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Study on effect of chitosan on body weight gain and anti-microbial activity in swiss albino mice

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Keywords:

Chitosan
Dietary Supplementation
Body Weight Gain
Antimicrobial Activity
E Coli Counts.

Abstract

A study was conducted to determine the effect of chitosan on body weight gain and anti microbial activity in swiss albino mice. A total of 12 swiss albino mice were selected and subjected for two dietary supplement with chitosan (200mg & 1gm/ Kg body weight respectively). The experimental trials were conducted for 5 weeks & dietary supplementation of chitosan was given at weekly intervals.The results of the study indicated that there is increase in the body weight gain of mice by every week due to the dietary suplementation of chitosan.Similarly every week faecal samples were collected & subjected for anti microbial activity by estimating E-coli Counts. There was decrease in the E.coli count for every week with the dietary supplementation of Chitosan indicating the growth promoting and antimicrobial activity of Chitosan.

Introduction

The usage of different additives instead of antibiotics has been recommended as a way to improve growth and to enhance gut health of animals which makes it possible to reduce or eliminate the use of antibiotic in feeds. Among these additives, Chitosan the second most abundant carbohydrate polymer in nature (Singla & Chawla, 2001; Luo & Wang, 2013) has been demonstrate to have positive effect on farm animals.

Chitosan is a polysaccharide prepared by deacetylation of Chitin which is widely distributed in the exoskeleton of living organisms such as Crustacea, insects and fungi (Crini, 2005; Huang et al, 2007, Li etal, 2009 & Xia et al, 2011). It was reported previously that dietary supplementation of chitosan was able to improve animal performance (Khajarern & Khajareran, 2002a.b, Shi et al, 2005) and has become a new candidate as a growth promoter for farm animals(Huang et al, 2005, Yuan & Chen, 2012). Hence present study was conducted in white swiss albino mice.

Material & Methods

Raw material used was *Penaeus monodon*, commonly known as Giant Tiger Prawn and *Penaeus indica* or Indian Prawn. The inedible parts including head,shells and tails were removed from the whole body for extraction of chitosan.

The chemicals used in this extraction process consists of

1. 4% Sodium Hydroxide (w/v – 1:4.5)
2. 4% Hydrochloric Acid (v/v – 1:4.5)
3. 50% Sodium Hydroxide (w/v – 1:20)
4. 1% (v/v) Acetic Acid

Chitin and chitosan were prepared from prawn shell waste. Biomass of shrimp waste collected was 5 grams. The shell waste was washed with tap water and dried for further use.It was then de-proteinised in 4% aqueous sodium hydroxide (1:4.5;w/v) at room temperature (25^{o}c) for 21 hours. After draining the alkali, for the removal of residual protein from the shell,it was washed with distilled water repeatedly

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unless the ph drops to neutral. The de-proteinised shell was de mineralized by 4 % HCL (1:4.5; v/v) at room temperature for 12 hours.The acid was drained off and washed thoroughly with distilled water. The chitin was dried at ambient temperature (30 ±2°C). The Chitosan was prepared by deacetylation of chitin by treating with 50% aqeous sodium hydroxide(1:20;w/v) at 40°C for 3 days.After deactylation,the alkali was drained off and washed with distilled water thoroughly until the pH is less than 7.5. Finally,the chitosan was dried at ambient temperature (30 ±2°C).

Hence present study was conducted in white swiss Albino Mice with two dietary supplementation of chitosan i.e. 200 mg / kg body weight & 1 gm / kg body weight. For this experiment three groups of Mice were selected Group- I for 200 mg/kg body weight dietary supplemention of chitosan, Group – II 1gm / kg body weight of dietary supplementation of chitosan along with control group. The dietary supplementation was given at weekly intervals and correspondingly body weights were taken.

Along with the body weight for the groups I & II along with the controls faecal samples were also collected for estimation of E Coli counts to determine the anti microbial activity of chitosan.

Experimental Design

Table 1:

S. No	Groups	Dietary Supplementation of Chitosan	Number
1	Control	-	2
2	Group - I	200 mg/ kg body weight	5
3	Group – II	1gm/kg body weight	5

Results & Discussions

The Chitosan was extracted from Biomass of shrimp and fed with two dietary supplementation viz. 200 mg & 1gm / Kg body weight to the white swiss albino mice for 5 weeks duration period. The effect of Chitosan supplementation on body weight of swiss albino mice was determined and there was increase in the body weight of mice and were shown in the Table 2. Chen et al(2001) reported that compound Chitosan enhanced the activity of pepsin in rats. Hence,increase in the body weight in Albino mice might be due to increase in feed efficiency & feed intake due to enhanced activity of pepsin in the stomach.

The antimicrobial activity of the Chitosan was determined by subjecting faecal samples that were collected on Zero day, First week, Second week, Third Week, Fourth Week & Fifth Week respectively. The detailed results were shown in the Table 3. The table 3 indicated that there is decrease in the E Coli count from first week to fifth week of two dietary supplementation (both 200 mg/kg & 1 gm/kg) of chitosan compared to the control group showing antimicrobial effect of chitosan. The antimicrobial activity of chitosan indicated that there is decrease in the E.coli count because dietary chitosan could inhibit the proliferation of E.coli in the intestine there by improving the micro ecological environment in the gut.These studies are in agreement with Xu et al , 2012. Further chitosan provided a beneficiary environment for the proliferation of enterocytes, preventing intestinal atrophy Han et al, 2012. Our studies also showed that chitosan was an effective polysaccharide in maintaining intestinal structure

Table 2: Body Weights of Mice at Different Periods of Experimental Study

Period	Control	Group – I (200 mg/ kg body weight)	Group – II (1gm/kg body weight)
Zero Day	14 gms	14 gms	14 gms
1st Week	18 gms	20 gms	22 gms
2nd Week	20 gms	28 gms	30 gms
3rd Week	22 gms	30 gms	33.5 gms
4th Week	24 gms	35 gms	39 gms
5th Week	26 gms	39 gms	44 gms

Table 3: Table showing E.coli with the Two Dietary Supplements of Chitosans

S. No	Dietary Supplementation of Chitosan	E-Coli Count (CFU/gm)	
		0 Day	5th Week
1	Control	5×10^8	5×10^6
2	200 mg/Kg	4.8×10^8	3×10^6
3	1gm/Kg	4.8×10^8	1.5×10^3

and function which might be one of the reasons for increase in growth performance in mice fed with chitosan dietary suppliments.

