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MILLET'S CONSUMPTION: A WAY TO COMBAT MALNUTRITION

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ABSTRACT

FAO reported that the number of undernourished people worldwide is around 702- 828 million. The most common types of malnutrition in low-income and food-insecure nations cause anaemia, stunting, and wasting among malnourished people. The level of malnutrition and mortality among children is worrying. Millets are ancient heritage grains that have been cultivated without the use of pesticides on poor soils; as a result, they might be considered organic grains. Owing to their excellent nutritional value in micronutrient concentration, fibre content, resistant starch, gluten-free status and different phytochemicals with medicinal benefits, they are known as Nutri-cereal and miracle grain. The present study gives a way to cope with malnutrition in the insecure food situation.

INTRODUCTION

Higher production in agriculture is possible through advancements in science and technology made during the green revolution. Today, we have crossed self-sufficiency in food crops and come under the category of exporter countries. But after the green revolution, many changes occurred, like increased fertiliser and pesticide consumption and the promotion of certain crops, mainly focused on rice and wheat (Eliazer *et al.* 2019). All these factors are responsible for malnutrition, nutritional deficiency and disease sensitivity, and India's situation is very alarming for malnutrition status. In India, before the 60s, there was a tradition of eating and cultivating coarse cereals. Till 50 years ago, coarse cereals were grown in Central and South India.

According to an estimate, the share of coarse cereals in the total food grain production in the country was up to 40 per cent, which has come down to only 15 per cent today. India's per capita consumption of coarse cereals was 44.6 kg per year from 1951-55, which decreased drastically to 4.2 kg in 2010 (Kane-Potaka *et al.*, 2021). If we see at the percentage-wise consumption from the total food consumption in India, the proportion of coarse to total cereals consumed declined from 17 per cent to 3 per cent in urban areas and 35 per cent to 5 per cent in rural areas between 1961 and 2011.

Millets are commonly called coarse cereals due to their rough surface. Most of the millets come under the grass family. The name "millet" is derived from the word "mil" or "thousand", which refers to

the large number of grains produced from a single seed. However, the Hindi word "*Kadanan*" comes from the Sanskrit word "*Kadannam*", which refers to the food grains of the poor or "*Nindit Ann*", which means poor's man food. Based on the size of the grains, millets are divided into two a) Coarse cereals viz; sorghum and pearl millet and b) Small grains viz; ragi, foxtail millet, Kodo millet, Proso millet, barnyard millet and little millets, etc.

The nutritional quality of millets is higher than that of conventional food crops, and they contain more crude fibre, iron, zinc, phosphorous, calcium, antioxidants, and better protein quality (Bajra and ragi). The nutrient-enriched millets are useful for overcoming nutritional deficiencies in children and women.

MAJOR MILLETS

Table 1. Commonly cultivated millets, their common name, scientific name and local name

Sr.No.	Common name	Scientific name	Local name
1	Sorghum	*Sorghum vulgare*	Great Millet/Milo/Char/ jowar
2	Pearl millet	*Pennisetum typhoideum*	Bajra/ Sajje
3	Finger Millet	*Eleusine coracana(l)*	Mandua/ madua/Ragi
4	Barnyard Millet	*Echinochloa frumantacea*	Jhangora/ Shama/Samai
5	Proso millet	*Panicum miliaceum (l)*	Barri / Baragu
6	Foxtail millet	*Setaria italica*	Japanese barnyard millet
7	Kodo millet	*Paspalum scrobiculatum*	Kodra / Harka
8	little millet	*Panicum sumatrense*	Kutki Same
9	brown top millet	*Urochloa ramosa*	
Pseudo-millets			
1	Amaranths	*Amaranthus cruentus L*	Cholai
2	Buckwheat	*Fagopyrum esculentum*	Kuttu

BENEFITS OF MILLET CULTIVATION

Cultivation of millets is mainly done in areas where other traditional crops cannot be grown easily. Coarse cereals are often adapted to harsh environmental conditions such as the semi-arid tropics and therefore prove to be the backbone for dry farming. Millet crops generally mature rapidly, making them easier to adjust to more intensive cropping systems. Fast-maturing millets and other slow-maturing crops can be easily used as catch crops or relay crops. The cultivation of coarse cereals has many benefits, such as an amazing ability to bear various environmental stresses in the current climate change era, short crop period, low production cost due to minimum nutrient demand, disease resistance to fight pests, and less water. It can also be grown on less fertile land with a good yield.

Millets are C4 crops; hence, they are climate change compliant and can grow under water stress and high temperature. There are varieties, mainly in proso and little millet, which mature in 65-75 days; yet provide reasonable and assured harvests even under the most adversative conditions. Moreover, millets

sequestrate more carbon than cereals, decreasing greenhouse gas (GHGs). Millets cultivation supports farming in rain-fed conditions on which 60% of Indian farmers depend. They provide food and fodder and can be cultivated as mixed cropping with other crops like pulses and vegetables.

HEALTH BENEFITS OF MILLETS

Millets contain an abundance of phytochemicals and micronutrients in them. Hence, they are pronounced as "nutritional grains, miracle grains/wonder grains and Nutri-cereals", which is useful for overcoming nutritional deficiency in children and women. For example, ragi is a highly nutritious coarse grain of Indian origin. It is rich in calcium, containing 344 mg of calcium per 100 grams of ragi (Table-2). Ragi is said to be beneficial for diabetic patients. Similarly, millet is rich in protein which contains 11.6 grams of protein and 132 milligrams of carotene per 100 grams of millet, which is beneficial for our eyesight. Coarse grains have anti-diabetic and anti-hypertension properties, which are helpful in diseases like diabetes, high blood pressure and heart disease. Consumption of millet reduces triglycerides and C-reactive protein, which prevents heart disease. In addition, all coarse grain varieties have high antioxidant properties that boost the body's ability to fight infection.

Table:2 Nutrient Content of Various Millets in comparison to Rice and Wheat

Grain (Millet /Cereal)	Protein (g)	Fat (g)	Dietary fibre (g)	Ca (mg)	P (mg)	Mg (mg)	Zn (mg)	Fe (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Folic acid (ug)	Phenols (mg/100 g)
Sorghum	9.9	1.73	10.2	27.6	274	133	1.9	3.9	0.35	0.14	2.1	39.4	43.1
Pearl Millet	10.9	5.43	11.5	27.4	289	124	2.7	6.4	0.25	0.20	0.9	36.1	51.4
Finger millet	07.2	1.92	11.2	36.4	210	146	2.5	4.6	0,37	0.17	1.3	34,7	102
Kodo millet	08.9	2.55	06.4	15.3	101	122	1.6	2.3	0.29	0.20	1.5	39,5	368
Proso millet	12.5	1.10	-	14.0	206	153	1.4	0.8	0.41	0.28	4.5	-	-
Foxtail millet	12.3	4.30	-	31.0	188	81	2.4	2.8	0.59	0.11	3.2	15.0	106
Little millet	10.1	3.89	7.7	16.1	130	91	1.8	1.2	0.26	0.05	1.3	36.2	-
Barnyard millet	06.2	2.20	-	20.0	280	82	3.0	5.0	0.33	0.10	4.2	-	-
Wheat	10.6	1,47	11.2	39.4	315	125	2.8	3.9	0.46	0.15	2.7	30.1	20.5
Rice	07.9	0.52	02.8	07.5	96	19	1.2	0.6	0.05	0.05	1.7	9.32	2.51

Sources-Longvah *et al.* 2017

HOW CAN WE CONSUME MILLET OR ADD IT TO DAILY LIFE?

