatively significantly correlated with the technological gap at 0.01 level of probability. Therefore, the null hypothesis was rejected, for these characteristics showed that there exists significant relationship between these characteristics and technological gap of recommended bishop's weed cultivation practices. However, age was positively and significantly correlated with technological gap at 0.05 level of probability. The variable like education did not show any significant relation with technological gap by bishop's weed growers. The null hypothesis for this variable was therefore accepted.

It could be interpreted that the technology gap was lower in young bishop's weed growers having higher scientific orientation and high economic motivation. It could also be inferred that the technological gap will be high if bishop's weed growers had less land holding, annual income, low socio-economic status, inferior soil type, less area under bishop's weed crop, less irrigation facilities, less number of information sources, less knowledge and low frequency of extension contact. So the extension agencies should give focus on these aspects for reducing the technology gap. These findings support the findings (5) and (4). Similar findings were reported by (3) observed education, land holding, socio-economic status, scientific orientation and knowledge were significantly correlated with technological gap at 0.01 level of probability. (2) Found that education, socio-economic status, size of land holding, irrigation availability, sources of information and knowledge increase the technological gap decreases.

CONCLUSION

It could be inferred that the technology gap was lower in young bishop's weed growers having higher scientific orientation and high economic motivation. Extension agencies should concentrate their efforts on these characteristics of bishop weed growers to minimize their technological gap about recommended practices of bishop's weed cultivation.





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Table 1: Coefficient of Correlation Characteristics of the Respondents with their Knowledge

Sr. No.	Variable	'r' value
1.	Age	-0.216*
2.	Education	-0.074
3.	Land holding	0.252*
4.	Annual income	0.199*
5.	Socio-economic status	0.164
6.	Soil type	0.301**
7.	Area under bishop's weed crop	0.302**
8.	Irrigation facilities	0.274**
9.	Economic motivation	-0.283**
10.	Scientific orientation	-0.360**
11.	Sources of information	0.397**
12.	Extension contact	0.346**

* - Significant at 0.05 level of probability, ** - Significant at 0.01 level of probability

Table 2: Coefficient of Correlation Characteristics of the Respondents with their Technological Gap

Sr. No.	Variable	'r' value
1.	Age	0.235*
2.	Education	0.184
3.	Land holding	-0.402**
4.	Annual income	-0.368**
5.	Socio-economic status	-0.312**
6.	Soil type	-0.503**
7.	Area under bishop's weed crop	-0.430**
8.	Irrigation facilities	-0.610**
9.	Economic motivation	0.429**
10.	Scientific orientation	0.338**
11.	Sources of information	-0.506**
12.	Extension contact	-0.397**
13.	Knowledge	-0.485**

* - Significant at 0.05 level of probability, ** - Significant at 0.01 level of probability





Histological Studies of Reticular Fibers in Heart of Pig

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ABSTRACT

Reticular fibers are very much significant in the parenchymatous heart tissue where in which each individual cells are outlined and framework of the organ is done by these fibers which can be best demonstrated by the silver impregnation technique. Scanty or absolute no evidence of reticular fibers in fibrous tissues like semilunar valves and chordate tendinae implicating that these fibers mostly are found in soft parenchymatous organ material.

Keywords: reticular fibers, heart,

INTRODUCTION

Swine are an excellent large animal model for human health and disease study because their similarity to humans in size and physiology, in particular, with respect to the skin, heart, gastrointestinal tract, and kidneys and organ transplantation has been one of the preeminent successes in the field of modern human medicine especially of heart (valves), and coronary arteries from pigs to humans. Reticular fibers are fine delicate fibers that are found connected to the coarser and stronger collagenous fibers which provide the bulk of the supporting framework of the more cellular or parenchymatous organs, where they are arranged in a three-dimensional network that served as scaffold for supporting cells in many organs. They are an integral part of the sub-basal lamina that connects lamina densa to the subepithelial connective tissue (Bacha & Wood, 1990; Dellmann & Eurell, 1998). Reticular fiber demonstration techniques are divided into those using dye as means of staining and metal impregnation methods. Dye technique for reticular fiber demonstration cannot be considered completely reliable, as the density of stain being insufficient to resolve the fibers and staining technique do not redially differentiate between collagen and reticulin fibers.

Metal impregnation technique, which provides better contrast and enabling even finest fibers to be resolved and is the most widely used method for demonstration of reticulin fibers (Bancroft 2008). Reticular fibers are continuous



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with collagen fibers through the exchange of these collagen fibrils. In silver-impregnated specimens, individual fibrils in reticular fibers are densely coated with coarse metal particles, probably due to the high content of glycoproteins around the fibrils (Ushiki 2002). Histological studies have been intensively studied in this regard but there is scant information on building block or framework network material i.e. reticular fibers are very scant and hence this study has been taken.

MATERIALS AND METHODS

Fresh samples of heart were collected from adult pigs irrespective of sex immediately after slaughter from private pig slaughter houses and samples were carried in box containing dry ice and brought to the laboratory which were carefully dissected out and then were fixed in 10% formal saline for 24 hours for histology processing. Embedded with by routine paraffin with ceresin block method and sections of same were taken at 4- 7 μ thickness using manual rotary microtome. Paraffin sections were subjected to Gomori's silver impregnation method for reticular fibers (Luna, 1968).