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References

1. Singla A.K., Chawla M. Chitosan: some pharmaceutical and biological aspects – an update. Journal of Pharmacy and Pharmacology, 2001; 53: 1047–1067.
2. Khajarern J., Khajarern S. Probiotic product lifts performance in layers. Asian Poultry, 2002a; 4:38–39.
3. Khajarern J., Khajarern S. Probiotic product lifts performance and reduces diarrhoea. Asian Pork, 2002b; 4(5):44–45.
4. Shi B.L., Li D.F., Piao X.S., Yan S.M. Effects of chitosan on growth performance and energy and protein utilisation in broiler chickens. British Poultry Science, 2005; 46:516–519.
5. Huang RL,Yin YL,Wu GY,Zhang YG,Li TJ,Li LL,Li MX,Tang ZR,Zhang J,Wang B,He JH,Nie XZ.Effect of dietary oligochitosan supplementation on ileal digestibility of nutrients and performance in broilers.Poult Sci. 2005; 28:1383-1388.
6. HUANG RL,Yin YL,Li MX,WU GY,Li TJ,Li LL,Yang CB,Zhang J,Wang B,Deng ZY,Zhang YG,Tang ZR,Kang P,Guo YM.Dietary Oligochitosan supplementation enhances immune status of broilers.J Sci Food Agric. 2007; 87:153-159.
7. Li Hy,Yan SM,Shi BL,Guo XY.Effect of chitosan on nitric oxide content and inducible nitric oxide synthase activity in serum and expression of inducible nitric oxide synthase mRNA in small intestine of broilwer chickens.Asian-Aust.J Anim Sci. 2009; 22: 1048-1053.
8. Xia W.S., Liu P., Zhang J.L., Chen J. Biological activities of chitosan and hitooligosaccharides. Food Hydrocolloids, 2011; 25:170–179.
9. Yuan SB,Chen H.Effects of dietary supplementation of chitosan on growth performance and immune index in ducks.Afr J Biotechnol. 2012; 11:3490-3495.
10. Han XY,Du WL,Huang QC,Xu ZR,Wang YZ.Changes in small intestinal morphology and digestive enzyme activity with oral administration of copper – loaded chitosan nanoparticles in rats.Briol Trace Elem Res. 2012; 145:355-360.
11. Luo Y.C., Wang Q. (2013): Recent advances of chitosanand its derivatives for novel applications in food science.Journal of Food Processing & Beverages, 2013; 1:13.

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A review on herbal feed additives in livestock

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Keywords:

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Abstract

Phytogenic feed additives are plant-derived products used in livestock nutrition to improve the performance of farm animals. The ban on nutritive antibiotic use in Europe and the increased awareness of the consumers triggered a need for natural and safe feed additives to achieve better production results of farm animals. Phytogenic feed additives comprise a wide variety of herbs, spices, and products derived thereof, and are mainly essential oils. Plant extracts are used in animal nutrition as appetite and digestion stimulants, stimulants of physiological functions, for prevention and treatment of certain pathological conditions, as colorants and antioxidants. This article is a review of present literature data on the commonly available herbs in India and usage of their medicinal properties including improve digestibility, antimicrobial, anti-inflammatory, anti-oxidant and immunostimulant in animal's diet.

Introduction

Keeping farm animals healthy is necessary to obtain healthy animal products. Only quality feed together with proper hygiene, potable water and management can ensure the production of nutritious animal products with desired organoleptic properties (Saxena, 2008). A ban of antibiotics as feed additives in animal nutrition is realized since 1986 in Sweden and later on to various countries. A general ban is foreseen in some years from now, because of the increased occurrence of pathogens resistant against therapeutical antibiotics used in animals and humans. With the restricted use or ban of dietary antimicrobial agents we must explore new ways to improve and protect the health status of farm animals (Wenk, 2003). In this aspect, herbs and spices are not just appetite and digestion stimulants, but can, with impact on other physiological functions, help to ensure good health and welfare of the animals, what can positively affect their performance.

Herbs, spices and their extracts were already used thousands of years ago in Mesopotamia, Egypt, India, China and old Greece, where they were appreciated for their specific aroma and various medicinal properties. During the last two decade the use of additives of natural origin in animal and human nutrition has been encouraged.

Feed additives are commonly described as non-nutrient substances that accelerate growth, efficiency of feed utilization and are beneficial for health or metabolism of the farm animals (Church and Pond, 1988). Beside the feed enzymes, probiotics, prebiotics (oligosaccharides), organic acids, the herbs and botanicals can be used as feed additives. A definition of various herbal feed additives can be derived from Webster's Encyclopedic Unabridged Dictionary of the English Language (1989):

Herb: A flowering plant whose stem above ground does not become woody and persistent. A plant when valued for its medical properties, flavour, scent, or the like.

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Spices: Any of a class of pungent or aromatic substances of vegetable origin, as pepper, cinnamon, cloves, and the like, used as seasoning, preservatives, etc.

Botanical: A drug made from part of a plant, as from roots, leaves, bark etc. Essential oils are any of a class of volatile oils obtained from plants, possessing the odour and other characteristic properties of the plant, used chiefly in the manufacture of perfumes, flavours and pharmaceuticals.

Active Principles in Herbs

To gain advantageous effects of herbs and spices, they can be added to feed as dried plants or parts of plants and as extracts. The composition of extracts from the same plant depends on the method of extraction and the properties of the extraction solvent used. Depending on the chemical characteristics of extraction solvents we can extract only certain molecules. Unpurified extracts contain a number of different molecules extracted with certain solvent, which can affect the action of each other, while purified extracts contain only one active component. Plants mainly contain one or some predominant active molecules (secondary metabolites), which are responsible for certain biological effects. The amount of these molecules varies depending on the variety of plant, growing conditions, harvest time etc. Generally these compounds enable the plants to interact with the environment and may act in a defence system against physiological and environmental stress as well as predators or pathogens (Wenk, 2003). Beside compounds with toxic properties, several of these secondary plant metabolites have been reported to show beneficial effects in food products and also in mammalian metabolism. They are of main relevance in herbs and are specifically enriched and eventually standardized in botanicals. The effect of active components from herbs and spices depends largely on the dosage used . No effect whatever can be observed at small doses; on the other hand, large amounts can be even toxic.

Modes of Action of Herbs And Botanicals

Beneficial effects of herbs or botanicals in farm animals may arise from activation of feed intake and secretion of digestive secretions, immune stimulation, anti-bacterial, coccidiostatic, anthelmintic, antiviral or anti-inflammatory activity and inhibition or - particularly - antioxidant properties. Most of these active secondary plant metabolites belong to the classes of isoprene derivatives, flavonoides and glucosinolates, and a large number of these compounds have been suggested to act as antibiotics or as antioxidants in vivo as well as in food (Wenk, 2003). Often used plants, its active components and functions are presented in Table 1(Frankic, 2009).

Table 1: Often used plants, its active components and functions (Frankic, 2009)

Sr. No.	Plant	Used parts	Major active Component	Function
			Aromatic Species	
1.	Nutmeg	Seed	Sabinene	Digestion stimulant, antidiarrhoeic
2.	Cinnamon	Bark	Cimetaldehyde	Appetite and digestion stimulant, antiseptic
3.	Cloves	Cloves	Eugenol	Appetite and digestion stimulant, antiseptic
4.	Cardamom	Seed	Cineol	Appetite and digestion stimulant
5.	Coriander	Leaves, Seed	Linalol	Digestion stimulant
6.	Cumin	Seed	Cuminaldehyde	Digestive,Carminative, Galactagogue
7	Anise	Fruit	Anethol	Digestion Stimulant, Galactagogue
8	Celery	Fruit, Leaves	Phtalides	Appetite and digestion stimulant
9.	Parsley	Leaves	Apiol	Appetite and digestion stimulant, antiseptic
10.	Fenugreek	Seed	Trigonelline	Appetite stimulant
			Pungent spices	
11.	Capsicum	Fruit	Capsaicin	Digestion stimulant
12.	Pepperr	Fruit	Piperine	Digestion stimulant
13.	Horsradish	Root	Allylizotiocianat	Appetite stimulant
14.	Mustard	Seed	Allylizotiocianat	Digestion stimulant
15.	Ginger	Rizome	Zingerone	Gastric stimulant
16	Garlic	Bulb	Allicin	Digestion stimulant, antiseptic
			Herbs	
17	Rosemary	Leaves	Cineol	Digestion stimulant, antiseptic, antioxidant
18	Thyme	Whole plant	Thymol	Digestion stimulant, antiseptic, antioxidant
19	Sage	Leaves	Cineol	Digestion stimulant, antiseptic, carminatif
20	Laurel	Leaves	Cineol	Appetite and digestion stimulant, antiseptic
21	Mint	Leaves	Menthol	Appetite and digestion stimulant, antiseptic

Herbs develop their initial activity in the feed of farm animals as flavour and can therefore, influence the eating pattern, secretion of digestive fluids and total feed intake. Herbs or the phytochemicals can influence selectively the micro-organisms by an anti-microbial activity or by a favourable stimulation of the eubiosis of the microflora. The consequence can be a better nutrient utilization and absorption or the stimulation of the immune system. Finally herbs can contribute to the nutrient requirements of the animals and stimulate the endocrine system and intermediate nutrient metabolism.