Millets have been named nutri-cereals and are now used either for fortifying existing products or developing novel food products. Traditionally, millet has been eaten long and is as old as civilisation. These can be consumed in the following ways:

1. *Bajra ka churma* is a traditional Rajasthani dish specially prepared in winter. That is prepared from course bajra flour by making roti. Then roast these rotis until they are crispy, grinding and making Bajra Churma ladoo by adding ghee, sugar and dry fruits.
2. *Rabodi ki sabzi* (dried papad)- is another traditional dish in western Rajasthan. Rabodi is made from buttermilk and bajra flour. Bajra flour is boiled in buttermilk, and after that, dried in sunlight, people make this rabodi and store it in air-tight containers. To cope with harsh climate conditions in Rajasthan, People make this rabodi and use it when there is a scarcity of vegetables to cook.
3. *Bajra ki kichadi* is famous in Haryana and Rajasthan also. It is a finely smashed Bajra porridge served with pure ghee.
4. *Babadi* is a Uttarakhand's traditional dish eaten in hilly regions and made from finger millet flour.
5. *Ragi mudde* is also known by different names like Ragi mudde, ragi sangati or kali, conversationally simply referred to as either mudde or hittu, i.e. 'flour'; is a meal in the state of Karnataka and the Rayalaseema region in Andhra Pradesh. It is mainly popular with the rural folk of Karnataka. In Tamil Nadu, especially in Western Tamil Nadu, it is called ragi kali
6. *Jowar's bhakhari* is famous in the Maharashtra region, and roti is prepared from sorghum flour.
7. *Jhangore (barnyard) ki kheer* is a delicious hilly dessert made using (barnyard millet), milk, and sugar and deliciously garnished with kewra essence, almonds and raisins.
8. *Millets Semolina,* the flour also known as Suji or Rawa. Millet Rawa Kesari, Ragi Suji and Bajra Suji are common.
9. Millet Flour uses to make various delicious products like idli, upma and dosa with cereals, pulses, and condiments. In addition, millets like ragi, pearl millet and sorghum are commonly used for making chapatis, and millet flour is recommended for people with diabetes.

Apart from the above, people may eat products prepared from millet which are available in the market in a ready-to-eat form, such as Millet namkeen, dosa, puff, bread, cookies, Ragi Vermicelli, pasta, Muffins (Ragi & Bajra), Alcoholic beverages and millet-based probiotic beverages.

CONCLUSION

Millets are ancient heritage grains that have been cultivated without the use of pesticides on poor soils; as a result, they might be considered organic grains. Owing to their excellent nutritional value in micronutrient concentration, fibre content, resistant starch, gluten-free status and different phytochemicals with medicinal benefits, they are known as Nutri-cereal and miracle grain. Therefore, there is a need to promote the cultivation of millets and adoption in the dietary pattern of a large population to combat malnutrition.

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IMPORTANCE OF PERIPHYTONIN IN AQUATIC ECOSYSTEM

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ABSTRACT

Periphytonin serve as a bridge between the substrate below and the water column above which create an impact on the ecosystem. Periphytons act as an important food source for nibbling fish like Rita rita and Botia sp. These serve as a crucial bioindicator of stream water quality and ecological health as well as a link in the transport of materials and energy along many food chains. Periphyton maintains the balance between biotic and abiotic components of aquatic ecology as well as these creatures act as a pollution indicator.

INTRODUCTION

The slimy layer that sticks to rocks and other stable substrates that make up the stream bed is known as the periphyton community. Periphytons are present in different forms in aquatic water bodies i.e. Algae, fungi and bacteria. The appearance of the periphyton layer is very variable and can reveal many fundamental details about the stream environment.The major group of microalgae is phytoplanktonic which means they contain chlorophyll and need sunlight to live and grow (Sigamani *et al.,* 2020). The plant group is a three-dimensional structure like a plant, in which the uppermost layer is spread in the form of mats, and filamentous algae, the central layer with erect stalks, and the lowest layer is found in the form of prostrate algae (Stevenson *et al.,* 1996). However, periphyton's significance in stream trophic structure has been proven by aquatic ecologists. They act as both structural and functional components of the aquatic ecosystems, and their relevance is a function of quality rather than quantity. Although use terminology words for the periphyton like "biofilms," "microlayers," "aufwuchs," and "benthos. Periphyton is the term currently used most frequently in the aquatic scientific literature (Gulzar *et al.,* 2017).

CLASSIFICATION OF PERIPHYTON

There are other periphyton subgroups depending on the type of substrate colonized, such as epiphyton (macrophytes), epixylon (wood), epilithon (stone), episammon (sandy sediments), and epipelon (muddy sediments)(Gulzar*et al.,* 2017).For taxonomic identification, the periphyton is divided into two groups: siliceous diatoms, which can be easily distinguished from one another, and non-salicaceous-diatom

algae, which are more diverse and can be easily distinguished from one another. The most varied and global are the algae·There are several types of periphyton. They are named according to where they grow as Follows (Chavan & Shaikh, 2019).

- **Epiphytic** algae grow on the surface of aquatic plants;
- **Epipelic** algae are attached to sediments;
- **Epilithic** algae are attached to rocks, and;
- **Benthic** algae grow on the bottom of a water body (including epipelic and epilithic algae) (Merican *et al.*, 2006).

The periphyton are divided into two groups for taxonomic identification, the diatoms having silica cases and can be easily identified to species while the non-diatom algae (sometimes called "soft" algae) are more difficult to identify and are more diverse and include several taxonomic orders·

REGULATING FACTORS

The structure of the benthic community in lotic systems is influenced by several elements, including those that are present at diff**e**rent times and locations (such as nutrient level, flow, substrate, physicochemical parameters, disturbance, etc.). An ecosystem's species respond differently to changes in the regional environment, and as a result, so does the ecosystem's composition.Any alteration to a species' natural environment does not affect the community as a whole; rather, only the percentage composition will change as a result of some species currently there being unable to proliferate.

NUTRIENT CONCENTRATION

While nutrients are necessary for a healthy aquatic ecosystem to function, they can have detrimental effects at much lower concentrations by changing tropic dynamics, increasing algal and macrophytic production, increasing turbidity (via increased phytoplanktonic algal production), lowering average dissolved oxygen (DO) concentrations, and increasing fluctuations in dissolved oxygen. Excessive nutrient concentrations lead to shifts in species diversity away from efficient assemblages of unacceptable species, which in turn causes these changes. The main limiting factors for periphytic algal development tend to be nutrient concentrations, especially nitrogen, and phosphorus, and the amounts of these nutrients are generally controlled by land use practices and intensification. In streams with a stable substratum and sufficient substratum irradiance, significant nutrient pollution increases periphyton biomass accumulation; nevertheless, the regulating role of nutrients in un-enriched or weakly enriched streams is still not fully understood. This could be because other taxa produce more biomass accumulation but need high nutrient concentrations to replace those that develop only modest biomass per unit area at low nutrient concentrations. Additionally, periphytic assemblages react more favorably to the addition of both nutrients

than to either nutrient individually. The dominance of filamentous and blue-green algae tends to shift away from diatoms as a result of nutrient enrichment. Thus, a decline in nitrogen levels without a subsequent reduction in phosphorus could promote the growth of blue-green plants.

FLOW VELOCITY

Variations in water level and velocity have an impact on the development and relative abundance of several species of periphytic algae in lotic habitats. The structural differences between two diatom-dominated communities that emerged under various current regimes were discovered. Several algae species measured increased rates of phosphorus uptake and respiration.