RESULTS AND DISCUSSION

Heart musculature was skeletal in nature with distinct striations (Fig.1), composed of epicardium, myocardium and endocardium in which epicardium did not show any evidence of reticular fibers but more of collagen fibers noticed as in (Fig.2). In myocardium individual cardiac muscle fibers were surrounded by thin wavy network of reticular fibers and had a branching communication with adjacent cells and epimysium and perimysium also had thick coat of reticular fibers which was similar to finding of Sokolov (1963) in mammals, Smolich *et al* (1990) in sheep and Fawcett (1994) in human however Schwintet.al 2004 opined that Silver stain of reticular fibres demonstrates the fine structure of the cardiac network but nuclei are also stained with current techniques which hinders computer image analysis hence suggested modified Gomoris technique. Sub endothelial connective had scanty amount of reticular fibers. (Fig 3) In the coronary artery three layers were easily distinguishable but tunica media layer had thick network of reticular fibers compared to tunica intima and tunica externa (Fig. 4). Major portion of moderator band was made up of collagen fibers however at periphery a layer of Purkinje fiber coat was noticed in turn covered by endothelium which was a continuation of endocardium (Fig 5&6) which was concurrent to the relevations made by Sathyamoorthy *et al* (2008). Semilunar valve and chordae tendinae showed no evidence of reticular fibers but was majorly composed of thick collagenous fibers found out to be a wavy in nature. (Fig 7&8)

CONCLUSION

Reticular fibers are the one of the prime connective tissue fibers which are very much essential for the framework of parenchymatous organs which gives strength and endurance for the proper functioning of the organs. These reticular fibers are indistinct in the routine H&E staining and silver impregnation techniques certainly gives a definitive demonstration of these delicate and fine fibers undoubtedly.

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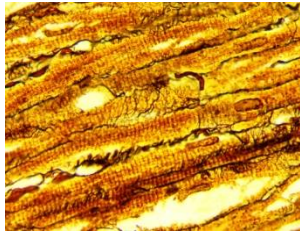


Fig.1 Longitudinal section showing striations in cardiac muscle along with reticular fibers

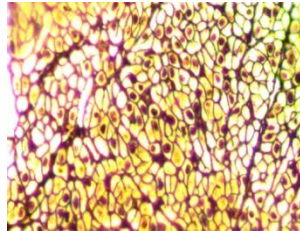


Fig.2 Cross section showing each cardiac cell surrounded by reticular fibers

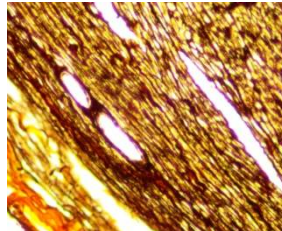


Fig.3 Longitudinal section of heart with pericardium rich in collagen

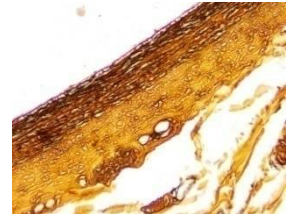


Fig. 4. Coronary artery cross section showing tunica media with abundant reticular fibers

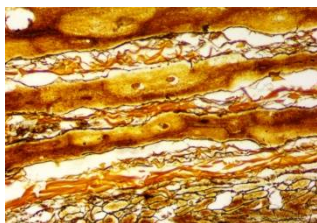


Fig.5. Moderator band longitudinal section showing purkinje fibers



Fig.6 Purkinje fibers surrounded by delicate reticular fibers

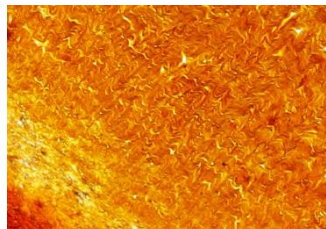


Fig.7 Atrioventricular valve with no evidence of reticular fibers

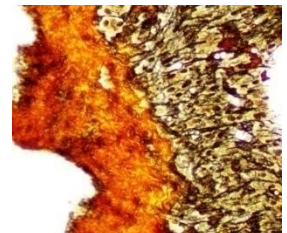


Fig. 8. Chordate tendinae with papillary muscle with scant reticular fibers





Reasons for Technological Gap in Bishop's Weed Cultivation

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ABSTRACT

The study was planned to investigate the technological gap of recommended package of practices of bishop's weed and to ascertain the reasons of technological gap of recommended package of practices of bishop's weed among bishop's weed growers in its cultivation. A wide gap exists between the available techniques in bishops weed cultivation and its actual application by farmers which is reflected through poor yield in the farmer's field. There is tremendous opportunity for increasing the production of bishop's weed if reasons can be find out for minimizing the technological gap in bishops weed cultivation for increasing the productivity.

Keywords- bishop's weed, correlation, reasons for technological gap

INTRODUCTION

India is well known as "Land of Spices" across the world since long back. We have been cultivating these precious spices for fulfilling our various needs since ages. The seed spices have emerged as one of the important group of spice crop in India. India is the largest producer, consumer and exporter of seed spices in the world. The seed spices account for about 36% and 17% of the total area and production of spices in the country. The area under bishop's weed in Akola district in Vidarbha region of Maharashtra is increasing day by day. The average yield of bishop's weed in Akola district is comparatively very low than other districts of Maharashtra. Productivity of bishop's weed can be enhanced by identifying the actual reasons about technological gaps in bishop weed cultivation and adopting the improved practices recommended by the National Research Centre on Seed Spices, Tabiji, Ajmer and agriculture universities (4)



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MATERIALS AND METHODS

Locale of the Study

The present study was carried out in Akola district of Maharashtra state of western Vidarbha region.

Selection of Tahasil's

Out of seven tahasil's in Akola district, selection of Akola, Akot and Telhara Panchayat Samiti has been done because of larger area comes under bishop's weed crop and farmers experience in bishop's weed cultivation.

Selection of Villages

The study was conducted in ten villages of Akola, Akot and Telhara Tahsils of Akola district, where the maximum number of bishop's weed growers are cultivating bishop's weed crop commercially as per the recommendation of Agriculture Development Office of Zilla Parishad due to higher hectares area under this crop in these tahsils.

