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Importance and Value Addition of Banana Flower: A Review

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ABSTRACT

Banana is an indigenous fruit of India; its various plant parts also have several health benefits. The core of a banana tree, the banana flower/ blossom, is abundant in nutrients and beneficial compounds. However, after harvesting, the banana flower is considered waste. There is numerous nutritional, therapeutic, and non-edible uses for banana blossoms. Although, the banana flower is an underutilized flower from a processing point of view, however, very few products with additional value have been developed like powder, concentrate, tea etc. Considering the banana flower's nutritional and functional properties, more products need to be developed and commercialized.

KEYWORDS

Banana flower/blossom, Nutritional importance, Value-added products.

1. INTRODUCTION

Banana plants are perennial herbs that are similar to trees. It is from the Musaceae family and genus Musa. As a fruit the banana is consumed; the plant has not much use after harvesting the fruits. But the researchers have found that even additional plant components, such as stems, leaves, and flowers have high nutritional and therapeutic uses. The blossom of a banana is rich in nutritional value which is helpful for developing new generic medicines for certain diseases which were facing difficulties to control [1].

Banana waste is generated in large amounts every year. Considering the large availability and rich composition of different nutrients, it can be added to various food processes. This waste utilization of bananas will be beneficial from economic and environmental views. The advantage in terms of financial benefit is based upon the perspective of utilizing such wastes as inexpensive raw materials for the development of other compounds with added value [2]. The plant stems after maturing gives rise to a bunch of rolled leaves and then protrude as a dark purple bud that is elongated and oval-shaped which is known as inflorescence or flower or banana blossom. Blossom has two parts mainly -

(i) Bract

Bracts of Musa acuminata usually have a purple or crimson colour. The bract usually has a high variety of components, including alkaloids, glycosides, saponins, steroids, phenols, terpenoids, flavonoids, and tannins [1].

(ii) Florets or Flowers

Male flowers naturally have pale cream-coloured petals whereas having an orange or rich yellow in colour stigma. The compound tepal, which is about 2.5 cm long, is translucent and has free tepalsthat are roughly half its length. It is white, yellowish, or somewhat purple with a yellow or white tip and lobes. Light, yellow-green, or purple-colours ovaries that are spherical in shape or have a few small hairs around the base [1].

The banana plant's tip contains bananablossoms, an edible blossom that contains a lot of nutrients. Not only is banana blossom grown for food, but also used for a type of therapeutic purposes. It is often purple or red in colour and attached to the ending of the banana fruit tree cluster. In the red or purple-red bracts, many small whitish flowers, which would turn into mature nutritious banana fruit, are found in India. The banana blossom's fibre content is quite valuable [1].

1.1. Nutritional Value of Banana Blossom

Banana blossom is a great source of fibre, enough protein, vitamins A, C, E, and minerals for example iron, phosphorus, magnesium, potassium, calcium, and antioxidants. It has great therapeutic value. Lower menstrual bleeding facilitates lactation, helps to defeat diabetes, helps shed pounds and is good for digestive health. So, it can be considered a nutritious food or a superfood [3]. An excellent resource for some phytochemicals that serve as antioxidants originates in banana blossoms. Data collected about the nutritional information, of two Banana flower varieties (species are Paradisiaca and Baxijiao) are as follows (see **Table-1**) [4].

Nutrients	Per 100 g
Calories	51 Kcal
Carbohydrates	9.9 gm.
Fat	0.6 gm.
Protein	1.6 gm.
Fibre	57 gm.
Vitamin E	1.07 gm.
Iron	56.4 mg
Phosphorus	73.3 mg
Calcium	56 mg
Magnesium	48.7 g

	Table-1.	Nutritional	value of	banana	blossom
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Potassium	Mg	
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Nutraceutical benefits of Banana blossom

The followings are the major benefits provided by banana blossoms

1.1.1. Beneficial for Diabetes

It has been found that eating banana blossoms regularly for about amonth brings down sugar levels in the blood and enhances the body's haemoglobin level since it is high in both iron and fiber, which helps in the development of red blood cells [4].

1.1.2. Lowers Menstrual Bleeding

Due to the blossom's capacity to control the progesterone hormone, muscle cramping reduces. Besides it also contains magnesium which can reduce anxiety during that period [4].