IMPORTANCE OF PERIPHYTON AS NATURAL FOOD FOR FISHES

Periphyton communities are the preferred food for fish.For nibbling fish like *Rita rita* and *Botia sp.*, periphyton is an essential food source. Fish and benthic insects prefer periphyton communities as their primary food source (Srivastava *et al.*, 2019)

ROLE OF PERIPHYTON IN THE ECOLOGY

Periphyton significantly contributes to bio-manipulation monitoring; since it quickly responds to slight variations in the environmental conditions, its short life cycle, and abundance in the littoral zones of aquatic ecosystems. Periphyton plays a crucial role in photosynthesis, the food chain, and the food web and acts as an important source of natural food for various aquatic organisms.

CONCLUSION

Periphyton plays a most important role in biotic and abiotic component aspects of streams, they mediate many ecological interactions, and their inconsistent responses to nutrients and other abiotic factors emphasize the significance of understanding the variables that regulate the temporal and spatial dynamics of these communities in lotic aquatic ecosystems.For nibbling fish like *Rita rita* and *Botia* sp., periphyton is an essential food source.

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ROLE OF DAIRYING IN IMPROVING RURAL ECONOMY

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ABSTRACT

Today, when there is a growing concern for greater attention to our rural economy, the dairy sector offers a big opportunity to transform our economy by bringing prosperity to the rural sector. The dairy sector provides immense opportunities for eradicating poverty. The fact that dairying could play a more constructive role in promoting rural welfare and reducing poverty by generating employment at the farm level is increasingly being recognised. A sustainable and financially viable dairy processing sector will generate income and self-employment through entrepreneurship, which is the day's need.

INTRODUCTION

Indian economy is a perfect symbiosis of crops and livestock sectors. The rural economy is facing a greater challenge post covid situation; under this, the dairy sector offers a significant opportunity to transform our economy by bringing prosperity to the rural sector. The dairy sector provides immense opportunities for eradicating poverty. The fact that dairying could play a more constructive role in promoting rural welfare and reducing poverty by generating employment at the farm level is increasingly being recognised. A sustainable and financially viable dairy processing sector will generate income and self-employment through entrepreneurship, which is the day's need. In this context following are the ways which can be beneficial for improving the rural economy:

ENTREPRENEURSHIP OPPORTUNITIES IN DAIRY PROCESSING

Entrepreneurship has become the most important phenomenon for rapid progress in the dairy sector. Scattered milk production in remote areas, regional and seasonal surpluses, transportation difficulties, lack of suitable marketing structure, and its perishable nature provides an opportunity for rural entrepreneurs to go in for the production of s dairy products as a market for them already exists. Therefore, the processing and marketing of milk are critical for providing the enumerative price to millions of dairy farmers. According to an estimate, only half of the milk produced is sold, and the remaining is used for household consumption. The market for raw milk is mainly informal and is dominated by local vendors who collect milk from producers and sell it to urban consumers. Traditional milk markets are often unstable and

exploitative, particularly during the flush milk production season. Traders do not buy the entire marketable surplus during the flush season; milk is generally underpriced. The cooperative moment has led to the development of linkages between producers and consumers, which resulted in a tremendous impact on milk production and producers' income, particularly smallholders.

The art of preparing sweets and other dairy products from surplus milk was developed centuries ago. Lack of cooling facilities to keep liquid milk fresh in warm climates resulted in milk diversion to prepare indigenous milk products with comparatively longer shelf life. Most dairy food delicacies are value-added products generating high profits. The demand for milk sweets is influenced by the nutritional and social values attached to each of them. The market demand, quality of milk, the economics of operation and shelf life determine the type of products to be manufactured and marketed. The dairy market in India is quite huge, and according to an estimate, the unorganised milk & milk product market is to be around Rs. 470 billion.

In contrast, the processed organised dairy market is only Rs. 10000 crores. India, with its population of more than 1 billion and diverse food habits, cultures, traditions and religions, offers a great market for milk & milk products. Milk products with well-defined quality characteristics and packaged in attractive containers can be marketed at parlours, hotels and restaurants, departmental canteens, supermarkets, airlines, railway catering, hostels and other points of strategic nature.

POTENTIAL DAIRY PRODUCTS FOR RURAL ENTREPRENEURS

A) INDIGENOUS DAIRY PRODUCTS

A wide range of technological packages are available for rural entrepreneurs, and the adoption of these depends on several factors. It includes availability and type of milk, entrepreneurship skills, the market's location and size, and a capital requirement. Some of the dairy products that offer great potential are: Conversion of milk into indigenous milk products in and around milk production areas is the least expensive and more remunerative because of simple technologies, use of low-grade energy sources, inexpensive infrastructure and equipment and low operating and overhead costs as compared with European or western systems of dairy processing. In addition, these indigenous products have great social, religious, cultural, medicinal and economic importance and have been developed over a long period with the culinary skills of homemakers and *halwais*. In addition to preserving milk solids for a longer time at room temperature, manufacturing traditional dairy products adds value to milk and provides considerable employment opportunities to the rural population. These products include curd, ghee, *khoa*, *chhana*, *paneer*, *shrikhand* and a variety of milk sweets, some of which are now produced by the organised dairy industries as well. About 50% of the total milk produced in India is estimated to be converted into traditional milk

products..The market for traditional dairy products in India is US $ 10 billion, the largest and fastest-growing segment of Indian dairy. This figure underlines the significance of traditional Indian products in the national economy.

B) KHOA AND KHOA-BASED SWEETS

Among the traditional dairy products, *khoa* – an intermediate concentrate that is the base material for a wider range of sweetmeats such as *burfi*, *peda*, *gulabjamun*, milk-cake, *kalakand* and *kunda* has great significance in India. According to one estimate, about 5.5% of total milk production is converted into khoa. The present milk production of about 96 million tons per annum is equivalent to about 14.7 million kg of *khoa* per day. *Khoa* is prepared by continuously boiling of milk with scrapping in a shallow pan (karahi). Milk thickens progressively as the evaporation of moisture takes place constantly. Vigorous stirring and desiccation continued until desired concentration (65 to 72% TS) was reached, and the product became viscous and pasty. Many khoa is being produced in various pockets around big cities. For example, to meet the great demand for *khoa* in Delhi, it is being produced in the interior villages of western Uttar Pradesh, Haryana and Rajasthan, where milk is comparatively cheaper, demand is less and availability is high. *Khoa*-based sweets can also be prepared and marketed without adding newer equipment, and the processing technologies are quite simple.



C) PANEER

Paneer, the indigenous variety of soft cheese, is obtained by the acid coagulation of heated milk. In the traditional process, buffalo milk is boiled in a vessel. A suitable coagulant (lime/citric acid/alum) is added with a slow stirring to coagulate the milk while still hot. The technology of manufacturing *paneer* from buffalo milk has been standardised to obtain the most acceptable and safe product with maximum solids recovery. Subsequently, the process of preparing *paneer* of acceptable quality from cow milk has also been developed. Irrespective of the type, milk should be standardised to a fat and SNF ratio of 1:1.65 so that the final product conforms to PFA requirements. Good quality *paneer* is obtained by heating milk

to about 90°C, and acidifying the hot milk by adding citric acid solution at 70°C. The formation of clear whey is indicative of complete coagulation. After the large lumps are formed, the vessel's contents are pored over muslin cloth to separate the coagulum from whey. The coagulum so obtained is highly pressed to facilitate the formation of paneer blocks, followed by their immersion in chilled water to impart a distinctive texture. Conventionally, citric acid is used for coagulating hot milk for *paneer* making, but certain non-conventional, low-cost coagulants have been suggested to manufacture *paneer* without any loss of yield and quality. The demand for value-added products with *paneer* as a base material is growing in urban areas. It is an excellent match for non-vegetarian food.