Selection of Beneficiaries

Gram Panchayat of selected villages were consulted for making a list of respondents who are cultivating bishop's weed from last 3 years. 10 numbers of respondents from each selected village, those growing bishop's weed from last 3 years were selected randomly. Thus 100 respondents were selected for the present investigation.

Research Design & Data Collection

An exploratory research design was used for the present study. Interview schedule was prepared and pre-tested. Data were collected in face to face situation. The interview with the beneficiaries was conducted at their resident or place with comfort situation to record the probable reasons about technological gaps.

RESULTS AND DISCUSSION

Reasons for Technological Gap for Each Cultivation Practices of Bishop's Weed

The data presented in Table 1 revealed that lack of improved farm implements and non-availability of labour were the major reasons in land preparation quoted by 7.00 per cent and 11.00 per cent bishop's weed growers respectively. In general, growers in the study area spread FYM in the field during the summer season and mix well during land preparation with tractors, however due to lack of cattle's at their own and non-availability of required quantity of FYM in village, they are unable to use FYM on their field during land preparation as quoted by 10.00 per cent of bishop's weed growers.

In respect of method of sowing, it was noted that cent per cent farmer use drilling method of sowing. So most of the growers use seed drill for sowing. Unavailability of seed drill (5.00%) and lack of knowledge about sowing depth for bishop's weed seed (12.00%) were reasons for technological gap. While studying the reasons related to sowing time, it was observed that the recommended sowing time did not follow by most of the farmers. The reason perceived by them showed that about 30.00 per cent of farmers stated unavailability of inputs during sowing of bishop's weed and thereby felt delayed in sowing time. Other reasons perceived by 13.00 per cent respondents were included unavailability of bullock pairs caused them to extended sowing time. Regarding seed rate, there was a recommendation to use 2.5 to 3.5 kg seed per hectare, but over half of respondents did not follow the



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recommendation. The reason perceived by them showed that 56.00 per cent of farmers not following recommended seed rate and have no knowledge about seed rate as they felt uneconomical. This feeling was based on their past experiences. They said the yield of bishop's weed is reduced if used recommended variety and majority (67.00%) respondents were unaware about variety. This observation may be due to the fact that the germination of bishop's weed is affected because of less rainfall. In October, if sufficient moisture in the soil is not available.

It may be noted from the percentages given in Table 16, that high technological gap was present in seed treatment because most of bishop's weed grower (76.00%) were not aware of importance of seed treatment with chemicals as well as rhizobium culture. 82.00 per cent of respondents reported that major reason as inadequate knowledge about recommended chemical seed treatment. These who have been aware of rhizobium culture stated its unavailability (12.00%) in the market at sowing time. Regarding spacing, most of the farmer (21.00%) unaware about maintaining proper plant population and 17.00 per cent of respondents have no knowledge about recommended spacing for bishop's weed. They felt that there is not any relation of plant population and yield of the crop. One reason for technological gap in spacing was that they depend on their past experience and follow the cultivation practices. While studying the reasons related to fertilizer application, it was observed that farmer felt this practice as costly affairs and they had not in economic condition to bear this expenses (40.00%). Lack of proper knowledge and guidance and unavailability of fertilizers during sowing period (14.00%) reported to be perceived reasons by few of the farmers. In respect of intercropping, lack of knowledge about the crop available as intercrop in bishop's weed is the main reason for technological gap about 87.00 per cent and row proportion of bishop's weed (93.00%) is important reason for technological gap in intercropping in bishop's weed.

In respect of plant protection, high technological gap was present because of lack of knowledge about pest and disease management (64.00%) and lack of technical guidance to growers (79.00%). On the basis of above results, it can be concluded that own experiences, traditions and beliefs of growers and faith on traditional cultivation practices were the reasons for technological gap in bishop's weed cultivation. Lack of technical knowledge, high cost of input, timely availability of inputs were responsible for creating technological gap in bishop's weed cultivation practices followed by growers. The scientists and extension workers may jointly find out the solution to decrease the technological gap of bishop's weed cultivation technology by introducing feasible and cost effective cultivation practices. This can be done by developing different educational strategies based on local conditions. In the light of the present findings it may be suggested that the bishop's weed growers need encouragement for use of rhizobium culture. The input supply agencies, therefore, make efforts to provide specific cultures of desired quality at the time of sowing. Extension agencies should make efforts to motivate the farmers for using bacterial culture and seed treatment. Demonstrations should be arranged to impart skill about seed treatment and bacterial culture application to bishop's weed for growers. The growers should get adequate financial support from the financial institution, both respect of amount and time. The most important consideration for significant increase in bishop's weed production should be transfer the technology to the grower's fields and to ensure adequate supply and quality seeds of inputs at proper time.

The present findings with respect to plant protection measures did support the findings of (1) and (2) noted that lack of knowledge, non availability of inputs, lack of technological guidance were the major constraints in adoption of plant protection measures. Most of the findings also go in consonance with the findings of (3) who also noted the same while investigated technological gaps in gram cultivation.

CONCLUSION

It can be said that there is huge gap between recommendations of actual adoption of bishop's weed technological by bishop's weed growers. Farmers own experience, traditions and misunderstanding affect the adoption of bishop's weed practices. It is felt that traditional, biological and agro-ecological factor may be studied carefully and solutions





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may be found out to lessen the technological gap and by which rate of adoption of bishop's weed technology will increase.