Often the desired activity of herbs is not constant. Conflicting results may arise from the natural variability of the composition of plant secondary metabolites. Variety and environmental growth conditions, harvesting time and state of maturity, method and duration of conservation and storing, extraction method of the plants, as well as possible synergistic or antagonistic effects, anti-nutritional factors or microbial contamination are factors which may substantially affect the results of in vivo experiments. For example, rosemary and sage from different geographical locations and types of processing (dried herbs and essential oils) or from different suppliers (Wenk, 2003) showed significant differences in antioxidative capacity. Furthermore, several secondary plant metabolites are showing strong flavours, which may affect sensory characteristics of the feed and, therefore, feed intake. Additionally, antibacterial properties and probably concentration dependent effects on feed intake and on digestion of nutrients can be expected and should be taken into consideration when conducting in vivo experiments with phytochemicals using farm animals.

Common Herbs Found in India

Turmeric (Curcuma Longa)

Turmeric is commonly called "Haridra" in Sanskrit, "haldar" in Gujarati, Haldi in Hindi "Pasupu" in Telugu, Kaha in Sinhala, Manjal in Tamil and "Arisina" in Kannada, (Eevuri and Putturu, 2012). Turmeric is a rhizomatous herbaceous perennial plant of the family Zingiberaceae, with medicinal properties known to possess antimicrobial and anti-oxidant properties. Rhizome is the segment of medicinal importance and is usually boiled, cleaned, dried and powdered before usage.

Composition

Dried turmeric contains 6.3% protein, 5.1% fat, 3.5% minerals, 69.4% carbohydrates and 13.1% moisture. It contains up to 5% essential oils and up to 5% curcumin (polyphenol). Curcumin is the active substance of turmeric which is known as C.I. 75300, or Natural Yellow 3. The active ingredients of turmeric are tetrahydro curcuminoids, curcumin, dimethoxy curcumin and bismethoxy curcumin (HMPC, 2009).

Uses: The continuing research indicates that turmeric and its active compound "Curcumin" is unique anti-oxidants, antimutagenic, antitumorigenic, anticarcino-genic, anti-inflammatory, antiarthritis, antimicrobial and hypocholesterolemic properties (Gowda et al., 2009). Therapeutic properties of turmeric include anti-oxidant, anti-diabetic, antibacterial, antifungal, antiprotozoal, antiviral and hypocholesteremic activities (Abbas et al., 2010; Ahmadi, 2010).

Turmeric and curcumin have been shown to protect liver against a variety of toxicants including carbon tetrachloride, aflatoxin B_1 and cyclophospha-mide in mouse, rat and duckling (Soudamini and Kuttan, 1992). The curcuminoids present in turmeric powder have shown protective effect against aflatoxin B_1 (Gowda et al., 2008). The traditionally turmeric is used in various conditions like biliary disorders, anorexia, cough, diabetes, wounds, hepatic disorders, rheumatism and sinusitis.

Tulsi (*Ocimum Tenuiflorum*)

Tulsi or *tulasi* (Holy Basil) is an aromatic plant in the family Lamiaceae, which is native throughout the Old World tropics and widespread as a cultivated plant and an escaped weed. The two main morphotypes cultivated in India and Nepal are green-leaved (Sri or Lakshmi *Tulsi*) and purple-leaved (Krishna *Tulsi*) .

Composition

Tulsi contains eugenol (1-hydroxy 2-methoxy 4 allyl benzene) a phenolic compound and ursolic acid having pharmacological effects. Other chemical constituents of *Tulsi* are: oleanolic acid, rosmarinic acid, carvacrol, linalool, β-caryo-phyllene, β-elemene, β-caryophyllene and germacrene-D (Prakash and Gupta 2005).

Uses

Tulsi is an effective treatment for reducing blood glucose levels and total cholesterol levels (Suanarunsawat et al., 2011). It is a well known therapeutic agent for several pathological conditions possess antistress and antioxidant properties and also possess remarkable biological activities like

antimicrobial, immunomodulatory, anti-cancerous, anti-oxidant, anti-inflammatory, hepatoprotective and cardioprotective etc. It also shows some promise for protection from radiation poisoning and cataracts. Experimental studies indicated that an alcoholic extract of *Tulsi* modulates immunity, thus promoting immune system function (Mondal et al, 2011). Marked by its strong aroma and astringent taste, it is regarded in Ayurveda as a kind of "elixir of life" and believed to promote longevity. *Tulsi* extracts are used in ayurvedic remedies for common colds, headaches, stomach disorders, inflammation, heart disease, various forms of poisoning, and malaria. Traditionally, *tulsi* is taken in many forms: as herbal tea, dried powder, fresh leaf, or mixed with *ghee*. Essential oil extracted from Karpoora *Tulsi* is mostly used in skin preparations due to its antibacterial activity.

Amla

Phyllanthus emblica (syn. *Emblica officinalis*), the Indian gooseberry, or *aamla*, is a deciduous tree of the Phyllanthaceae family and is known for its edible fruit. Common name of this tree include Usiri (in Telugu), Nellikai (in Tamil and Kannada).

Composition

Amla powder contains 5.05 to 6.78 per cent moisture, 0.23 to 0.59 per cent fat and minerals like Calcium 79.6mg, Phosphorous 12.38mg and Iron 88.03mg/100g (Mishra et al., 2009). Amla is one of the richest sources of Vit-C. Several active tannoid principles (Emblicanin-A, Emblicanin-B, Punigluconin and pedunculagin) have been identified for their health benefits. The fruit also contains other polyphenols: flavonoids, kaempferol, ellagic acid and gallic acid (Rehman et. al., 2007).

Uses: Medical studies conducted on Amla fruit suggest that it has antiviral, anti-bacterial and anti-fungal propertiest. Amla has been particularly indicated for anemia, asthma, bleeding gums, diabetes, chronic lung disease, hyperlipidaemia, yeast infections, scurvy and cancer. Amla has been known in Ayurvedic medicine for its tonifying, anti-ageing and immune enhancing properties (Eevuri and Putturu, 2012). Animals fed on amla powder showed better ability for uptake and killing of bacteria, which might be due to the presence of tannins which stimulates phagocytic cells.

Indian gooseberry has undergone preliminary research, demonstrating *in vitro* antiviral and antimicrobial properties. There is preliminary evidence *in vitro* that its extracts induce apoptosis and modify gene expression in osteoclasts involved in rheumatoid arthritis and osteoporosis (Pennolazzi et al, 2008). It also promoted the spontaneous repair and regeneration process of the pancreas occurring after an acute attack (Sidhu et al., 2011). Experimental preparations of leaves, bark or fruit have shown potential efficacy against laboratory models of disease, such as for inflammation, cancer, age-related renal disease, and diabetes. It has antioxidant property eventhough it has high density of tannins.