Moreover, paneer production costs are low because of its significantly higher yield and short preparation time. This is likely to increase the returns on investment. Therefore, there is a need to tap the market potential of *paneer* both for domestic consumption and export. The manufacture of *paneer*, therefore, has great social and economic significance in our country.

D) CHHANA

Chhana is another heat and acid-coagulated product which serves as a base product for a large variety of Indian delicacies, namely, *Rasogolla, Chhana gala, Sandesh, Cham cham, RasmaIai, Pantoha, Rajbhog, Chhana murki* etc. It differs from *paneer* as no pressure is applied to drain the whey, and its pH is slightly higher. *Rasogolla* is undoubtedly the king of all Indian sweets. Its production is largely confined to the cottage and small-scale industry. In the traditional production of *chhana*, a small portion of boiled milk is transferred to a small coagulating vessel. The required amount of coagulant (usually the previous day sour *chhana* whey) is added to the hot milk and stirred with a wooden ladle till the coagulation is complete. The contents are then poured over a clean muslin cloth held over another vessel where the whey gets collected. The muslin cloth containing the curd mass is hung to drain out whey further and to cool the *chhana* simultaneously.

E) GHEE

Ghee is heat-clarified butterfat derived solely from milk, curd, desi butter (cooking butter), or cream to which no colouring matter or preservative has been added. In India, *ghee* is considered an excellent cooking or frying medium. In addition, *ghee* is used for numerous religious rites by Hindus, and it also has many medicinal uses. It is usually prepared from cows, buffalo, or mixed milk. *Ghee* made from cow milk fat has a distinct golden yellow colour, attributable to carotene. On average, cow or buffalo ghee contains 99.0-99.5% fat and less than 0.5% moisture. Traditionally, *ghee* is produced by first converting milk into *dahi*, churning *dahi* to produce *makkhan*, and subjecting *makkhan* to heat clarification to yield the final product. *Hence, ghee* production forms the largest segment of India's milk consumption and utilisation

pattern. Hence, for obvious reasons, many efforts have been made by various workers to mechanise the process of *ghee* production.

F) DAHI AND OTHER FERMENTED MILK PRODUCTS

Dahi is a well-known fermented milk product consumed by the majority of the population in India. It is used either as a part of the diet or as a refreshing beverage. It is a mildly sour product with a pleasant flavour formed by the combined action of acid-producing and flavour-producing lactic acid bacteria. The choice of the majority of consumers of Dahi lies in a product with a glossy to semi-glossy velvety appearance, medium firm body, moderately acidic and delicate flavour.

Dahi is prepared using starter cultures, growing at appropriate temperatures depending on the strains used. Therefore, the production of the product varies from place to place. The types of organisms include *Lactococcus lactis* ssp. *lactis*, *Lactococcus lactis* ssp. *cremoris*, *Lactococcus lactis* ssp. *lactis* var. *diacetylactis*, *Leuconostoc mesenteroides* ssp. *cremoris*. Dahi is also prepared by using thermophilic starter, viz., *Streptococcus thermophilus*, *Lactobacillus delbrueckii* ssp. *bulgaricus* and other *Lactobacillus* species.

Shrikhand is a semi-solid, sweetish-sour fermented milk product prepared from dahi (curd). Shrikhand is a popular dessert and forms a part of a meal on festive occasions, particularly in the states of Gujarat and Maharashtra. Like dahi, it is very refreshing, particularly during the summer months. Whey is drained from dahi to yield chakka, sugar, flavour, colour and spices are thoroughly mixed into chakka to form a soft homogeneous mass resembling Germany's sweetened quarg.

G) DAIRY BEVERAGES

Milk-based beverages have emerged as one of the most promising segments among value-added dairy products. Milk processors must exploit the opportunities to keep pace with the changing product consumption pattern. Apart from traditional milk beverages like lassi, flavoured milk etc., a wide range of fruit-based dairy beverages could be added to the product portfolio. Milk-fruit-based beverages are another range of products that offer the tremendous market potential for the Indian dairy industry because they are nutritionally rich. Similarly, minor cereals and millet-based milk beverages seem lucrative for school feeding programmes. Recent statistics suggest that around one million tons of whey are produced in India annually, corresponding to approximately 70,000 tons of whey nutrients. Liquid whey has also been utilised to manufacture a wide range of beverages and soups. As a result, many such products are available to consumers. The ready-to-serve (RTS) type beverage may be prepared by mixing an appropriate fruit juice or concentrate and minimally processed whey along with other minor additives to improve the sensory characteristics and thermally processed to make it shelf-stable.

A process has been standardised to manufacture whey-fruit beverages using cheese or paneer whey with three different fruits: banana, lemon and pineapple. Among the beverages, the mango beverage scored a maximum for all sensory attributes, and it contained 15% mango pulp, 7% sugar, and 78% whey and the beverage's pH was kept below 4.5.

H) WHEY-BASED SOUPS

Soups are served as appetisers before meals as they stimulate the secretion of gastric enzymes that leads to a feeling of hunger. In the market, many ready-to-make soup mixes are available to suit the palate of consumers. Moreover, they do not seem to provide quality nutrients and utilising whey for soup preparation is an attractive possibility.

Producing whey-based soup involves blending vegetables in whey and cooking corn flour, followed by heating. The time-temperature combination of cooking vegetables, corn flour and seasoning is important for the dispersion of vegetables, gelatinisation of starch and flavour perception of soup, respectively. The developed product could be stored for a week under refrigeration, and UHT treatment can be adopted to improve the shelf-stability. Paneer and cheese whey were utilised for the potato-carrot-tomato and spinach soups. Cheese whey was preferred for the manufacture of vegetable soups over paneer whey. The reason could be the low pH of paneer whey, resulting in an acidic product not usually compatible with most vegetables. Whey-based soups have been reported to be more viscous than water-based, most probably due to the gelation of whey proteins on heating. Whey-based soups require less salt, thickener and fat and technology for manufacturing retort processed low-fat tomato-whey soup has been developed recently at our Institute. These products can be marketed through retail outlets, hotels & restaurants.

CONCLUSION

The dairy sector offers a big opportunity to transform our economy by bringing prosperity to the rural sector. Moreover, the dairy sector provides immense opportunities for eradicating poverty. The fact that dairying could play a more constructive role in promoting rural welfare and reducing poverty by generating employment at the farm level is increasingly being recognised. A sustainable and financially viable dairy processing sector will generate income and self-employment through entrepreneurship, which is the day's need.

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NATIONAL HORTICULTURE MISSION: A BOON TO THE FARMING COMMUNITY

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ABSTRACT

The National Horticulture Mission (NHM), a programme for the comprehensive development of horticulture, was launched by the Indian government in 2005–2006 in recognition of the enormous potential of horticulture to support the growth of Indian agriculture. In NHM, 85% of the funding for the development programmes come from the Government of India (GOI) and remaining 15% comes from the State Government. There was a strong correlation between NHM and the type of family, size of horticultural land holding, socioeconomic status, degree of education, size of land holding, annual income from horticulture crops, annual family income, and exposure to the media. The details about the national horticulture mission are discussed in this popular article.