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Table 1: Reasons for Technological Gap for Each Cultivation Practices of Bishop's Weed

Sr. No.	Reasons	Frequency (n=100)	Percentage
I)	Land preparation		
i.	Lack of improved implements for the preparation of land	7	7.00
ii.	Non-availability of labour	11	11.00
iii.	Non availability of FYM in village	10	10.00
II)	Sowing method		
i.	Lack of knowledge about sowing depth for bishop's weed seed	12	12.00
ii.	Unavailability of seed drill	5	5.00
III)	sowing time		
i.	Unavailability of inputs	30	30.00
ii.	Unavailability of bullock pair	13	13.00
IV)	Seed rate and variety		
i.	Lack of knowledge	56	56.00
ii.	Unavailability of recommended variety	67	67.00
V)	Seed treatment		
i.	Unaware about seed treatment	76	76.00
ii.	Inadequate knowledge about recommended chemical seed treatment	82	82.00
iii.	Unavailability of rhizobium at the time of sowing	12	12.00
VI)	Spacing		
i.	Unaware about maintaining proper plant population	21	21.00
ii.	Unaware of recommended spacing for bishop's weed	17	17.00
VII)	Fertilizer application		
i.	High cost of fertilizer and poor economic condition	40	40.00
ii.	Unavailability of fertilizers during sowing period	14	14.00
VIII)	Intercropping		
i.	Lack of knowledge about the crop recommended as intercrop in bishop's weed	87	87.00
ii.	Lack of knowledge about row proportion of intercrop in bishop's weed	93	93.00
IX)	Plant protection		
i.	Lack of knowledge about pest and disease management	64	64.00
ii.	Lack of technical guidance	79	79.00





RESEARCH ARTICLE

Clinical Findings and Haematological Changes Associated With Mycoplasmal Infection in Sheep

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ABSTRACT

Clinical findings and haematological changes were analyzed in 15 flock of sheep having 12 animals in each flock affected with mycoplasma. The clinical findings noticed were mostly related to the respiratory tract infection with a few to other organ systems. Significantly higher values were noticed in the mycoplasma affected group when compared to the control animals.

Key words: *Mycoplasma*, clinical signs, *pneumonia*, respiratory infection, arthritis and conjunctivitis

INTRODUCTION

Mycoplasmosis in small ruminants is associated with a variety of syndromes which ranged from mild to severe and fatal outcomes. Although clinical signs of the disease are characteristic, laboratory confirmation of field diagnosis is essential because several look alike mycoplasmal and bacterial infections. *Mycoplasma* infections cause emaciation, delayed market weight and infertility, owing to the sub-acute or chronic pneumonia especially in small ruminants, which are of great importance in rural development. A major health problem of small ruminants is pneumonia/pleuropneumonia (Hiraet *al.* 2015).

MATERIALS AND METHODS

The study animals consisted of sheep from different parts of south Karnataka. A total of 15 flocks of sheep affected with mycoplasma infection were selected for the purpose. The clinical findings and haematological changes were recorded and analysed. A 'Z' test was used to know the significant difference between control and mycoplasma affected population.





RESULTS AND DISCUSSION

In this study the clinical signs attributable to respiratory tract infection and the signs suggestive of mycoplasmosis were recorded. The clinical signs observed in the sheep are depicted in the Table 1. All animals in the present study manifested different clinical signs and the clinical signs in the flocks which have been studied were mostly upper respiratory tract infection like nasal discharge (74), conjunctivitis (17), abortion (15), mastitis (08), arthritis (08) and corneal opacity (03). The percentage of the same was 41.11, 9.44, 8.33, 4.44, 4.44 and 1.66, respectively.

The clinical signs and their percentage noticed in were similar to those observed by various authors namely, Bergonier et al. (1997), Mansoet al. (2007), Woubitet al. (2007), Kumar et al. (2011) and Hiraet al. (2015). In the present study, 41.11% of sheep showed nasal discharge which was the predominant sign suggesting the involvement of upper respiratory tract infection. It has been reported by Elena et al. (2005) that *M. ovipneumoniae* plays a role either as a primary pathogen, as a predisposing agent, or as a secondary invader in pneumonia in small ruminants.

High percentage of nasal discharge may be due to the reason that *Mycoplasma ovipneumoniae* is the most commonly isolated mycoplasma from the respiratory tract of normal sheep and can play a significant role in respiratory disease as reported by Lin et al. (2008). During times of stress, subclinical infection may predispose sheep to atypical pneumonia with paroxysmal coughing. The inhibition of ciliary activity is correlated with hydrogen peroxide produced by *M. ovipneumoniae* and with autoantibodies against cilia produced by infected sheep. Bottinelli et al. (2016) reported that many pathogens are involved in sheep pneumonia, such as viruses, parasites, chlamydiae and mycoplasmas. The bacteria most frequently isolated from pneumonic lungs in both sheep and lambs are *Mycoplasma (M) ovipneumoniae*, *Mannheimia haemolytica* and *Pasteurella multocida*. It is known that *M. ovipneumoniae* is able to cause atypical pneumonia in sheep, but it may also facilitate invasion and infection by *Ma. haemolytica*, Parainfluenza-3 virus (PI3V) and Respiratory Syncytial Virus (RSV). A wide variety of clinical signs suggestive of respiratory tract infection as reported by Shahid et al. (2016) may be due to *M. ovipneumoniae* which can cause severe respiratory disease in small ruminants and also acts as a predisposing factor for the attack of other microorganisms.