All parts of Amla tree are used in ayurveda / unani medicines. It may be used as a herbal *rasayana* called *Chyawanprash* (rejuvenative) to promote longevity, and traditionally to enhance digestion, treat constipation, reduce fever, purify the blood, reduce cough, alleviate asthma, strengthen the heart, benefit the eyes, stimulate hair growth, enliven the body, and enhance intellect (Rehman et. al., 2007).

Aloe Vera (*Aloe barbadensis*)

Aloe vera belongs to *Asphodelaceae* (*Liliaceae*) family, and is shrubby, perennial, xerophytic, succulent, pea-green color plant. It has fleshy, long triangular leaves that have spikes along the edges. The fresh parenchymal gel from the centre of the leaf is clear and dried to form concentrate and juice products. The sticky latex liquid is derived from the yellowish green pericyclic tubules that line the leaf (rind): this is the part that yields laxative anthraquinones (Eevuri and Putturu, 2012).

Composition

Dried aloe contains 73.07% carbohydrates, 4.73% protein, 0.27% fat and trace amounts of tannins (0.155%g/100g), oxalate (0.68g/100g) and Phytate (0.54g/100g). It contains phyto-chemicals like saponins (5.651g/100g), flavanoids (3.246g/100g), alkaloids (2.471g/100g) and phenols (0.232g/100g) phenols, which is an indicative of cosmetic and medicinal value. It is also rich in minerals like Na, K, P, and Mg (Adesuyi et al., 2012).

Uses

Aloe vera promotes the rate of wound healing and effective in treatment of wounds. Topical application is effective for genital herpes and psoriasis. Aloe vera extracts may be useful in the treatment of diabetes and elevated blood lipids in humans (Boudreau and Beland, 2006) which is due to the presence of compounds such as mannans, anthraquinones and lectins.

Aloe vera extracts have been used as immunostimulant that aids in fighting cancers in cats and dogs (King et al., 1995). Extracts of aloe vera might have anti-bacterial and anti-fungal activities which possibly could help to treat minor skin infections such as boils, benign skin cysts and may inhibit growth of fungi causing tinea. Juice from the pulp is useful for treating jaundice, menstrual disorders, scalp disorders, skin diseases, burns and haemorrhoids. Moghadassi and Verma (2011) has reviewed that it is useful for skin damaged from X-rays. On other hand concentration of glucose in gelatin results in high osmotic pressure that protects skin from live bacteria.

Ginger (*Zingiber officinale*)

Ginger is a rhizomatous plant grown throughout South Eastern Asia, China and parts of Japan, Austria Latin America, Jamaica and Africa. It has been used as spice and medicine in India and China since ancient times (Sasidharan and Nirmala, 2010).

Composition

Dried ginger contains 7.8% protein, crude fibre 6.2%, Ether extract 11.0% and ash 9.0% (Aletor, 2014). It contains phyto-chemicals like Gingerol, Ginderdiol, Gingerdione, dehydroshogaol, Curcumene, Gingerone, Zingiberene, Camphene, and Paradol (Agarwal et al., 2001; Gupta and Ravi Shankar, 2005; Ali et al 2008).

Uses

Ginger is used as growth promoter, antimicrobial and antioxidant agent, hypolipidemic or anti hyperlipidemic, hupocholesterolomic, meat and carcass quality improver (Agarwal et al., 2001; Ademola, 2009; Zhang et al., 2009).

Garlic (*Allium sativum*)

Garlic is spice / herb well known for its medicinal uses and its origin assumed to be in Central Asia. It is a medicinal plant of Alliceae family. Garlic is used in various food products and herbal products and Indian garlic is famous for its aroma with sweetness.

Composition

Dried garlic contains 27.4% crude protein, crude fibre 1.0%, Ether extract 2.5% and ash 1.5% (Aletor, 2014). Garlic contains at least 33 sulphur compounds, which are responsible both for garlic pungent odour and many of its medicinal effects like lowering cholesterol level. It contains phyto-chemicals like Allicin, Diallyl Sulphide, Diallyl Trisulphide and Ajone (Chang and Cheong, 2008; Kim et al 2009; Choi et al 2010).

Uses

A variety of herbal supplement including garlic have been widely used to maintain and improve health of human. It has been long being considered that garlic has several beneficial effects for human and animals, exhibiting antimicrobial and antioxidant, antiviral antifungal anti parasitic properties (Ankri and Mirelman, 1999).

Possible Use of Herbs and Spices

Herbs and Spices as Appetite and Digestion Stimulants

There is evidence to suggest that herbs, spices and various plant extracts have appetite and digestion-stimulating properties (Afshar, 2012). When considering supplementing the feed with herbs and spices or their extracts to stimulate the appetite, we have to know the taste preferences of different animal species. The spices known for their appetite stimulant effect are cinnamon, cloves, cardamom, laurel and mint. Janz *et al.* (2007) found that pigs preferred the feed supplemented with garlic or rosemary over the feed supplemented with oregano or ginger.

Due to the wide variety of active components, different herbs and spices affect digestion processes differently. Most of them stimulate the secretion of saliva. Curcuma, cayenne pepper, ginger, anis, mint, onions, fenugreek, and cumin enhance the synthesis of bile acids in the liver and their excretion in bile, what beneficially effects the digestion and absorption of lipids (Afshar, 2012).. Most of the prelisted spices stimulate the function of pancreatic enzymes (lipases, amylases and proteases), some also increase the activity of digestive enzymes of gastric mucosa (Srinivasan, 2005). Besides the effect on bile synthesis and enzyme activity, extracts from herbs and spices accelerate the digestion and shorten the time of feed/ food passage through the digestive tract (Suresh and Srinivasan, 2007).

Influence of Herbs or Botanicals on Feed Intake

A large number of herbs are used as feed additives to replace the antibiotics for livestock production. Wenk (2003) reported that 0.25% Turmeric in feed of laying hens improved feed intake but at higher levels up to 1% feed intake returned to the control treatment without supplementation. In has been concluded that in both species (piglet and broiler) a slight increase in

feed intake could be observed at least partly at low levels and then a dramatic decrease at higher levels of a particular herb.

Antimicrobial Action of Herbs and Spices

Feed supplements with growth promoting activity increase stability of feed and beneficially influence the gastrointestinal ecosystem mostly through growth inhibition of pathogenic microorganism's growth. Due to improved health status of digestive system, animals are less exposed to the toxins of microbiological origin. Consequently herbs and spices help to increase the resistance of the animals exposed to different stress situations and increase the absorption of essential nutrients, thus improving the growth of the animals (Windisch et al., 2008).

Numerous secondary metabolites formed by plants serve as defence agents against physiological and environmental stressors, predators and pathogenic microorganisms. Several *in vitro* studies showed strong antimicrobial activity of certain plant extracts against Gram" and Gram positive bacteria. Pasqua et al. (2006) found a change in long chain fatty acid profile in the membranes of *E. coli* grown in the presence of limonene or cinnamaldehyde. Similar observations were made with *Salomonella enterice* grown in the presence of carvacrol or eugenol and with *Bronchotrix thermosphacta* grown in the presence of limonene, cinnamaldehyde, carvacrol or eugenol. The changes in fatty acid composition can affect surviving ability of microorganisms. The studies measuring hydrophobicity of *E. coli* (test for measuring the ability of microbial attachment) showed a large increase of hydrophobicity of *E. coli* grown in the presence of Chinese cinnamon and a moderate increase when medium was supplemented with thyme or Ceylon cinnamon (Wenk, 2003). The differences in hydrophobicity were in good correlation with MIC50 values (minimal inhibitory concentration).