1.1.3. Source Phytochemicals and Anti-oxidants

The blossoms contain high levels of antioxidants along with antibacterial qualities. These flowers possess great potential to treat gastric ulcers, pneumonia, and constipation. Therefore, it is advised to incorporate banana blossom health supplements given their high antioxidant property [4].

1.1.4. Good for the Gastrointestinal Tract

Banana blossom is a source of both insoluble and soluble dietary fibre, and is very helpful for those who are afflicted with irritable bowel syndrome i.e. (IBS) and diarrhea [4].

1.1.5. Increases Lactating Mothers' Ability to Produce Milk

Banana blossom consumption increases milk productivity in nursing.

1.1.6. Helpful in Ulcers

Ulcers may describe as wounds alongside the intestinal linings. Patients suffering fromulcers are urged to boost their vitamin C intake-rich foods as it stands believed that Vitamin C is essential for tissue growth, and wound healing. Since the blossoms are having a lot of that vitamin, it is able to help in ulcer management as they neutralize gastric juices in stomach and reduces ulcer irritation [4].

1.1.7. Helpful in Infection Treatment

Banana blossom extract is very useful for treating the infection in a natural way. During research on the anti-microbial properties of blossom extract, banana blossoms exhibited antimicrobial defenses for bacteria Bacillus. Along with that the floral essence is also helpful in the curing of wounds especially in children and preventing the Malaria parasite. In addition to disease prevention and treatment, juice is very helpfulin healing the wound and burn faster [4].

1.1.8. Beneficial for Weight Reduction

While banana blossoms have a lot of fiber, it is great for adults and children who are obese or overweight to lose weight. Including banana flowers in meals in the form of curry, salad, soups or any additional form, can facilitate weight loss [4].

1.1.9. Keeps Raised and Diminished Mood Anxiety

Everybody's state of mind can be improved by banana blossoms, children especially. Teenagers with mental illness issues like anxiety can benefit from banana blossoms since they lessen the feeling of anxiety. Banana blossom's capacity to ease anxiety can be linked to containing magnesium which has anti-depressive effects without negative cons.

1.1.10. Anti-aging Potential

It is beneficial to come upon free- radicals and treat the related health problems, including as cancer and premature ageing [5].

1.1.11. Cancer and the heart disease

Tannins, acids, flavonoids, and other antioxidants are abundant in considerable concentrations in banana blossoms aid in halting the oxidative damage that leads to cancer and heart diseases and fights free radicals [5].

1.2. Natural Disorders

By routinely consuming banana flowers, one might decrease the likelihood of producing free radicals, which may lead to diseases like Alzheimer's and Parkinson's. [5].

1.3. Anthocyanin Extraction from the Banana Flower (Musa paradisiaca) Bract

The anthocyanin concentration in the banana bracts ranges from 14 to 32 mg. of anthocyanin per 100 gm bracts. Hence this is admirable resource of anthocyanin. The extracts were identified for their anti-oxidant function along with anthocyanin content and it turned out to be a more effective source as bio food **colorants**. In foods, cosmetics, and pharmaceutical products, bracts from **the** banana flower are used [6].

2. VALUE-ADDED PRODUCTS MADE FROM BANANA BLOSSOMS/FLOWER

2.1. Banana Blossom/ flower Powder (BBP)

To prepare banana blossom powder, the slices are crushed using a food mixer. The citric acid solution at the concentration of 0.5 per cent is applied directly to it to reduce enzymatic browning. After that, slices are dried, crushed and sieved using 40 meshes in size, sealed in polyethene bags, and after that stored at 50 °C. After the analysis, the result shows that it is high in both protein and food fibre and low in fat content. The quantity of moisture and the value of ash is also high [7].

2.2. Banana Blossom Preservation with a High Fibre Content as Like a Dried Vegetable

Banana flower is a valuableresource of crude fiber in the human diet. The important quality characteristics of the dehydrated items include color and rehydration ratio. The level and activity of the enzyme polyphenol oxidase (PPO) determine the banana flower's high reactivity. Slices are immersed as a pre-treatment in 0.2 per cent solution of citric acid for 30 minutes, dried at 50°C for 6 hours, followed by dehydration to create a product that is ready to cook, acceptable relating to appearance, flavor, and overall quality, in addition, it reduces browning. Regarding the prospective packaging material for the dried banana flower, aluminum foil laminated with high-density polyethene is far superior to orientated polypropylene laminated with cast polypropylene (OPP/CPP). The product might possibly be kept for longer than one month [8].