Seventeen sheep in the present study had conjunctivitis which accounted for 9.44% of the overall clinical signs. Similar findings were observed by different authors described below. Marie et al. (1999a) reported that *Mycoplasma capricolum* subsp. *capricolum* causes sporadic outbreaks of arthritis, mastitis, keratoconjunctivitis, pneumonia and septicaemia. Awan et al. (2009) and Mohkber Dezfouli et al. (2011) also described similar findings in their study. Madanat et al. (2001) postulated that infectious agent of CA is transferred by circulating blood to different target organs and eye leading to inflammatory changes characterised by keratoconjunctivitis. Pourbakhsh et al. (2015) reported that Mcc rapidly affects goat, however it could also occur in sheep, wild goats and cattle as well. The Mcc causes sporadic outbreaks of keratoconjunctivitis and also other *Mycoplasma* species cause keratoconjunctivitis in sheep.

Abortion may occur less frequently during advanced pregnancy by *Mycoplasma agalactiae* (Bergonier et al., 1997) and abortion can also occur in chronically infected animals (Azevedo et al. 2006). In small ruminants mycoplasmas are known to localise in the genital tract (Awan et al., 2009 and Kumar et al., 2011) leading to inflammatory changes in the uterus causing abortion and may also give birth to non-viable offspring. In the study, few animals also had a history of abortion. Mastitis (8), arthritis (8) and corneal opacity (3) were observed in the present study with a percentage of 4.44, 4.44 and 1.66, respectively. Bergonier et al. (1997) observed that the clinical stages of CA consists of localization of the infectious agents in three target organs namely udder in lactating females, carpal and tarsal joints and eye leading to mastitis, arthritis and keratoconjunctivitis.

Members of the cluster *M. agalactiae* and *M. capricolum* are among some of the species involved in the 'MAKePS' syndrome, characterised by mastitis, arthritis, keratoconjunctivitis, pneumonia and septicaemia in small ruminants





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(Woubitet *et al.*, 2004, Azevedo *et al.*, 2006 and Mansoet *et al.*, 2007). Kumaret *et al.* (2011) reported that mycoplasmas in small ruminants are known for respiratory disease, arthritis, eye lesions, genital disease and mastitis. Lacrimation, ocular opacity in some cases, painful, hot and swollen joints leading to lameness, depression and prostration has also been reported by MohkberDezfouli *et al.* (2011). The mean \pm standard error and the range of haematological parameters for the control group and the group affected ($n = 180$) of mycoplasmosis is given in the Table 2. The mean \pm SE values of TLC ($\times 10^3/\mu\text{L}$), TRC ($\times 10^6/\mu\text{L}$), Hb (g%), PCV (%), platelets ($\times 10^3/\mu\text{L}$), granulocytes ($\times 10^3/\mu\text{L}$), monocytes ($\times 10^3/\mu\text{L}$) and lymphocytes ($\times 10^3/\mu\text{L}$) in control group were 9.41 ± 0.63 , 6.44 ± 0.28 , 7.35 ± 0.26 , 27.39 ± 1.27 , 262.83 ± 19.66 , 7.56 ± 0.64 , 1.49 ± 0.13 and 2.32 ± 0.28 , respectively while that of mycoplasmosis affected were 13.82 ± 2.75 , 6.87 ± 1.03 , 7.93 ± 0.72 , 25.87 ± 1.32 , 243.12 ± 21.22 , 8.32 ± 1.01 , 1.65 ± 0.21 and 2.68 ± 0.31 , respectively.

A 'Z' test was used to know the significant difference between control and mycoplasma affected population. No significant difference was observed between infected and control group in all the studied haematological parameters except for TLC which was significantly higher in overall mycoplasma suspected population compared to the control group. The values of other parameters were in normal physiological range in both suspected and control group, however, there was variation in the values within the normal limits.

In the present study, mean \pm SE values of TLC ($\times 10^3/\mu\text{L}$) in the control group were 9.41 ± 0.63 while that of mycoplasmosis was 13.82 ± 2.75 with significantly higher values in mycoplasma affected animals. This finding is in line with Kumar *et al.* (1992) who observed progressive neutrophilia on 3rd day post infection followed by a gradual leucocytosis which peaked at 20th day post infection in experimentally infected lambs with mycoplasma ovine/caprineserogroup 11. They observed no significant difference in the other haematological parameters studied and was similar to their findings in the present study. The results of the study are also in agreement with Arshad, 2010.

Tizard (1987) reported that neutrophilia occurred as a result of systemic response to tissue injury and acute inflammation due to mycoplasma invasion. This systemic response is mediated by IL-1 which is released by macrophages following exposure to the stimulus of invading mycoplasma and also due to damage or inflamed tissue. IL-1 is chemotactic for neutrophils and also acts directly on the bone marrow to stimulate the release of neutrophils into the circulation causing neutrophilia. In this study neutrophilia was observed but on the contrary Omer and Haydar (2006) observed no statistically significant differences relative to WBC, RBC, Hb and percentage of PCV between the groups in their study.

CONCLUSION

Clinical signs exhibited by affected sheep were nasal discharge, conjunctivitis, abortion, mastitis, arthritis and corneal opacity with majority related to respiratory tract infection. There was no significant difference in the haematological parameters between the control and the affected sheep except total neutrophil count.