INTRODUCTION

The National Horticulture Board is implementing the National Horticulture Mission (NHM), a sub-scheme of the Mission for Integrated Development of Horticulture (NHB). The objective was primarily created to support the expansion of the horticultural industry, which includes cashew, cocoa, flowers, mushrooms, spices, and root and tuber crops. Under this aim, 85% of the funding for the development programmes will come from the Government of India (GOI), while the remaining 15% will come from the State Government. The National Horticulture Mission is thoroughly examined in this essay. Over the past few years, horticulture production in India has increased significantly. Significant advancements have been made in expanding the area planted with horticulture crops since the National Horticulture Mission (NHM) was launched in 2005–2006, leading to increased production. Patil and Hosamani (2017) studied the performance of the national horticultural mission (NHM) scheme and its impact on horticulture development in Karnataka and found area coverage, creation of water resources, protected cultivation, horticulture mechanisation, post-harvest management and rejuvenation, vermin composting units/bio-digester unit were the most important components which influences the performance of NHM in the study area. According to Kadli *et al.*, (2014), even after a decrease in the area under fruits during post-NHM, the production and productivity increased, indicating the diffusion of technologies and adoption of modern

technology by the fruit-growing farmers. Besides, initiatives taken by the government through NHM might have had a positive role in this direction. According to Suvagiya Shilpa, Shah and Ardeshna (2017); Mehta (2012), the results revealed that kinked growth rates of acreage under vegetable crops increased significantly for both the study periods separately. There may be a reason that farmers put more area under vegetables. Hence, the production increased, but in the absence of suitable infrastructures for vegetable production, such as irrigation, quality inputs and susceptibility of high-yielding varieties to pests and diseases, the productivity of vegetables decreased during the post-NHM period.

OBJECTIVE

The main objectives of the National Horticulture Mission are as follows:

- Increasing the horticulture industry's growth through research, technological promotion, post-harvest management, processing, and marketing, among other things.
- To boost nutritional security, increase horticultural production, and quadruple farmer income.
- To create a convergence between several ongoing and upcoming programmes for horticulture development.
- Advancing and developing technology by integrating old and contemporary scientific knowledge.
- To open up employment prospects, particularly for young people who lack skills or training.

MISSION STRATEGY

To accomplish the goals mentioned above the mission would employ the following strategies:

- Encouraging the development of new production, post-harvest, and processing technologies.
- Ensuring complete assistance for cultivation, post-harvest administration, marketing, and processing ensures producers receive fair returns.
- Increasing production by switching from conventional crops to plantations.
- Provide farmers with the necessary technology for high-tech horticulture farming and cultivation.
- Assisting in constructing post-harvest facilities for marketing infrastructure and value addition, such as ripening chambers, pack houses, cold storage, controlled atmosphere (CA) storage, etc.
- Promoting partnerships, processing, and marketing organisations in the public and commercial sectors at the national, state, and district levels.
- Encouraging the development of human resources and capabilities at all levels.

MISSION INTERVENTION

Mission interventions heavily rely on geographic information systems, remote sensing, and information communication technology. The infrastructure facilities for post-harvest management, markets, and production projections are monitored and planned using this system.

ELIGIBILITY CRITERIA

COST OF APPLICATION FORM AND SCHEME BROCHURE: Application form and scheme brochure fees will be as follows:

PROJECT COST	COST OF APPLICATION FORM AND SCHEME BROCHURE
Projects with costs up to Rs. 10 lakhs	Rs. 1000/-
Projects with costs above Rs. 10 lakhs and below Rs. 20 lakhs	Rs. 2000/-
Projects with costs above Rs. 20 lakhs and below Rs. 50 lakhs	Rs. 5000/-
Projects with costs above Rs. 50 lakhs	Rs. 10000/-

ELIGIBLE ORGANISATIONS

NGOs, Associations of Growers, Individuals, Partnership/Proprietary Firms Companies, Corporations, Cooperatives, Agricultural Produce Marketing Committees, Marketing Boards/ Committees, Municipal Corporations/ Committees, Agro-Industries Corporations, SAU and other relevant R&D organisations are among the eligible promoters under the schemes as mentioned above.

WHO CAN APPLY FOR GETTING A LETTER OF INTENT?

To request the issuance of a letter of intent (LOI), one must be a natural person, a group of people, or a legal person (a partnership firm, a trust, a cooperative society, a society registered under the Registration of Societies Act, a business, or a self-help group, for example).

ONLINE SUBMISSION OF APPLICATION

NHB has established a framework for online Letter of Intent applications through its website, www.nhb.gov.in, the Letter of Intent (LOI). Visit the "Apply Online and Track Status here" option on the website. This Section includes details on how to apply, the cost of applying, and other information. Candidates can apply online with the help of payment choices, a checklist, etc. The applicant has the following three choices for covering the application fee:-

- Demand Draft

- Electronic Transfer of funds in NHB's account
- Credit/Debit Card (VISA/Master)

HOW TO ESTABLISH THE IDENTITY OF THE APPLICANT?

If the applicant is a natural person, establishing the identity of the person or group of people will typically be sufficient with the applicant's name, sex, age, occupation, father's or husband's name, permanent address, and full postal address supported by a self-attested passport-size photograph of the applicant attached to the application. However, if the applicant is a statutory person, it is necessary to insist on knowing the following information about them:

a) Authenticated copy of the applicant body's or company's registration document.
b) Authorising signatory of application to seek for a bank loan, NHB subsidy, and all other associated essential procedures in this regard is the Board of Directors Resolution, validly passed. The name, age, sex, designation or employment, father's or husband's name, permanent address, postal address, and self-attested photograph of the applicant must be listed as the signatory of the application in the Board resolution.
c) It is also recommended to include the Board of Directors or Competent Body of Management's resolution from the applicant body authorising the investment project, taking out a bank loan, etc.
d) A copy of the most recent audit and annual reports for the applicant body.

TITLE OF THE LAND AND COPY OF RECORD OF RIGHT

The applicant must hold ownership or lease rights to the parcel of land for at least a 10-year term on which the proposed project is built. The minimum lease term should be 15 years for plantation crops and fruit orchards with longer gestation periods. Land lease agreements must be registered with the appropriate authority, such as the office of the sub-registrar, etc. The application must be accompanied by the most recent copy of the register of rights attesting to this fact. Even though the credit institution may have thought so, mortgaged land shall not be regarded equally with leasing. Similarly, the power of Attorney given by the owner of the land in favour of the applicant shall not qualify him for benefit under the scheme.

DOCUMENTS THAT MUST BE SENT WITH THE APPLICATION FORM:

- A copy of the right-over document for the project land.
- If the land is being leased for the project, a certified copy of the lease document must be submitted with the LOI application and registered.
- Acknowledgement in the enclosed form.

- Prescribed cost of application form and scheme brochure.
- Copy of last submitted income tax return, if any
- A copy of the project report presented to any financial institution or bank together with a letter stating that the loan application is being considered.
- Key map of the project land (free hand sketch) displaying the project's layout and land boundaries, as well as any sources of irrigation water and other relevant information.
- If the applicant is a partner in a partnership firm engaged in a related activity, the NOC granted by that organisation.
- If the project calls for the primary processing of fruits and vegetables and the production of any fruit product covered by FPO 1955, a NOC from the Ministry of Food Processing Industries (MFPI) must be submitted.