2.3. Banana Blossom Concentrate

In the study of concentration banana flowers, the dehydration, concentrate extraction, and nutritional characteristics of flowers were studied. Dehydrated and powdered banana blossom was extracted using ethanol along with water extract. It was observed that flowers extracted with methanol produced the highest yield. The collected sample (extract) was further purified by a method such as GC-MS. For advanced analysis, both hot and cold extraction methods were used to extract the sample and obtain results. After extraction, chromatographic separation of the bioactive element was done using Thin LayerChromatography method (TLC). After the analysis, when compared to fresh samples, the moisture value for the powdered samples (10%) was significantly lower than the nutritional values. The dried powder contained higher ash percentage(3.5 per cent) and the fresh one had 2 per cent. The banana flavour essence had 33.10 per cent essence, 48.95 per cent water, and 17.95 per cent propylene glycol. Timsina *et al.* (2014) found that the toluene treatment of the sample gave the best results for the chromatogram [9].

2.4. Banana Blossom Integrated Nut Chocolate

For the development of nut chocolate incorporated by banana blossom was used after the removal of three to four outer leaves of the banana flowers/blossom's. After weighing and cleaning (to effectively remove soil and other bacteria), it was cut into little pieces. Banana blossom was added to nut chocolates in proportions of 10%, 20, and 30%. The overall acceptance and the rating scale were high for the Banana flowers with 20% formulation. As the nutritional value of banana blossoms is found to be high, it may be included in a range of different food products [10].

2.5. Banana Flower Tea

Banana flower tea is considered as the world's healthiest tea as it is abundant in minerals, vitamins, and amino acids, along with other necessary nutrients. Clinical studies have shown that it protects the heart by lowering high blood pressure, heart attacks, and strokes. This smooth, gently scented tea, which is caffeine-free by nature, complements any meal and ideal after-dinner and bedtime beverage. Begin by picking fresh banana blossoms, trimming, cleaning, and washing them. Then comes the cutting/shredding of the flower's wherein said flowers are cut manually or mechanically. After that, the flowers are dehydrated in a dryer or sun-dried followed by roasting at 400–450°F for 5-7 mins. The roasted flowers can then be crushed, mixed with flavourings and aromas, and placed in tea bags or boxes for later brewing to prepare a tea using banana flowers.

2.6. Product Development using Indian Gooseberry and Powdered Banana Blossom for Teenage Girls with Anaemia

Despite being mostly rich in micronutrients, primarily iron in addition to fibre, the banana flower is not well-known and is only eaten by a very small number of individuals. Prior to becoming a powder after processing and protected from moisture exposure by aluminum foil during storage, fresh banana flowers were peeled, washed, and then dried for six hours at 50° C in the hot-air oven. 18g, 20g, and, 25g of powdered banana flower/ blossoms and 2g, 3g, and 5g of Powdered Indian gooseberry are found in 100g of hummus, respectively. The finished product contains a concentration which is 3g Indian gooseberry powder, and 20g powdered banana blossom received a high rating on a 9-point hedonic rating scale. The iron content was 16.9 mg / 200 gm, which nearly corresponds to the daily need for iron for women.

3.0. CONCLUSION

The banana tree's component that is dumped after the harvesting process is the banana flower. After harvesting, it is recycled and used as a fertilizer or utilized directly in decomposition. But banana flower contains various nutrients in addition to bioactive compounds. It has a number of health benefits as mentioned in the presentreview paper. It is processed into a number of value-added products. But such

products are fewer. Efforts must be taken to commercialize the value-added goods of banana flowers/blossoms.

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Design and Development of Cleaning Section for Black Gram Thresher

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ABSTRACT

Materials from the threshing unit are mixtures of long stalks, chaff, small fragments of spikes, small stalks, leaves and grains. Threshed grain requires considerable additional cleaning operation before it can be used as food. *Cleaning process presents more difficulties than the threshing processing terms* of labour demanding requirement. Limitation of natural wind method for cleaning is its unpredictable direction, speed and continuity, high labour requirement and rather imprecise degree of separation. In mechanical cleaning operations air is blown for lighter weight impurities from grain mixtures. Aerodynamic characteristics of particles mixtures are important for cleaning. Vibratory cleaning sieves divide overall movement of grain within chaff layer as segregation movement to the top of the sieve, transport movementalong the sieve and passing through the sieve openings. There are no available on-farm multi crop threshers developed with low power requirement and good cleaning efficiency. This mechanical cleaning section includes vibratory screen and blower and separates grain, chaff materials and the blower eliminate dust particles to obtain sound grains. The best cleaning efficiency of the developed thresher with 25⁰ angle of repose and air velocity1.2 m/sunder the lab condition was found as 98.71% at a moisture content of 10.34% (wb).