This confirms the fact that herbs and spices act as antimicrobial agents by changing the characteristics of cell membranes, and causing ion leakage, thus making microbes less virulent (Windisch et al., 2008).

The exact antimicrobial action of herbs and spices in *in vivo* situations is hard to evaluate, because of the very complex and balanced microbial populations in gastrointestinal tract and the interaction of active components from herbs and spices with other nutrients. Castillo et al. (2006) reported that the mixture of cinnamaldehyde, capsicum oleoresin and carvacrol enhances the growth of lactobacilli, and so increases the ratio of lactobacilli to enterobacteria. So herbs and spices do not posses only the antimicrobial activity, but also modulate the composition of microbial population by prebiotic activity.

Anti -Inflammatory Action

Extracts of curcuma, red pepper, black pepper, cumin, cloves, nutmeg, cinnamon, mint and ginger showed anti-inflammatory effect in the studies on rats (Srinivasan, 2005). The major active molecules with anti-inflammatory action are terpenoids and flavonoids and suppress the metabolism of inflammatory prostaglandins.

Antioxidative Action

Many active components of herbs and spices can prevent lipid peroxidation through quenching free radicals or through activation of antioxidant enzymes like superoxide dismutase, catalase, glutathione peroxidise and glutathione reductase. Main molecules responsible for the antioxidative properties of herbs and spices are phenolic substances (flavonoids, hydrolysable tannins, proanthocianidins, phenolic acids, phenolic terpenes) and some vitamins (E, C and A). Often used herbs rich in phenolics are: rosemary, thyme, garlic, oregano, sage, green tea, chamomile, ginko, dandelion and marigold.

The health promoting effect of antioxidants from plant is thought to arise from their protective effects by counteracting reactive oxygen species. Antioxidants are compounds that help delay and inhibit lipid oxidation and when added to foods tend to minimize rancidity, retard the formation of toxic oxidation products, and help maintain the nutritional quality (Aghsaghali, 2012). Herbs and spices can protect the feed against oxidative deterioration during storage.

The herb commonly used for feed/food preservation is rosemary (*Rosmarinus officinalis*) and it can be used individually or in combination with tocopherols or synthetic antioxidants (Jacobsen et al., 2008).

Immunostimulant Function

The immune system generally benefits from the herbs and spices rich in flavonoids, vitamin C and carotenoids. The plants containing molecules which possess immunostimulatory properties are echinacea, liquorice, garlic and cat's claw. These plants can improve the activity of lymphocytes, macrophages and NK cells, they increase phagocytosis or stimulate

the interpheron synthesis (Craig, 1999).

Conclusion

With the trend towards more "natural" animal production systems, anti-microbial agents are being replaced by herbal feed additives. These are not just appetite and digestion stimulants, but can, with impact on other physiological functions, help to sustain good health and welfare of the animals and improve their performance. They can regulate feed intake and stimulate digestive secretions and finally an optimized digestion capacity with reduced risk of digestive disorders. Several phytochemicals like essential oils or dietary fibre can contribute to a balanced microflora (eubiosis), an optimal precondition for an effective protection against pathogenic micro-organisms and an intact immune system. The common herbs found in India are Turmeric, Tulsi, Amla, Aloe vera, Neem, Garlic, Ginger and other various types of spices. Possible use of herbs can be summarised as appetite and digestion stimulants, increased feed intake, antimicrobial action, anti-inflammatory, Antioxidative and Immuno-stimulant function. Current studies show promising results regarding the use of phytochemicals as growth and production promoters. There is still a need to clarify the phytochemical composition and the mechanisms of action for many herbs, spices and their extracts and furthermore, to assess the appropriate dose that should be safely used in specific circumstances and animal species.

References

1. Abbas RZ, Iqbal Z, Khan, MN, Zafar MA and Zia MA. Anticoccidial activity of *Curcuma longa L.* in broilers. Brazilian Archives of Biology and Technology 2010; 53:63-67.
2. Ademola S G, Farinu G O and Babatunde G M. Serum lipid, growth and haematological parameters of broilers fed garlic, ginger and their mixtures. World Journal of Agricultural Science 2009; 5(1):99-104.
3. Adesuyi AO, Awosanya OA, Adaramola FB and Omeonu AI. Nutritional and Phytochemical Screening of Aloe barbadensis. Current Research of Journal Biological Sciences 2012; 4(1):4-9.
4. Afshar M A. Importance of medical herbs in animal feeding: A review. Annals of Biological Research 2012; 3(2):918-923.
5. Agarwal M, Walia S, Dhingra S and Khambay B P S. Insect growth inhibition, antifeedant and antifungal activity of compounds isolated / derived from *Zingiber officinale* (ginger) rhizome. Pest Management Science 2001; 57:289-300.
6. Aghsaghali AM. Importance of medical herbs in animal feeding: A review. Annals of Biological Research 2012; 3(2) 918-923.
7. Ahmadi F. Effect of turmeric powder on performance, oxidative stress state and some of blood parameters in fed on diets containing aflatoxin. Global Veterinaria 2010; 5:312-317.
8. Aletor O. Physiological characterization and antioxidant properties of the seeds and oils of ginger (*Zingiber officinale*) and garlic (*Allium sativum*). Science Journal of Chem. 2014; 2(6):44-50.
9. Ali BH, Blunden G, Tanira M O and Nemmar A. Some phytochemeical, pharmacological and toxicological properties of ginger (*Zingiber officinale roscoe*): A review of recent research. Food and Chemical toxicology 2008; 40:409-420.
10. Ankri S and Mirelman D. Antimicrobial properties of allicin from garlic. Microbes and Infection 1999; 2: 125-129.
11. Boudreau MD and Beland FA. An evaluation of the biological and toxicological properties of *Aloe barbadensis* (miller), Aloe vera. J. Environ Sci. Health Environ Carcinog Ecotoxicol Rev. 2006; 24(1): 103-54.
12. Castillo M, Martín-Orúe SM, Roca M, Manzanilla EG, Badiola I, Perez JF, Gasa J The response of gastrointestinal microbiota to avilamycin, butyrate, and plant extracts in early-weaned pigs. Journal of Animal Science 2006; 84:2725–2734.
13. Chang K J and Cheong S H. Volatile organosulpfur and nutrient compounds from garlic by cultivationg areas and processing methods. Federation of American Societies for Experimental Biology 2008; 22:1108-1122.
14. Choi L H, Park W Y and Kim Y J. effects of dietary garlic powder and alphatochopherol supplementation on performance, serum cholesterol levels and meat quality of chicken. Poultry Science. 2010; 89: 1724-1731.
15. Church D C and Pond W G. Basic Animal Nutrition and Feeding. 3rd Ed. 1988. Wiley, New York USA 1988; 267-275.
16. Craig W J. Health-promoting properties of common herbs. American Journal of Clinical Nutrition. 1999; 70:491S–499S.
17. Eevuri T R and Putturu R. Use of certain herbal preparations in boiler feeds – A review, Vet. World 2013; 6(3):172-179.
18. Frankic T, Voljc M, Salobir J and Rezar V. Use of herbs and spices and their Extracts in animal nutrition. Acta Agri. Slovan. 2009; 94(2):95-102.
19. Gowda, N K S, Ledoux DR, Rottinghaus GE, Bermudez A J and Chen YC. Efficacy of turmeric

(*Curcuma longa*), containing a known level of curcumin, and a hydrated sodium calcium aluminosilicate to ameliorate the adverse effects of aflatoxin in broiler chicks. Poultry Science 2008; 87: 1125-1130.