CONCLUSION

The National Horticulture Mission (NHM), a programme for the comprehensive development of horticulture, was launched by the Indian government in 2005–2006 in recognition of the enormous potential of horticulture to support the growth of Indian agriculture. NHM can promote the horticultural activity in the different states by taking initiative on encouraging vegetable seed production, protective agriculture, bee keeping activity, improving the post harvest storage options etc. Hence, it can be conclude that NHM can be bone for development and upliftment of Indian farming community.

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MILLETS: A SUSTAINABLE SOURCE OF NUTRITION

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ABSTRACT

Food and nutritional security are under significant stress from the rising population and climate change. Millets, which have various benefits like early maturing, drought resistance, demanding little inputs, and being largely free from biotic and abiotic stresses, can alleviate all these issues. Again, it may help mitigate climate change's effects because they leave a smaller carbon footprint. Grains of millet are rich in protein, minerals and vitamin B-complex, have a balanced amino acid profile, high levels of macro and micronutrients, and insoluble dietary fibre. Thus, millets are known as"wonder grains". This article will give a glimpse into millets, their types and their importance.

INTRODUCTION

The farming system is strongly affected by climate change, such as rising temperatures, changing rainfall regimes and variations in the frequency and intensity of extreme climatic events like floods & drought. The agriculture sector is not only among the most susceptible sectors to the impacts of climate change but also directly contributing to 14% of global greenhouse gas emissions. Climate change is a major threat to global food security, agricultural production, and the income of rural livelihoods. The recent report of FAO's estimated that global food production must increase by 70% to meet the projected food demand of the estimated 9.1 billion global population by 2050. Hence, providing sufficient nutritious food while minimising GHG emissions is a global challenge.Due to the global crisis and increasing environmental stresses, there is an increased need for agricultural diversification through encouraging crops suited for cultivation in harsh climates. Recognising the nutritional importance of millets and their ability to overcome climate challenges, the United Nations General Assembly, at its 75th session in March 2021, declared 2023 the International Year of Millets (IYM).

Millets can contribute to more diversified, balanced, and nutrient-dense food while also boosting sustainable production and consumption, which can help to promote public awareness. According to the Directorate of Economics and Statistics' Fourth Advance Estimate for 2020-21, the total area covered by Nutri-coarse cereals (millets) is 23.83 mha, and its total production is 51.15 Mt, with a productivity of 2146 kg ha^{-1}. Furthermore, millets assist in mitigating the effects of climate change as they have a lower carbon

footprint than wheat and rice, which have carbon dioxide equivalents of 3,968 and 3,401 kg per hectare, respectively.

WHAT ARE MILLETS?

The Small-seeded grasses that are frequently referred to as dry-land cereals are commonly referred to as "millet." Millets support the health of both people and animals, especially that of pregnant women and child. Several different types of cereals fall under the category of millets, including sorghum (or big millet), pearl, proso, foxtail, barnyard, little, Kodo, finger and barnyard millets. In Sub-Saharan Africa and Asia, they are a traditional staple crop for millions of farmers because they were among the first domesticated plants.

TYPES OF MILLETS:

Millets are broadly classified into two categories Major millets and Minor millets.

- Sorghum *(Jowar)*

  Sorghum is traditional and staple crop in both India and Africa. Sorghum grain is entirely gluten-free and much preferred by those who can't tolerate wheat-based products. It is rich source of protein, fibre, thiamine, riboflavin, beta-carotene, and folic acid.

- Pearl Millet *(Bajra)*

  Pearl millet has a high protein content (10–12 %) and fat (4-6%). In addition, magnesium, present in pearl millet, aids in alleviating asthmatic patients' respiratory problems and decreases the effect of migraines.

- Finger Millet *(Ragi)*

  Finger Millet is among the most nutritious cereals and is the richest source of natural calcium, which helps with bone strengthening and iron, helping in anaemia, malnutrition and degenerative diseases. In addition, grains have excellent malting properties and are widely used as a weaning food.

- Kodo Millet *(Kodon)*

  Kodo millet is a traditional food that resembles rice, helps in weight loss, reduces joint pain and regularises menstruation in women. It is rich in Vitamin B, particularly niacin, pyridoxine and folic acid.

- Foxtail Millet *(Kakum)*

  It is an easily digestible and nutritious food rich in protein, fibre, and magnesium, all of which assist in lowering the risk of diabetes and heart disease.

- Barnyard Millet *(Sanwa)*

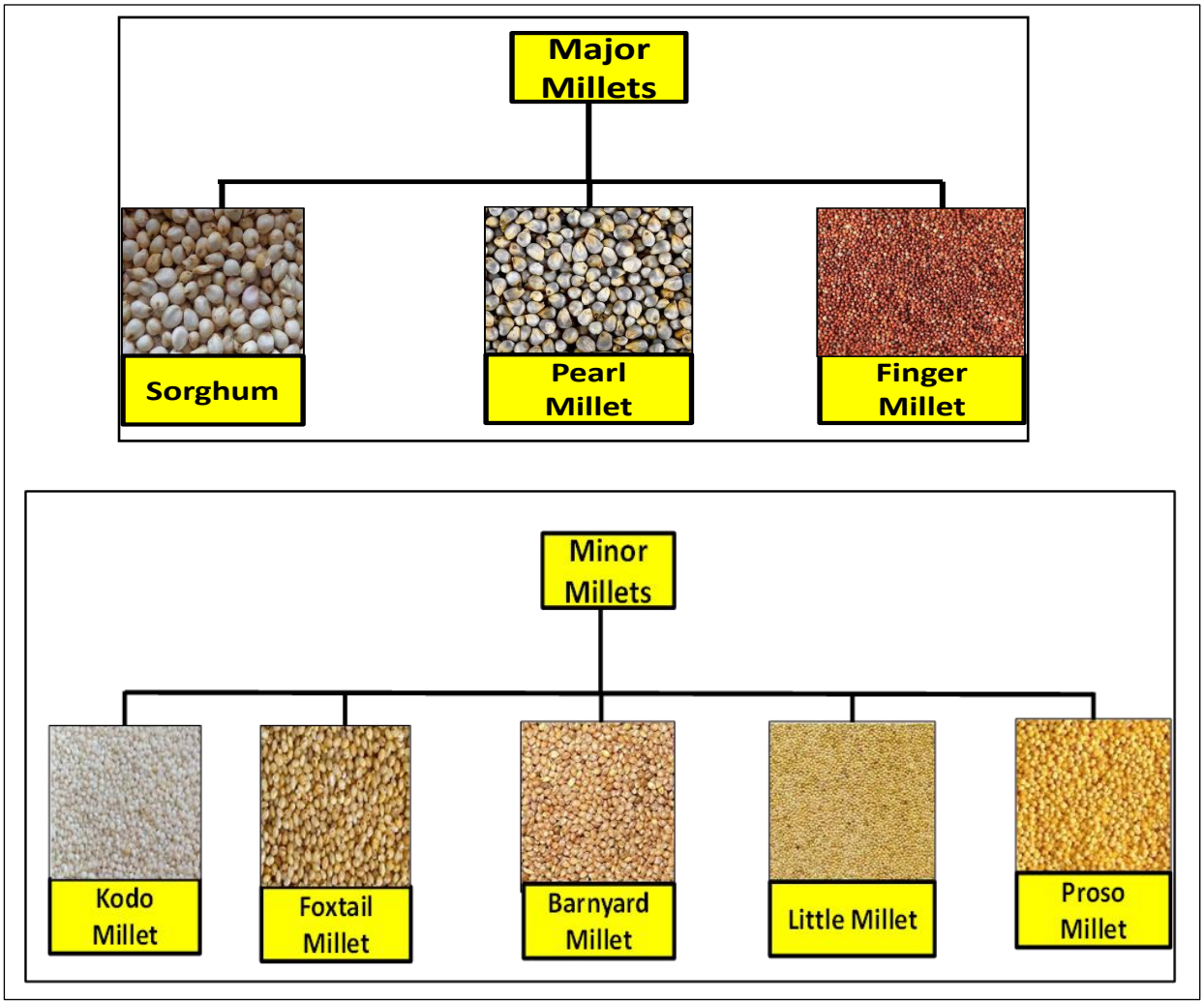
  It is a rich source of crude fibre and iron. In addition, its grain contains constituents of gamma amino butyric acid and beta-glucan as antioxidants which help reduce blood lipid levels.