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Table1: Clinical Signs in Sheep Suspected For Mycoplasmosis Observed in the Study

Sl. No.	Flock	Place	No. of animals exhibiting various clinical signs						
			Nasal discharge	Conjunctivitis	Abortion	Mastitis	Arthritis	Corneal opacity	Without clinical signs
1	Flock 1	Hassan	02	02	02	01	01	-	4
2	Flock 2	Nagamangala	03	-	01	02	-	01	5
3	Flock 3	Konehally	05	01	03	-	02	-	1
4	Flock 4	Magadi	04	-	01	-	-	-	7
5	Flock 5	Kollegal	06	01	03	-	-	-	3
6	Flock 6	Dhanaguru	05	04	-	-	01	-	2
7	Flock 7	Nelamangala	08	-	-	-	-	01	3
8	Flock 8	Madduru	04	-	-	-	02	-	6
9	Flock 9	Shira	07	01	01	01	-	-	2
10	Flock 10	Bannuru	04	01	01	-	01	01	4
11	Flock 11	Ramanagara	06	-	01	01	01	-	3
12	Flock 12	Bangalore	05	01	-	01	-	-	5
13	Flock 13	Bandalli	06	02	-	01	-	-	3
14	Flock 14	T.N.Pura	05	04	01	01	-	-	1
15	Flock 15	Mysore	04	-	01	-	-	-	7
		Total (%)	74 (41.11)	17 (9.44)	15 (8.33)	08 (4.44)	8 (4.44)	03 (1.66)	55 (30.55)

Table2: Mean±SE values of haematological parameters of control and Mycoplasmasuspected sheep

	TLC (×10 ³ /μL)	TRC (×10 ⁶ /μl)	Hb (g%)	PCV (%)	PLT (×10 ³ /μl)	GR (×10 ³ /μl)	MO (×10 ³ /μl)	LY (×10 ³ /μl)
Control(n=12)	9.41±0.63 ^a	6.44±0.28	7.35±0.26	27.39±1.27	262.83±19.66	7.56±0.64	1.49±0.13	2.32±0.28
Suspected(n=180)	13.82±2.75 ^b	6.87±1.03	7.93±0.72	25.87±1.32	243.12±21.22	8.32±1.01	1.65±0.21	2.68±0.31
1. Hassan	11.48±1.07	6.23±1.15	8.19±0.62	25.88±1.9	182.42±17.87	6.47±0.81	1.74±0.25	3.8±0.34
2. Nagamangala	15.56±1.24	7.6±0.42	7.33±0.69	22.82±1.85	175.17±22.9	10.6±1.28	2.36±0.39	2.6±0.32
3.Konehalli	12.05±1.24	7.82±1.06	6.36±0.46	19.47±1.39	182.08±22.11	9.36±1.03	0.94±0.12	1.74±0.21
4.Magadi	13.48±1.57	6.72±0.47	8.23±0.6	23.8±1.24	146.67±27.15	10.56±1.33	1.05±0.14	1.88±0.26
5.Kollegala	14±2.10	7.91±0.58	8.48±0.78	25.91±2.51	238.92±25.09	9.29±1.73	1.88±0.34	2.82±0.48
6.Dhanguru	9.67±0.47	5.39±0.24	6.01±0.57	25.16±1.91	220.92±24.99	5.7±0.48	1.27±0.12	1.69±0.24
7.Nelamangala	12.85±2.25	5.83±0.5	7.42±0.72	27.36±2.19	216.83±29.1	8.75±2.23	1.53±0.24	3.0±0.55
8.Madduru	12.2±0.49	5.59±0.23	6.6±0.51	28.98±0.9	269.08±22.56	4.99±0.42	1.54±0.09	2.69±0.37
9.Malavalli	11.43±2.26	6.74±0.43	8.08±0.57	23.52±1.89	269±23.86	11.84±2.46	2.93±0.35	3.67±0.43
10.Bannuru	15.58±2.37	5.1±0.65	6.88±0.67	22.08±1.79	253.83±40.39	10.3±2.17	2.18±0.2	3.08±0.27
11.Ramnagara	15.79±2.44	6.85±0.62	8.77±0.87	28.69±2.44	226.17±59.26	11.24±2.34	2.02±0.37	3.49±1.98





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12.Bengaluru	15.25±2.05	6.12±0.42	8.99±0.88	27.53±2.67	282.08±39.4	11.68±2.17	0.91±0.22	3.0±1.2
13.Bandalli	12.78±2.32	7.03±0.36	7.98±0.72	23.68±1.79	219.92±20.32	10.77±2.01	1.18±0.45	0.83±0.16
14.T.N.pura	14.31±2.1	5.64±0.63	8.34±0.99	25.6±3.06	264±39.52	11.67±2.1	0.89±0.18	1.71±0.93
15.Mysore	15.38±2.7	5.62±0.34	10.62±1.06	34.06±3.2	290.42±40.15	11.39±2.3	1.73±0.38	2.4±0.64
Averagerange	9.2 - 15.79	5.10 - 8.72	6.01-10.62	19.47-28.69	182.08- 290.42	4.99-11.84	0.94-2.93	0.83-3.8





Technological Gap in Bishop's Weed Cultivation

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ABSTRACT

The area under bishop's weed in Akola district is increasing day by day. The average yield of bishop's weed in Akola district is 8 to 9 quintal per hectare and is comparatively very low than the national productivity of bishop's weed i.e. 12.6 quintal per hectare. The reason for this low productivity might be the technological gaps in cultivation practices of bishop's weed followed by bishop's weed growers, hence this study was planned to assess the technological gaps in cultivation of bishop's weed. Findings indicated that there is huge gap between recommendations of actual adoption of bishop's weed technology by the bishop's weed growers. Farmers own experience, traditions and misunderstanding affect the adoption of bishop's weed practices.