20. Gowda, N K S, Ledoux DR, Rottinghaus GE, Bermudez A J and Chen YC. Antioxidant efficacy of curcuminoids from turmeric (*Curcuma longa* L.) powder in broiler chickens fed diets containing aflatoxin B1. British Journal of Nutrition 2009; 102: 1629-1634.
21. Gupta S and Ravishankar S. A comparison of antimicrobial activity of garlic, ginger, carrot and turmeric pastes against *Escherichia coli* O157:H 7 in laboratory buffer and ground beef. Foodbourne Pathogens and Disease 2005; 2:330-340.
22. HMPC (Committee on Herbal Medicinal Products). Assessment Report on *Curcuma Longa* L. Rhizoma. European Medicines Agency 2009.
23. Jacobsen C, Let MB, Nielsen NS, Meyer AS. Antioxidant strategies for preventing oxidative flavour deterioration of foods enriched with n-3 polyunsaturated lipids: a comparative evaluation. Trends in Food Science & Technology 2008; 19: 76–93.
24. Janz J A M, Morel P C H, Wilkinson B H P and Purchas R W. Preliminary investigation of the effects of low-level dietary inclusion of fragrant essential oils and oleoresins on pig performance and pork quality. Meat Science 2007; 75:350–355.
25. Kim Y J, Jin S K and Yang H S. Effect of dietary garlic bulb and husk on the physiochemeical properties of chicken meat. Poultry Science 2009; 88:398-405.
26. King G K, Yates K M and Greenlee P G. The effect of Acemannan Immuno-stimulant in combination with surgery and radiation therapy on spontaneous canine and feline fibrosarcomas. Journal of American Animal Hospital Association 1995; 31(5):439–47.
27. Mishra P, Srivastava V, Verma D, Chauhan O P and Rai G K. Physico-chemical properties of chekiya variety of Amla (*Emblica Officinalis*) and effect of different dehydration methods on quality of powder. African Jr. of Food Sc. 2009; 3(10):303-06.
28. Moghaddasi SM and Verma S K. Aloe vera their chemicals composition and applications: A review. Int J Biol Med Res. 2011; 2(1):466-471.
29. Mondal S, Varma S, Bamola V D, Naik S N, Mirdha B R, Padhi M M, Mehta N and Mahapatra S C. Double-blinded randomized controlled trial for immunomodulatory effects of *Tulsi* (*Ocimum sanctum* Linn.) leaf extract on healthy volunteers. Journal of Ethnopharmacology; 2011; 136(3):452–56.
30. Pasqua RD, Hoskins N, Betts G, Mauriello G. Changes in membrane fatty acids composition of microbial cells induced by addiction of thymol, carvacrol, limonene, cinnamaldehyde, and eugenol in the growing media. Jr. of Agri. and Food Chem. 2006; 54:2745–2749.
31. Penolazzi L, Lampronti I, Borgatti M, Khan MTH, Zennaro M, Piva R and Gambari R. Induction of apoptosis of human primary osteoclasts treated with extracts from the medicinal plant *Emblica officinalis*. BMC Complementary and Alternative Medicine 2008; 8:59-65.
32. Prakash P and Gupta N (2005) Therapeutic uses of *Ocimum sanctum* Linn (Tulsi) with a note on Eugenol and its pharmacological actions. A short review. Indian Journal of Physiology Pharmacology 2005; 49(2):125-131.
33. Rehman HU, Yasin KA and Choudhary MA. Studies on the chemical constituents of *Phyllanthus emblic*. Natural Product Research 2007; 21(9):775–81.
34. Sasidharan I and Nirmala M A. Comparative chemical composition and antimicrobial activity fresh and dry ginger oils (*Zingiber officinale roscoe*). International Journal of Current Pharmaceutical Research 2010; 2:40-43.
35. Saxena MJ. Herbs –A safe and scientific approach. International Poultry Production 2008; 16(2): 11–13.
36. Sidhu S, Pandhi P, Malhotra S, Vaiphei K and Khanduja KL. Beneficial Effects of *Emblica officinalis* in l-Arginine-Induced Acute Pancreatitis in Rats, Journal of Medicinal Food 2011; 14(1-2):147-155.
37. Soudamini KK and Kuttan R Inhibition of lipid peroxidation and cholesterol levels in mice by curcumin. Indian Journal of Physiology Pharmacology 1992; 36:239-243.
38. Srinivasan K. Spices as influencers of body metabolism: An overview of three decades of research. Food Research International 2005; 38:77–86.
39. Suanarunsawat T, Ayutthaya W D A and Songsak T. Lipid-lowering and antioxidative activities of aqueous extracts of *Ocimum sanctum* L. leaves in rats fed with a high-cholesterol diet. Oxidative medicine and cellular longevity 2011; 1-9.
40. Suresh D and Srinivasan K. Studies on the *in vitro* absorption of spice principles – curcumin, capsaicin and piperine in rat intestines. Food and Chemical Toxicology 2007 45:1437–1442.
41. Webster's Encyclopedic Cambridge Dictionary of the English Language (1989). Gramercy Books, New York.
42. Wenk C. Herbs and Botanicals as feed additives in Monogastric animals. Asian-Aust. J. Anim. Sci. 2003; 16 **(**2):282-289.
43. Windisch W, Schedle K, Plitzner C and Kroismayer A. Use of phytogenetic products as feed additives for swine and poultry. Journal of Animal Science 2008; 86:E140–E148.
44. Zhang G F, Yang Z B, Wang Y, Yang W R, Jiang S Z and Gai G S. Effects of ginger root (*Zingiber officinale*) processed to different particle sizes on growth performance, antioxidant status and serum metabolites of broiler chickens. Poultry Science 2009; 88:2159- 2166.

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Insect pests of cattle and their management

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Cattle Pests
Management Practices.

Abstract

Pests are more than a nuisance to livestock, they can potentially drive your profits down as pest irritation can lead to stress that can affect reproduction, weight gain and overall stock health. The productivity of affected animals is impaired and the utility of farm animals is reduced resulting in huge aggregate yearly losses. The insect pests of cattle are mostly members of Dipterans (Flies). The first line of defense in fighting flies is a waste management program. Break the fly cycle by removing fly breeding materials (manure, wet grain, spilled silage, moist hay, etc.) on a weekly basis. Use sticky fly ribbons and baited traps to attract and catch flies.When using chemicals around your facility pay special attention to any chemical treatment.

Introduction

Harm to livestock or pets may come from painful biting and itching due to inflammation at the biting site or to allergic reactions that cause scratching. Intense scratching may produce loss of hair, wool or feathers as well as skin wounds that can be infected with bacteria or other microorganisms, or attract other parasites. Blood loss due to heavy infestations may also cause anemia and negatively affect livestock performance. Uncontrolled screw worms and blow fly larvae may literally devour their prays from the outside within days. Other myiasis caused by warble and bot flies may occasionally damage essential organs or just debilitate the host's organism. Such harm often leads to substantial economic losses in livestock production. The annual loss of national wealth of India due to insects and arachnids attacking domesticated animals has been reported to approximately four hundred crores of rupees.

In the 1980's, the USDA estimated the annual losses in the US to the livestock industry due to biting flies to be about 500 million US$, those from lice about 40 milion US$ and those caused by other various insects about 300 million USD. Economic loss due to ticks in Brazil was recently estimated to be more than 2 billion US$.