- Little Millet *(Kutki)*

  Little millet is smaller, but it is highly nutritious than other millets. It provides essential fats to the body. It is a good source of vitamin B and minerals like calcium, iron, zinc and potassium.

- Proso Millet *(Chenna/ Barri)*

  Proso millet has a high content of niacin and protein (12.5%) and is also beneficial in preventing Pellagra condition. In addition, it is used as a therapeutic dish, particularly after childbirth or illness.



IMPORTANCE OF MILLETS

- Millets are rich in heritage and good food for human and animal health.
- Millets are the least cost-intensive crops and thus help in sustainable production.

- Millets are called climate-smart crops, grown on poor soils and resistant to climatic stress, pest and diseases.
- It has a low carbon footprint hence helping to maintain the ecological balance.
- A source of income for marginal production areas in the rural, urban region.
- They are a rich source of antioxidants, protein, and macro and micronutrients.
- Gluten-free with a low glycaemic index to address intolerances and diabetes.
- They are a storehouse of nutrients that can reduce malnutrition and provide food security and nutrition.

CONCLUSION

Food and nutritional security are under significant stress from the rising population and climate change. Millets, which have various benefits like early maturing, drought resistance, demanding little inputs, and being largely free from biotic and abiotic stresses, can alleviate all these issues. Again, it may help mitigate climate change's effects because they leave a smaller carbon footprint. Grains of millet are rich in protein, minerals and vitamin B-complex, have a balanced amino acid profile, high levels of macro and micronutrients, and insoluble dietary fibre. Looking at the importance of millets, daily consumption of the millets may be recommended to improve the nutritional security of the family.

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NUTRITION FOR BOVINE CALVES

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ABSTRACT

Sound calf feeding and management practices start with the mother, two months prior to calving. The majority of calf growth takes place during the last two months of gestation and the dam provides the nutrients required for growth. Also, the management practices of the dam affects the quality and amount of antibodies found in her colostrum, or first milk, which directly influences the calf health after birth. Calves should be reared carefully to obtain an optimum gain in body weight so that they attain about 70 to 75 percent of their mature body weight at puberty. Poor feeding of young calves leads to a higher age at first calving and higher mortality, thus an overall loss of productivity.

INTRODUCTION

Calves are born with little immunity against disease. They acquire resistance to disease from their dam through timely and adequate intake of high-quality .Initial protection of calf through Ig in colostrum colostrum i.e their mother's first milk. Colostrum is vital to the newborn calf because, it contains antibodies called immunoglobulins (IgG, IgM and IgA) which provide immunity. It is also rich in energy (carbohydrate, fat) and nutrients like Vitamins (A, D and E) and Minerals (Ca, Mg, Fe and P) that are essential for growth. Hormones (insulin) and growth factors (IGF-1) in colostrum also aid metabolism. The 3Qs of colostrum management i.e. Quality, Quantity and Quickly are required to be followed for better calf growth.

QUALITY

High-quality colostrum contains at least 50g / L of IgG and ensure cows are milked as soon as possible after calving so that the best possible colostrum is collected and fed to newborn calves. Three types of immunoglobulins (Ig) in colostrum are of utmost importance. Immunoglobulin G (IgG) makes up 70-80 percent of the immunoglobulins and helps identify and destroy invading pathogens. Immunoglobulin M (IgM) comprises 10-15 percent of immunoglobulins and serves as the first line of defence against septicaemia. Immunoglobulin A (lgA) comprises the remaining 15 percent of immunoglobulins in colostrum and protects the mucosal surfaces, such as the intestine, from invasive pathogenic bacteria.

Immune status of dam, length of dry period and dry cow nutrition are some major factors that affect IgG concentration in colostrum.

QUANTITY AND QUICKLY

To optimise immunity, the calf must receive their first colostrum (1 / 10 th of their body weight) feed as soon as possible after birth, ideally within two hours because the ability of calves to absorb Ig (immunoglobulins) fall drastically after 12 hours and is blocked at 24 hours of age. It also has laxative action and helps the calf in evacuating accumulated faecal matter (meconium).from intestine. Feeding colostrum to calves over several days is beneficial for building immunity and fighting against infections.

IMPORTANCE OF COLOSTRUM FEEDING

1) Provide passive immunity.
2) Laxative effect.
3) Antitrypsin action.
4) Excellent source of Vit A, D and E.
5) Excellent economic diet for both the neonates and older calves.
6) Contain antibacterial substances- lactoferrin, lactoperoxidase and lysozyme.

KEY POINTS TO BE REMEMBER

Feed appropriate quantity of good quality colostrum to calf as soon as possible after birth. Remember the major factors

• Quantity - 1 / 10 th of body weight
• Quality-contains at least plus/minus 50 * g / L * of lgG
• Quickly-within two hours of birth

WHOLE MILK FEEDING

The best measure of a successful calf rearing system is production of a healthy calf that has reached its targeted weaning weight. Traditionally, the recommendation to feed calves at 10% of body weight and then translated into feeding two litres of milk twice daily. Whole milk is the natural follow- on from colostrum. This does not provide growing calves with sufficient energy. Feed whole milk or a suitable milk replacer @10-15% of calf body weight to suffice the energy requirements.

CONSIDERATION WHILE FEEDING

1) Milk with high bacterial contamination, e.g. high SCC, risk of Johne's disease, Salmonella and E. coli should only be fed to calves after pasteurisation.

2) Milk from cows administered with antibiotics and still within the withdrawal period, should never be fed to calves as it can affect the milk taste leading to calves not drinking as much milk, with resultant lower weight gains. More importantly, bacteria that are resistant to these antibiotics can develop and if animals need to be treated with these antibiotics they may not work as effectively.
3) Teat feeding is more natural. Drinking from teat help calves satisfy their urge to suckle but artificial teat feeders can also be used.

MILK REPLACER

Milk needs of young calves can be replaced by milk replacer. During first three weeks of life, calves can be fed with milk replacer that contains all milk proteins made from dried skim milk or whey products and it is more economical than whole milk feeding. Milk replacer powders are reconstituted with warm water and make an excellent liquid feed for baby calves. Milk replacers should contain a minimum of 18 to 22% crude protein, 10 to 22% crude fat, and less than 0.5% crude fiber. Milk replacer has almost all the essential nutrients, similar to milk. It comprises of skim milk powder, soybean meal, edible oils, grains, vitamins, mineral mixture, preservatives, etc. (Table 2).

- **Advantages of using milk replacer**Reduces risk of disease transfer (e.g. Johne's disease and BVD).
- Consistency of product, when mixed correctly-l
- **Disadvantages of using milk replacer**Products with plant-based proteins have lower digestibility in calves under 3 weeks old.