Keywords- bishop's weed, technological gaps

INTRODUCTION

Ajwain or Bishops weed is herb belonging to Apiaceae family. Botanical name is *Trachyspermum ammi* (L), sprague (*Carum Copticum* Heirn). It's Indian names are: Hindi-Ajwain; Bengali-Jowan; Gujarati-Yavan; Kashmiri-Jawind; Kannada-Oma; Oriya-Juani; Punjabi & Urdu-Ajowain; Sanskrit-Ajmoda Yavanika; Tamil-Omum; Telgu-Vamu. Bishop's weed is a small erect herb (shrub), minutely pubescent and its stem is much branched and leafy. This herb is commercially cultivated in large scale in Madhya Pradesh, Andhra Pradesh, Gujarat, Bihar, Maharashtra, Uttar Pradesh, and Rajasthan. Bishop's weed is also cultivated extensively in backyard gardens in India. The area under bishop's weed in Akola district is increasing day by day. The average yield of bishop's weed in Akola district is comparatively very low than other districts of Maharashtra. The various recommended practices and other scientific techniques of bishop's weed production are not followed significantly by the cultivators, as a results per hectare yield of bishop's weed have not reached to its maximum level. The reasons for low productivity may be due to traditional



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method of cultivation followed by the farmers. Productivity of bishop's weed can be enhanced by adopting the improved practices recommended by the National Research Centre on Seed Spices, Tabiji, Ajmer and agriculture universities (2)

MATERIALS AND METHODS**Locale of the study**

The present study was carried out in Akola district of Maharashtra state of western Vidarbha region.

Selection of Tahasil's

Out of seven tahasil's in Akola district, selection of Akola, Akot and Telhara Panchayat Samiti has been done because of larger area comes under bishop's weed crop and farmers experience in bishop's weed cultivation.

Selection of Villages

The study was conducted in ten villages of Akola, Akot and Telhara Tahsils of Akola district, where the maximum number of bishop's weed growers are cultivating bishop's weed crop commercially as per the recommendation of Agriculture Development Office of Zilla Parishad due to higher hectares area under this crop in these tahsils.

Selection of Beneficiaries

Gram Panchayat of selected villages were consulted for making a list of respondents who are cultivating bishop's weed from last 3 years. 10 numbers of respondents from each selected village, those growing bishop's weed from last 3 years were selected randomly. Thus 100 respondents were selected for the present investigation.

Research Design & Data Collection

An exploratory research design was used for the present study. Interview schedule was prepared and pre-tested. Data were collected in face to face situation. The interview with the beneficiaries was conducted at their resident or place with comfort situation.

Assessment of Technological Gap

For the present study, Technological gap is operationally defined as the gap between recommended cultivation technologies of bishop's weed and its actual adoption by the bishop's weed growers.

In the first instance, package of practices of bishop's weed cultivation were ascertained with the literature available in the Chili Research Unit, Dr. PDKV, Akola. In order to decide important package of practices of bishop's weed cultivation, help of specialist was sought and finally important package of practices of bishop's weed cultivation and recommendations were finalized.

These selected packages of practices were- 1) Land preparation 2) Sowing method 3) Period of sowing 4) Seed rate and variety 5) Seed treatment 6) Spacing 7) Intercropping 8) Fertilizer 9) Plant protection. The recommendations made to these practices were considered as full level of adoption and the practices actually adopted by the growers were considered as bishop's weed grower's level of adoption. Then, the gap for each practice was calculated by





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deducting the farmer's level of technology. It was also asked to the respondents to quote one important reason they feel important regarding non-adoption of the recommendation made for bishop's weed cultivation. The replies from the non-adopter of selected bishop's weed cultivation practices was then recorded and categorized systematically. On the basis of raw score obtained for technologies adopted by the bishop's weed growers the technological gap index for each practice was then worked out by using formula.

R - A

Technological gap index = ----- x 100

R

Where,

R = Added score for technological adoption of all
Component in respect of particular recommended Technology.
A =Score obtained out of total sub component.

The Composite Gap Index (CGI) for individual respondent bishop's weed grower was then calculated by summing technological gap indices of all selected technologies and deciding the same by total number of technologies. Finally the respondents were categorized on the basis of Composite Gap Index into low, medium and high technological gap.

RESULTS AND DISCUSSION

The technological gap of various practices connected with bishop's weed growing by respondents was further ascertained practice wise and the same have been reported in Table 1 It is evident from the distribution in Table 1, that there was high technological gap of bishop's weed cultivation practices like rhizobium application to bishop's weed seed (82.00%), disease and their control measure (82.00%), the recommended varieties for bishop's weed (85.00%), application rate of thirum/captan per kg of bishop's weed (90.00%), intercropping in bishop's weed (93.00%) and row proportion of intercrop in bishop's weed (99.00%). However, it is observed that the majority of respondents have technological gap in cultivation practices such as the recommended fertilizer application dose for bishop's weed (53.00%), seed rate for bishop's weed (68.00%) and control measure for pest (68.00%). It was also found that there is low technological gap in cultivation practices such as land preparation (9.00%), selection of soil (13.00%), method of sowing (17.00%), FYM application (23.00%), spacing (23.00%) and sowing time (36.00%).

Thus, it could be inferred that majority of the respondents by and large did not adopt some important practices as per recommendation whereas technological gap is found maximum in adopting practices like seed treatment with rhizobium and also with chemicals like thirum/captan, control measure for disease, varieties of bishop's weed and intercropping . As regards to treatment of seed with rhizobium and with chemical, they seemed to be ignorant. The probable reason for non-adoption of practices of seed treatment application to seed by bishop's weed growers may be that the bishop's weed growers did not possess knowledge about the seed treatment. Secondly, rhizobium culture may not be available in the market at sowing time. Thus, there is a need to impart knowledge about seed treatment application to bishop's weed growers through method demonstration. Care also need to be taken to make available rhizobium culture in the market before the start of sowing season. The majority of respondents did not use or adopt the practices like recommended dose of fertilizer, application of FYM and control measure for pests.