Horse fly: Stabanus striatus (Tabanidae: Diptera)

Strong fliers, prominent eyes, eyes contiguous in males, 10 to 25 males, 10-25 mm long. Females bite and feed on the blood (day time feeder), resulting in low milk production, males feed on the flower nectar. Mechanical transmitter of anthrax, talermia and anaplsmosis. Breeds in marshy places. Eggs laid on masses 100 to 1000 are glued to the overhanging surface of acquatic vegetation; they hatch in a week. Larvae occur in moist condition. Whitish in colour with a tracheal siphon; larval period lasts a few months to one year. Life cycle is completed in 70 days to 2 years.

Stable Fly: Stomoxys Calcitrans (Muscidae:Diptera)

Similar to house house flies in appearance. Both male and female are vicious biters and blood sucking.

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They usually feed on the legs during the day time, causing irritation and weakness, loss of blood, secondary infection,10-20% reduction in milk production. Breed in pills of moist fermenting straw, grass and other materials in cattle shed, lays white, sausage shaped eggs in batches 500 to 600. life cycle completed in 20-60 days.

Cattle Fly:Hippobosca maculate (Hippoboscidae: Diptera)

Flat leathery with strong pre-tarsal claws with which they cling mostly to the sides of the neck and suck the blood. Larviparous (never lays eggs) mature larva drops to the soil and the adult emerges from the puparia in a week.

Blow Fly or Bot/Bottle fly: Chillophora,Lucilia spp. (Calliphoridae:Diptera)

Metallic blue or green coloured fly. Larva attack open wounds of cattle, feed on the decaying tissues. Also bore into the flesh, causing cutaneous myiasis and other complications. Also helpful in cleaning the wounds of dead tissues.

Ox Warble Fly: Hypoderma spp (Osteridae:Diptera)

Makes the hide (Sin of the animal).lays six or more rows of eggs on the host hair 800 eggs which lay in 2-3 days. Maggots penetrate the skin and move to the esophageal wall and then reach the back of the animal where they form tumor like swellings or warbles. Skin of the warble is perforated for respiration and also for the emergence of full grown larvae that fall to the ground for pupation. Total life cycle is one year.

Sand Flies: Phlebotomus sp. (Psychodidae:Diptera)

Small moth like flies known as punkies: body and wings covered with coarse hairs and scales.Breeds in wet or aquatic habitats, in decaying organic matter. Source annoyance and irritation. Vector of kala azar, leishmaniasis and pappataci fever.

Bitting Midges,Culicoides Spp.(Ceratopognidae: Diptera)

Small gnat like-blood sucking flies,antennae plumose in males and pilose in females. Mouth parts adopted for biting. Vector of blue tongue virus in sheep. Larvae or terrestrial breeding in organic matter.

Eye Fly:Siphonculina sp (Chloropidae:Diptera)

Tiny,shiny black flies seen clustered on hanging stringer in the shed hover in front of the eyes and feed on the secretions from the eyes.

House Fly: Musca spp (Muscidae:Diptera)

Breeds in decaying materials like dung and night soil. Lays about 200 eggs in her life cycle. Eggs hatch within hours. Pupation occurs in damp compact soil. Carriers of many cattle diseases.

Ticks: Boophilus Annulatus (Acari: Ixodidae)

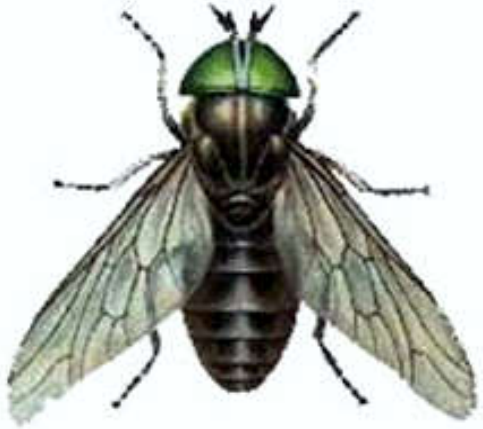
It causes inflammation and swelling at the biting site. Causes blood loss, produces wounds.Transmits anaplasmosis, bovine plasmosis and talarmeia.

Mosquitos: Culex sp (Culicidae:Diptera)

Causes painful bites. Loss of weight and decrease milk production.

Management Practices

- Eliminate or reduce the breeding sites by removing all manure, wet straw and decaying plant materials once a week to break the breeding cycle of flies.
- Use traps and attractants like Octenol.
- Use disinfecting tools and other instruments
- Chase out of insects with water infusion of lime and tobacco.
- Mechanically remove larvae and pupae
- Use chemical insecticides like Fenthion and Dichlorvas as residual sprays. Permethrin can be used as a premise spray to control flies.
- Methoprene is a feed additive larvicide.
- Use self treatment methods like dust bags (Malathion) and backrubbers to control flies on cattle in pastures.



Horsefly

Cattle fly

Ox Warble fly

Sand fly

Stable fly

Blow fly

House fly

Eye fly

References

1. Vasantharaj David. B, Kumaraswami.T. Elements of economic entomology 1st editio.Popular Book Depot; 1996.
2. https://en.wikipedia.org/wiki/Stable fly, eye fly, sand fly, horse fly, Ox warble fly (accessed Sep 13, 2016).

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Seed production technologies in small milltes

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Keywords:

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Pests, Diseseas.

Abstract

Millets are small grained cereals, the smallest of them include finger, kodo, foxtail, proso, little and barnyard millets. They are the staple food of the millions inhabitating the arid and semiarid tropics of the world. They are distributed in most of the Asian and African countries and parts of Europe. The grains of small millets, being nutritionally Superior to rice and wheat, provide cheap proteins, minerals and vitamins to poorest of the poor where the need for such ingredients is the maximum. Practically devoid of grain storage pests, the small millets have indefinite storage life. The untapped grain yield potential coupled with nutritional superiority makes the small millets potential future food crops particularly in the more difficult rainfed areas.

Small millets are a group of crops which are hardy and grow well in dry zones as rainfed crops under marginal conditions of soil fertility and moisture. These are some of the oldest food grains known to human kind and possibly the first cereal grains to be used for domestic purposes.

Millets are also unique due to their short growing season. India is the world's largest producer and consumer of millets. These crops form an important component of nutritional and livelihood security of resource poor farmers of India.

They exhibit wide adaptation in marginal production and niche areas and provide farmers with best available opportunity for assured harvest, staple food, required nutrition and sufficient fodder in environments characterized by scanty rainfall. These crops are climate change compliant. Besides, these millets also provide raw materials for agro industries such as poultry and cattle feed, value added products, potable alcohol, starch, bio-fuel etc.

Small Millets

These crops are widely grown in hilly and rainfed areas. They are self pollinated crops and require an isolation distance of 3 metres. They are as follows

Millet	Common name	Botanical name	
Finger Millet	Ragi	*Eleusine coracana*	

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Millet	Common name	Botanical name	
Little Millet	Samai	*Panicum sumatrense*	
Proso Millet	Panivaragu	*Panicum miliaceum*	
Barnyard millet	Kudiraivalli	*Echinochloa frumentacea*	
Kodo millet	Varagu	*Paspalum scrobiculatum*	
Foxtail millet	Tenai	*Setaria italica*	

Seed Production Stages

Breeder seed - Foundation seed – Certified seed

Land Selection

Small millets can be grown in poor to fertile soil. Finger millet and barnyard millet can tolerate salinity better than any other crops. Well drained loam or sandy loam soils rich in organic matter are ideal for cultivation. The selected land should be free from volunteer plants. The land should not be cultivated with same crop in the previous season. Land should be ploughed 2 - 3 times to get fine tilth and levelled.