KEYWORDS

Aerodynamic, Air velocity, Angle of repose, Degree of separation, Threshing unit, Vibratory cleaning.

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1. INTRODUCTION

Pulses are the edible seeds of pod bearing plants known to be reserves of nutrient providing energy, dietary fibre, protein, minerals and vitamins required for human health. India is the largest producer and consumer of black gram which accounts for more than 40% of total legume seeds traded in the world [1]. Post harvest losses of black gram are estimated at 25-50% [2]. The pulses constitute an important source of dietary protein particularly in those countries where consumption of animal protein is limited by non-availability or by self-

imposed reasons such as religious and cultural habits. Hence pulses are also referred as "poor man's meat" [3]. The losses are mainly due to lack of efficient drying, threshing and milling equipment's at industrial scale. The traditional threshing of pulses is generally done by hand: bunches of panicles are beaten against a hard element (e.q. a wooden bar log, bamboo table or stone) [4]. Almost all the pulses are being threshed by traditional methods.i.estamping by heavy animals, rolling the roller or by beating the dry crops by wooden sticks. Threshing by bullock treading is practiced on large scale in the country but it is also time consuming and involves drudgery.Tractor in many places is now used in place of animals for threshing. Introduction of animal drawn thresher reduces the drudgery of the operator and gave comparatively higher output per unit time [5].

There are no standard mechanical threshers with cleaning section for threshing of black gram. Modifiedpaddy threshers were used sometimes but that requires high power and is expensive. The limitation of traditional cleaning methods affects the degree of separation. Though the developed thresher providedhigher efficiency but lacked a cleaning section. A cleaning section for separation of black gram seeds from the chaff and other impurities will improve the performance of the black gram thresher. Hence the research work is carried out to design and develop cleaning section and to evaluate the performance of the cleaning section of the black gram thresher.

2. MATERIALS AND METHODS

2.1. Black Gram Seeds

The vamban variety of black gram seeds was collected from local farms for the evaluation of cleaning efficiency of black gram thresher with the developed cleaning section unit.

2.2. Pulleys and Belt

The nominal pitch length of motor to counter shaft belt was determined in order to know the actual belt size that is needed to transfer power from the electric motor to the counter shaft.

2.3. Bearings

Self-aligning ball bearings were used in the cleaning section.

2.4. Sieve Box

This main part of cleaning section was placed underneath the threshing section. The rectangular sieve box has the dimension of 295 cm \times 130 cm and was attached to the threshing section with the help of hangers.

2.5. Sieve

The sieve was rectangular type with dimension 76.2 cm \times 76.2 cm.it was made of stainless steel with the perforation of 0.7 cm.it was attached to the bottom half

portion of the drum in threshing section to separate the threshed grains from chaff.

2.6. Hanger

The hanger was attached with the sieve box underneath the threshing cylinder. The height of hanger was 30 cm. The hanger was drilled with four holes of 2 cm diameter. For the black gram the sieve box was attached with an angle of inclination of 25° C.

2.7. Eccentric Unit

An eccentric was circular discs (3.175 cm diameter) solidify fixed to a rotating axle with its centre offset from that of the axle, for reciprocating action. It has two main parts that are-1) Eccentric disc 2)connecting Rod

2.8. Blower Unit

The blower has a rectangular opening at the discharge end with the dimension 20 $\text{cm} \times 10 \text{ cm}$. different air velocities were obtained by changing the value of the blower for various blower speed of 450 rpm (9.18 m/s), 550rpm (11.23 m/s) and 650 rpm (13.27 m/s). L-shaped frame made of mild stainless steel was used to support the blower.

2.9. Collection Unit

The collection unit was designed in an inclined position and was connected below the sieve box for collecting the cleaned separated seeds.

2.10. Waste Outlet

There are three waste outlets i.e major waste outlet (concave screen), other chaff materials (vibratory screen) and fine dust waste outlet (blower)

2.11. Motor

Three phase motor was used for the rotation of the central shaft which directly used to produce the impact force. For the cleaning section, a 1 H.P motor was used with 1.5 kW capacity and rotational speed of 1400 rpm.