It is quite logical that the involving low cost technologies like spacing, timely sowing and land preparation has found to be low technological gap by majority of respondents whereas the technology involving knowledge, skill and experience was found to be high technological gap of respondents. The extension agency should play dominant role in educating the farmers. This will helps in lowering the technological gap of practices to greater extent, as the extent of extension agency contact is directly related with adoption behaviour. There is need to organized special training



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for village extension workers so as to keep themselves abreast with the latest technology of bishop's weed cultivation. It is also suggested that both method and result demonstrations should be arranged to educate the bishop's weed growers about the use of fertilizers, plant protection measures, rhizobium treatment etc. Further it is to say that well organized and carefully supervised block demonstrations of package of practices would provide good opportunity to the farmers to get convinced about the worth of the practices.

Average Technological Gap of Major Cultivation Practices of Bishop's Weed

The data regarding average technological gap in different practices of bishop's weed are summarized in Table 2.A perusal of Table 2 revealed that the average technological gap was found varies from component to component and could be ranged from 96.00 per cent to 14.33 percent. The maximum gap was observed in intercropping (96.00%) having first rank followed by seed treatment (86.00%) recorded second rank. Lowest technological gap was observed with respect to land preparation i.e. 14.33 per cent. It was observed that the land preparation was traditionally done by the growers and at 9th rank. In case of sowing method of bishop's weed, 17.00 per cent average technological gap having 8th rank was observed. Similarly, in sowing time of bishop's weed, technological gap (36.00%) was low having 6th rank. In case of recommended seed rate and varieties, the average technological gap (76.00%) was found in bishop's weed cultivation having 3rd rank. As regards to the spacing, average technological gap (23.00%) was observed. This could be only due to dependency on labour who indolently manages the spacing and having 7th rank. As regards to fertilizer application 53.00 per cent average technological gap was calculated having 5th rank and the plant protection recorded 75.50 per cent average technological gap because of lack of knowledge about diseases and pest.

In overall, 52.98 per cent technological gap was recorded for recommended cultivation practices of bishop's weed. In this gap intercropping, seed treatment, seed rate and variety, plant protection and fertilizer application practices contributed more. Hence, it is necessary to pay attention on these practices for increasing the yield of bishop's weed in Akola district. State department of Agriculture and Krishi Vigyan Kendra has to concentrate more in these areas and with the use of intensive extension methods to lower down the technological gap in bishop's weed.

Table 3 reveals that over three-fourth of the farmer (70.00%) were included under medium category of technological gap level of bishop's weed cultivation practices, followed by high level of technological gap (18.00%) and low level of technological gap (12.00%). The null hypothesis set earlier is therefore disproved. Thus, their existing huge gap in adoption of bishop's weed cultivation practices by the farmers. The findings therefore pointed out that inadequate and sporadic effort were made in popularizing and taking the low cost bishop's weed cultivation technology to the door step of the farmers. A concrete effort on the part of extension agency to popularize this technology through various means is thus essential.

It could be inferred from the above findings that over three-fourth of the respondents were in medium level of technological gap about recommended practices of bishop's weed. These findings are in line with the findings reported by (1)

CONCLUSION

It could be inferred that over three-fourth of the respondents were in medium level of technological gap about recommended practices of bishop's weed.





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Table1: Distribution of Respondents According to Their Extent of Technological Gap About Recommended Package of Practices of Bishop's Weed

Sr. No.	Recommended practices of bishop's weed	Frequency (n=100)	Percentage
A)	Low technological gap		
1.	The land preparation for bishop's weed (Ploughing and 2-3 harrowing)	9	9.00
2.	Type of soil required for bishop's weed (Medium to heavy soil)	13	13.00
3.	Method of sowing (drilling method)	17	17.00
4.	FYM application dose recommended for bishop's weed (10-12 cart loads of FYM)	23	23.00
5.	The recommended spacing for bishop's weed (45×45 cm)	23	23.00
6.	The recommended sowing time for bishop's weed (Rainfed : 15 Sept-14 Oct; Irrigated : 20-25 Oct)	36	36.00
B)	Medium technological gap		
1.	The recommended fertilizer application dose for bishop's weed (40:20:20)	53	53.00
2.	The recommended seed rate for bishop's weed (2.5-3.5kg/ha)	68	68.00
3.	Pest of bishop's weed with their control measure for bishop's weed	68	68.00
C)	High technological gap		
1.	The rhizobium culture application to bishop's weed	82	82.00
2.	Disease of bishop's weed with their control measure from bishop's weed	82	82.00
3.	The recommended varieties for bishop's weed (AA-01-19, Ajwain-2)	85	85.00
4.	Application rate of thirum/ captan for bishop's weed (3 g/kg seed)	90	90.00
5.	Crop recommended as intercrop in bishop's weed	93	93.00
6.	Row proportion of intercrop in bishop's weed	99	99.00





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Table 2. Average technological gaps in different components of bishop's weed technology (N=100)

Sr. No.	Different components of bishop's weed technology	Average technological gap	Rank
1	Land preparation	14.33	ix
2	Sowing method	17.00	viii
3	Sowing time	36.00	vi
4	Seed rate and variety	76.00	iii
5	Seed treatment	86.00	ii
6	Spacing	23.00	vii
7	Fertilizer application	53.00	v
8	Intercropping	96.00	i
9	Plant protection	75.50	iv
	Overall technological gap	52.98	

Table 3: Distribution of Respondents According to Their Extent of Technological Gap

Sr. No.	Category	Frequency (n=100)	Percentage
1.	Low	12	12.00
2.	Medium	70	70.00
3.	High	18	18.00
	Total	100	100.00
	X -56.06	S.D. -15.01	