SOURCES OF MILK REPLACER PROTEIN

- Milk-based (ex. dried skimmed milk, dried whey, delactosed whey, casein)
- Egg based
- Plant-based (ex. soya, wheat gluten, pea)

The new borne calf can digest protein in milk and 14 day onwards they are able to digest non-milk proteins. After four weeks of age microbes in the rumen may digest some feed.

OIL AND FAT

- Generally, vegetable fats (palm oil, coconut or soybean) have similar digestibility to milk fat in calves over three weeks old

FIBRE

- Fibre is an indicator of protein quality.
- Products with less than 0.15% fibre contain milk or egg
- Fibre levels over 0.20% indicate the inclusion of plant proteins

VITAMIN AND MINERALS

Calves require many of the same vitamins as monogastric, including vitamin K and the water- soluble B vitamins: thiamine, riboflavin, niacin, choline, biotin, pyridoxine, folic acid, B_{12} and pantothenic acid. These vitamins can be added in milk and milk replacer.

ASH

- Ash indicates the overall level of minerals
- The ash content should not be higher than 8%.

CALF STARTER

- At birth, the first three compartments of stomach I e. rumen, reticulum and omasum are undeveloped and do not aid in digesting feeds
- When the calf starts digesting calf starter (mixture of grains, protein source, vitamins and minerals) and water, the rumen starts to develop.
- Calf starter should be introduced from second week onward.
- Calf starter should be formulated to include palatable ingredients and to contain adequate protein, minerals, and vitamins.
- It should have C P(min) 23-26%, DCP (min) 18.8-19.5% and TDN (min) 75%.
- Feeding calf starter and good quality leguminous hay stimulate early development of rumen papillae essential for rumen function and favours digestion of large proportion of fodder at an early age.
- Calf starter ration should contain traditionally available highly palatable ingredients such as soybean meal, decorticated cotton seed meal, crushed maise, wheat bran, rice polish, molasses, skim milk powder, etc. After three weeks of eating calf starter, the rumen will have enough microbes to ferment the feed and supply the calf with energy.

Calf starter increases the number and variety of rumen bacteria and protozoa. These microorganisms grow rapidly on grain carbohydrates and produce volatile fatty acids i. e butyrate and propionate. These acids provide nutrients for calf and stimulate rumen development. Dietary requirements during early age are best met with high quality diets formulated from sources of carbohydrates, proteins and fats, having good digestibility. Proteins supply in calf helps in maintaining biological processes on daily basis, as well as germinal regeneration, enhance growth and form blood. Animal proteins, such as fish meal, are more valuable to calves than plant proteins because their amino acid makeup more closely matches those of the rapidly growing calf.

The followings should be considered while selecting calf starter:

PHYSICAL FORM

Select whole, coarsely ground, cracked, crushed, rolled, steam-flaked, or texturised grains. Do not feed high-moisture corn in a calf starter as it often heats and gets mouldy. Avoid dusty, mouldy or off-flavour feeds.

a) Pellet quality: Avoid pellets that are too hard or too soft; pellets at both extremes will affect intake.

b) Fines: Finely ground mixtures are not recommended as fine feeds tend to cake together when wet and deteriorate intake

c) Protein sources: Protein sources like, urea, raw soybeans and feather meal should be avoided. The inclusion of Vit. -B complex is necessary.

d) Molasses or molasses-based products: It can be included between 5 to 8 percent of total mixture because higher levels can adversely affect handling and storage, especially when bags become cold in the winter months.

e) Coccidiostats: Must be included to increase shelf life and viability.

Care should be given that After six months of age, calf starter should be replaced with calf growth meal which is more economical.

HAY FEEDING IN CALVES

The concentrate feed is significantly more important than the roughage to develop the calf's stomach but forages are a good source of fibre, which promotes the growth of muscular layer of the rumen and helps to maintain the health of rumen lining. In addition to starter, good quality forage should be offered from week onwards, little and often basis to ensure freshness and encourage intake. Amount should be increased gradually. The forage/hay should be of good quality and free of mould. Do not feed haylage or forages with protein levels exceeding 22 percent as these feeds can contain high levels of non-protein nitrogen. Young calves are not very efficient at processing non-protein nitrogen because the rumen is not fully functioning. Calves fed forages high in non-protein nitrogen will often scour and look unthrifty with symptoms similar to coccidiosis. Calves need small quantities of roughage-hay or straw. This is more important if feeding a pelleted ration. Avoid feeding too much as it can result in pot belly condition. There is a greater risk of this with overeating of hay. Where pot bellies (or hay bellies) are observed it indicates that the rumen is packed with hay which can't be digested properly,

WATER

- Water accounts for 70-75% of a calf's body weight. Water should be provided free-choice starting at four days of age.

- Feeding calves free-choice water increases starter intake and weight gain.
- As per reported study, calves deprived of drinking water decreased starter intake by 31% and decreased weight gain by 38% over those calves provided water free-choice.
- Providing warm water (16-18°C) during cold weather may stimulate starter intake.
- In hot weather, particularly in temperatures above 25° C the calf's water intake will increase to maintain hydration and normal body function.
- During periods of scours, dehydration will result in reduced feed intake, feed conversion and growth.
- Scouring calves will consume greater volumes of water so must be provided with continual access to water.
- By 20 days of age, water intake increases dramatically and in parallel with reductions in feeding of milk replacer and increasing starter intake.
- Calves require four times more water than feed (dry matter) or a water to feed intake ratio of 4:1 (kg basis).

It should be noted that for supplementation of electrolyte is often needed for calves to replace lost fluids, restore acid- base balance and furnish nutrients and energy to the calf with moderate to severe scours.

GROWTH RATE

Growth rate measurement of young calves provides useful information about how well they are growing. Indirectly it measures the efficiency of feed conversion. Meeting growth rate targets ensures maximum return on investment. Growth is at its most efficient in the first two months of life, so high growth rates should be targeted during milk feeding. Monitoring growth from birth can guide continual management improvements to ensure that every calf is pregnant recommended for cow health and calf's growth as well as daily weight gain.

BENEFITS OF RECORDING GROWTH

- Maximise growth efficiency cost-effectively.
- Identification of poor-performing and sick calves.
- Achieve targeted growth rates for breeding.
- Determination of Management status.

For growth calculation at least two measurements should have to be done. Initial weight (birth weight) of the calf should be recorded first as this figure provide a baseline against which average daily gain (also known as daily live weight gain, DLWG) is recorded.

EFFECTIVE DEWORMING OPTIMISES GROWTH

Deworming ensures the utilisation of nutrients for better and effective weight gain and improved immune status of calves. Worms like Ascaris and Toxocara vitulorum in addition to neonatal diarrhoea and pneumonia are major causes of calf mortality. Nematode infestation is commonly reported in India and Southeast countries hence special attention should be paid to effective prevention by following the prescribed deworming protocol. It is advocated to follow rotational deworming system to minimise parasitic resistance.

CONCLUSIONS

Enhanced colostrum intake and a subsequent biologically normal (intensive) milk feeding programme support body growth and organ development in dairy calves. Only providing traditional restricted feeding is detrimental to animal immunity, life-time performance and leaves calves hungry for long periods of time. This practise is therefore not consistent with animal welfare principles. Other contentious practices in the dairy industry, like early cow-calf separation and subsequent individual housing of the dairy calf are gaining increasing attention from the general public. Scientific evidence does not support the common opinion, that these practices are beneficial for the health of calf or cow. Profound changes in current calf management practices are needed to improve dairy calf health and survival, enhance long-time performance of dairy heifers and satisfy consumer interests in farm animal welfare.

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