3. METHODOLOGY

Knowledge of physical and aerodynamic properties of black gram is important for designing the cleaning section [6]. The properties of black gram seeds such as moisture content, geometric mean diameter, sphericity, bulk density, terminal velocity, and angle of repose were measured by using standard methods and procedures as discussed below [7].

3.1. Black Gram Thresher with Cleaning Section

The developed cleaning unit assembled with the existing black gram thresher is shown in **Figure-1**.



Figure-1. Front View and side view of Black Gram Thresher.

3.2. Performance Evaluation of the Cleaning Section of the Black Gram Thresher

About 9 kg of black gram seeds was used for the performance evaluation of cleaning section. The black gram was divided into three samples, 3 kg each which was then subjected to hot air oven drying in order to obtain three different moisture contents (10.34, 12.65 and 14.75% w.b). The machine was first run under no load condition using an electric motor of 1.5 kW with speed rating of 1500 rpm. This was done in order to ascertain the smoothness of operation for the machines rotating parts. The testing of the machine was targeted to evaluate its cleaning efficiency and the % cleaning losses based on the moisture content of the seeds [8]. The overall effect of moisture content on cleaning efficiencies was investigated. The number of impurities to be added (200 g) for the performance evaluation of cleaning section was calculated by the results obtained by [9].

4. RESULTS AND DISCUSSION

4.1. Performance Evaluation

4.1.1. Cleaning Efficiency

The results of the cleaning efficiency of the machine are presented in **Table-1**. From the results, the higher value of cleaning efficiency was 98.71% for the black gram seeds of moisture content of 10.34% (w.b). The lowest values of cleaning efficiency was recorded as 95.367% moisture content of 14.75%(w.b) [10] foundthat cleaning efficiencies was found to be increased by increased of drum speed and decreased by increasing both the feed rate and moisture content.

4.1.2. Percentage Cleaning Loss

The results of percentage losses of the seeds at three different moisture content are presented in **Table-2**. Cleaning of black gram at 14.75% moisture

content and speed of 350 rpm produced the highest value of percentage loss of 2.81%. This could be as a result of high moisture content of the seed for the moisture content of 14.75% (w.b) the maximum cleaning efficiency was found to be 94.62% and the minimum wasfound to be 95.78%. While at the moisture content of 12.65% (w.b) the maximum cleaning efficiency was found to be 96.83% and the minimum was found to be 98.02%. From the results it can be concluded that the cleaning efficiency decreases with increase in moisture content of seeds [11]. Producing resistance to dislodging as such more of the seed were lost with the stalk. It was also observed that the percentage loss decreased with decrease in moisture content of the seed and increased with increase in seed moisture content. The trends are presented in **Figure-2** and **Figure-3**.





Figure-2. Effect of Moisture Content on Cleaning Efficiency

Figure-3. Effect of Moisture Content percentage loss

M.C %(w.b)	Trials	Mass of clean seeds(g)	Mass of remov ed impuri ties(g)	Mass of removed impurities (g)	Avg. mass of unsepera ted impuritie s (g)	Avg. Qty.of recovere d grains(g)	Los s gra in (g)	Cleaning efficiency (%)	Percentage loss (%)
	T1	3000	200	198.13	1.87	2962.37	37.63	98.66	1.27
10.34	T2	3000	200	198.45	1.55	2957.89	42.11	98.99	1.42
	T3	3000	200	198.05	1.95	2965.37	34.63	98.60	1.16
					Average			98.71	1.28

Table-1. Physical properties of black gram seeds

Page 12

	T1	3000	200	195.57	4.43	2940.46	59.54	96.83	2.02
12.65	T2	3000	200	196.12	3.88	2951.53	48.47	97.22	1.69
	T3	3000	200	197.24	2.76	2965.67	34.33	98.02	1.15
Averag	ge							97.35	1.62
	T1	3000	200	192.47	7.53	2920.26	79.73	94.62	2.73
14.75	T2	3000	200	193.98	6.02	2919.75	80.25	95.7	2.74
	T3	3000	200	194.11	5.89	2913.33	86.67	95.78	2.97
Averag	ge							95.36	2.81