Field Selection and Sowing

Finger millet is a season bound crop and the best season to take up sowing is December - January and June - July. Seeds used for seed production should be of good quality certified seeds from an authentic source. Seeds should be healthy with required germination percentage. Recommended seed rate is 2 kg/acre (5 kg/ha). Selected seeds should be treated with *Azospirillum* @ 125gms/kg of seeds.

The main field is prepared with 2 – 3 ploughing to make it a fine tilth and formed into ridges and furrows. During final plough apply compost or farmyard manure @ 5 tonnes/acre (12.5 tonnes/ ha) and incorporate into the soil. 20-25 days old seedlings transplanted to the main field. Two seedlings per hill should be planted. Follow a spacing of 15× 15 cm.

For all other small millets the recommended seed rate is 4 kg/acre (10 kg/ha). Selected seeds should be treated with *Azospirillum* @ 60 gms/kg of seeds. Treated seeds should be sown with a spacing of 30 x 10 cm. Seeds should be sown in June–July or September – October onset of monsoon rains. Summer crop should be sown in the month of February –

March. Seeds are broadcasted manually or raised in flat beds.

Nutrient Management

Before final ploughing compost or farmyard manure @ 5 tonnes/acre (12.5 tonnes/ha) should be applied and ploughed into the soil. Instead of this cattle penning can also be practiced. 50 kg neem cake and 500 kg vermicompost per acre (125 kg neem cake and 1250 kg vermicompost per hectare) should be applied as basal manure. After first weeding at 20 – 25 days after sowing first top dressing should be done using enriched vermicompost (2 kg *Azospirillum*. 2 kg *Phosphobacterium* and 2 litres *Panchagavya* mixed with 250 kg vermicompost and kept covered for a week and then used) @ 250 kg/ acre (600 kg/ha) followed by the second top dressing at 40–45 days after sowing using 25 kg neem cake and 250 kg vermicompost per acre (60 kg neem cake and 600 kg vermicompost per hectare).

During flower initiation stage 10% tender coconut solution (1 litre tender coconut water + 9 litres of water) should be sprayed. For rainfed crop, 50 kg pungam cake and 250 kg vermicompost should be applied as basal manure just before sowing. First top dressing should be done at 20 – 25 days after sowing using 250 kg/ acre of enriched vermicompost. At 40 – 45 days after sowing apply 25 kg pungam cake and 250 kg vermicompost per acre (60 kg pungam cake and 600 kg vermicompost per hectare) as second top dressing. Spray 10% tender coconut water at the time of flower initiation. All the above mentioned inputs should be applied to the rainfed crop only when the soil is wet.

Weed Management

The seed production field should be maintained weed free from the initial stage. The first weeding should be done on 15th day after planting and followed by the second one on 30th day. After hand weeding allow the weeds to dry for 2–3 days.

Irrigation

The irrigation should be done once a week after life irrigation on the third day of sowing. Irrigation during flowering and grain setting stages are very critical.

Pest and Disease Management

Ragi is affected by pests and diseases like pink stem borer, aphids, root aphids, earhead caterpillars, blast, brown spot, mottle streak virus etc., at different growth stages. Detailed management measures for these pests and diseases are provided in Annexure- I.

Roguing

Roguing should be done often to remove the offtypes, volunteer plants and diseased plants from the seed production field to avoid the genetic contamination. Roguing should be done upto the flowering stage. Maximum percentage of offtype permitted at the final inspection is 0.05% for foundation and 0.10% for certified seed production.

Field Inspection

A minimum of two inspections should be done between flowering and maturity stages by the Seed Certification Officer. The first inspection is done at the time of flowering to check the isolation and off-types and the second done during the maturity stage prior to harvest to check the off-types and to estimate the yield.

Harvesting and Processing

Harvest is done once the earheads are physiologically mature. Physiologically mature earheads will turn from brown to green colour. Harvesting is done in two pickings since, the maturation of the earheads are not uniform because of the tillering habit of the crop. Second harvesting should be done seven days after the first one. Mature earheads should be harvested and threshed with bamboo sticks. Threshed grains are further cleaned by winnowing.

Drying and Storage

The cleaned seeds should be sun dried to attain a safe moisture level of 12%. Care should be taken while drying to avoid mechanical injury to the seeds and contamination. Seeds can be stored upto 13 months under proper storage conditions.

Seed Standards

The percentage of minimum physical purity of certified and foundation seeds should be 97% with a minimum of 75% of germination capacity and 12% of moisture content. The presence of inert matter should not exceed 2.0%.

Annexure I

Crop	Common pest and disease	Management measures
Finger millet	Ragi blast *(Pyricularia grisea)* (attacks at the early vegetative phase)	Crush and apply the bark of *Careya arborea* @ 2-3 kg, boil 1 kg wild Tulsi leaves in 2 litres of water and spray this solution @ 2 ml/litre of water for twice at 15 days interval.
	Rice tungro virus, Mottle streak virus of ragi (attacks at all the growth stages of the crop)	Spray the fermented cow's urine (fermented for one week) over the crops to control bacterial and fungal diseases, spray a solution of cow's urine (1 litre) and buttermilk (1 litre) diluted with 8 litres of water and spray 300 ml of sweet flag extract mixed with 1 litre of cow's urine and 8.7 litres of water to control the disease spread.
	Ragi *(Helminthosporium nodulosum),* (attacks at the early vegetative phase)	Treat the seeds with 20% mint leaf extract for 24 hours, spread the leaves of *Cleistanthus collinus* @ 25 quintals/ha the field and allow them to decay and irrigate after three days.
	Pink stem borer of Ragi *(Sesamia inferens)* (attacks in the later vegetative phase)	Plough deeply soon after harvest to destroy the eggs and pupae, apply neem cake @ 42 – 50 kg/ha as basal manure, using pheromone traps to attract and destroy male adult moths and using *Trichogramma* cards.
	Aphids - root aphid *(Tetraneura nigriabdominalis)* – (attacks in the vegetative phase)	Sprayg garlic extract (100 gms crushed and mixed with 50 litres of water) or apply manure prepared using *Adhatoda* vasica.
	Ear head caterpillar of ragi- (Damage is severe after earhead formation)	Managed by planting the crops in early kharif season.
	Shoot fly *(Atherigona varia soccata)*- (attacks from early vegetative to maturation stage)	Managed effectively by keeping fish meal traps @ 12 numbers / ha.

References

1. Dodake SS, Dhonuksa BL. Variability in floral structure and floral biology in finger millet (Eleusine coracana (L.) Gaertn.). Indian Journal of Genetics 1998; 58:107-112.
2. Malm RN, Rachie KO. *Setaria* Millets. A review of the world Literature, University of Nebraska, Lincoln, 1971.p.133.
3. National research council. Lost crops of Africa (Vol 1:Grains) National Academy press, Washington DC, USA, 1996.p.383.
4. Sundararaj DP, Thulasidas G. Botany of Field crops, Macmillan Publsher, India, 1971.p.509.
5. Yadava HS. Retrospect and prospect of kodo millet in Indian agriculture. In: National seminar on small millets, 23-24 April 1997, Coimbatore, India 1997.p.7-9 (extended summaries).

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[1] Flink H, Tegelberg Å, Thörn M, Lagerlöf F. Effect of oral iron supplementation on unstimulated salivary flow rate: A randomized, double-blind, placebo-controlled trial. J Oral Pathol Med 2006; 35: 540-7.

[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, et al. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347-55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3-9.

Corporate (collective) author

[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792-801.

Unpublished article

[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal author(s)

[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O, Kidd EAM,

editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. p. 7-27.

No author given

[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ 20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

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