Properties	Observa tions	Min	Max	Mean	Variance	Std Deviatio
	tions					n
Length (mm)	15	4.03	5.32	4.63	0.72	0.84
Width (mm)	15	3.1	3.52	3.33	0.07	0.28
Thickness (mm)	15	3.26	4.28	3.74	0.49	0.70
Geometric	15	3.51	4.5	3.93	0.48	0.69
mean						
diameter						
(mm)						
Sphercity	15	0.77	0.92	0.839	0.01	0.10
Aspect ratio	15	0.67	0.86	0.741	0.01	0.13
-						
Properties	Obser-	Min	Max	Mean	Variance	Std
Properties	Obser- vations	Min	Max	Mean	Variance	Std Deviatio
Properties	Obser- vations	Min	Max	Mean	Variance	Std Deviatio n
Properties Length (mm)	Obser- vations	Min 4.03	Max 5.32	Mean 4.63	Variance 0.72	Std Deviatio n 0.84
Properties Length (mm) Width (mm)	Obser- vations 15 15	Min 4.03 3.1	Max 5.32 3.52	Mean 4.63 3.33	Variance 0.72 0.07	Std Deviatio n 0.84 0.28
Properties Length (mm) Width (mm) Thickness	Obser- vations 15 15 15	Min 4.03 3.1 3.26	Max 5.32 3.52 4.28	Mean 4.63 3.33 3.74	Variance 0.72 0.07 0.49	Std Deviatio n 0.84 0.28 0.70
Properties Length (mm) Width (mm) Thickness (mm)	Observations	Min 4.03 3.1 3.26	Max 5.32 3.52 4.28	Mean 4.63 3.33 3.74	Variance 0.72 0.07 0.49	Std Deviatio n 0.84 0.28 0.70
Properties Length (mm) Width (mm) Thickness (mm) Geometric	Obser- vations 15 15 15 15	Min 4.03 3.1 3.26 3.51	Max 5.32 3.52 4.28 4.5	Mean 4.63 3.33 3.74 3.93	Variance 0.72 0.07 0.49 0.48	Std Deviatio n 0.84 0.28 0.70 0.69
Properties Length (mm) Width (mm) Thickness (mm) Geometric mean	Observations 15 15 15 15 15	Min 4.03 3.1 3.26 3.51	Max 5.32 3.52 4.28 4.5	Mean 4.63 3.33 3.74 3.93	Variance 0.72 0.07 0.49 0.48	Std Deviatio n 0.84 0.28 0.70 0.69
Properties Length (mm) Width (mm) Thickness (mm) Geometric mean diameter	Observations 15 15 15 15 15	Min 4.03 3.1 3.26 3.51	Max 5.32 3.52 4.28 4.5	Mean 4.63 3.33 3.74 3.93	Variance 0.72 0.07 0.49 0.48	Std Deviatio n 0.84 0.28 0.70 0.69
Properties Length (mm) Width (mm) Thickness (mm) Geometric mean diameter (mm)	Obser- vations 15 15 15 15	Min 4.03 3.1 3.26 3.51	Max 5.32 3.52 4.28 4.5	Mean 4.63 3.33 3.74 3.93	Variance 0.72 0.07 0.49 0.48	Std Deviatio n 0.84 0.28 0.70 0.69
Properties Length (mm) Width (mm) Thickness (mm) Geometric mean diameter (mm) Sphercity	Obser- vations 15 15 15 15 15	Min 4.03 3.1 3.26 3.51 0.77	Max 5.32 3.52 4.28 4.5 0.92	Mean 4.63 3.33 3.74 3.93 0.839	Variance 0.72 0.07 0.49 0.48	Std Deviatio n 0.84 0.28 0.70 0.69 0.10

Table-2. Cleaning efficiency and percentage loss of grains

5. CONCLUSION

From the present study it has been concluded that the developed thresher will reduce the stress of milling industry as it can give the maximum efficiency for the threshing with cleaning. This mechanical cleaning section reduces human drudgery and saves the time required for the cleaning. So, the present design of cleaning section for the black gram thresher was found successful at the lab level.

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Study on Efficiency of Green Tea Polyphenols as Natural Preservative for Chicken

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ABSTRACT

The current study set out to establish the preservative role of green tea extract on the physicochemical characteristics as well as in prevention of the spoilage organisms in chicken. Green tea offers polyphenolic substances with antioxidant and antimicrobial characteristics that extend the shelf life of a chicken. Prepared ethanol extract of green tea was used as a natural preservative to study its efficiency. Chicken chunks were dipped in an acidic mixture (1% glacial acetic acid and lactic acid mixed at equal proportion) and in green tea extract separately. For four days of storage in the refrigerator, the chicken's physicochemical (pH, PV and WHC) and microbiological (TPC) qualities were assessed. Sample C2 treated with green tea extracts outperformed the other sample treated with acid mixture in their physicochemical and microbial characteristics. PV value and TPC of sample C2 after four days of refrigerated storage were 0.28 mEq02/Kg of fat and 1.53x104 respectively which are under standardized limit. Hence it was found that green tea as a natural preservative can be a novel source for preservation of chicken meat.

KEYWORDS

Green tea extract, Polyphenols, Antibacterial, Chicken, Physicochemical properties.

1. INTRODUCTION

For there to be a constant supply of food both during the growing season and the offseason, food must be preserved, processed, and stored. Agriculture's seasonal character is a crucial factor that sets it apart from all other industrial activities. Foods naturally deteriorate or are perishable. Major food preservation methods can be divided into three categories based on their mode of action: reducing the rate of chemical deterioration and microbiological development; directly inactivating bacteria, yeast, molds and enzymes; and preventing recontamination both before and after processing.

Poultry meat is the fastest growing component of global meat demand and India is experiencing rapid growth in the poultry sector. Chicken meat has become a very popular food commodity due to its high biological value animal proteins, essential amino acids, fatty acids, vitamins and other nutrients [1]. Oxidation of lipids, auto oxidation and microbial proliferation are the major cause so quality deterioration in meat and meat product [2]. Meat processing like mincing, cooking and other processing steps disrupt muscle cell membranes and results in increased lipid oxidation leading to rapid quality deterioration and development of rancidity [3]. Many synthetic preservatives have been successfully used to prevent the spoilage in meat products. Since concern over the safety of chemical additives has arisen in recent years, consumers increasingly demand the use of natural products as alternative preservatives in foods [4].

Next to water, green tea is the most consumed beverage worldwide. Its sensory qualities, reasonably low retail price, stimulating effects, and potential health advantages are credited for its appeal. Originating in Southeast China, the tea plant *Camellia Sinensis* gradually spread to India, Sri Lanka, and other tropical and subtropical nations. Caffeine and polyphenols are the two most significant compounds found in tea and have significant pharmacological relevance. The following is a quick description of some of the main component groupings found in tea: The flavonols (catechins), flavonols, and flavanol glycosides are the most significant forms of flavonoids found in green tea leaves. Tea leaves contain 2.5 to 4.0% caffeine on a dry weight basis and much smaller quantities of the related methyl xanthine theobromine. There are also lipids, amino acids, minerals, volatiles and enzymes are present in minor amounts.

Flavonols (catechins), which account for up to 30% of the total phenolic compounds in tea leaves, are their main component and make up the majority of their dry weight (90 percent of the total phenolic compounds). Catechins can be divided into two isomers: trans-catechins and cis epicatechins, based on the stereo chemical configuration of the 3', 4'dihydroxyphenyl and hydroxyl groups at the 2- and 3positions of the C-ring. Both of them have two optical isomers: (+)-catechin and (-)catechin, as well as (-)-epicatechin and (+)-epicatechin. While (-)-catechin can be transformed into the esterified or galloyl catechins ((-)-catechin-3-gallate, (-)epicatechin-3-gallate, (-)-epigallocatechin-3-gallate, and (-)-gallocatechin-3-gallate) by esterification with gallic acid. Its functions as an antioxidant, anticarcinogen, antimutagen, anti-inflammatory, and antibacterial are only a few of these positive health impacts. Therefore, several types of end products of green tea drinks have become well-known and widespread in the nutraceutical and health market. The primary quality characteristics or indicators of tea products have been tea phenolic components, also referred to as tea polyphenols (TPs). The first stable product of oxidation during fermentation is theaflavins. It is created when catechin and catechin gallates are oxidized [5].

The proposed work is based on the objectives like to carry out proximate analysis of green tea leaves and chicken, to extract polyphenols from green tea leaves, to study its preservation action on chicken and to evaluate the storage stability of chicken.

2. MATERIALS AND METHODS

The present investigation entitled "Study on efficiency of green tea polyphenols as natural preservative for chicken" was carried out in the laboratory of the Department of Food Technology, Shivaji University, Kolhapur. All raw materials required were purchased from a local market in Kolhapur.

2.1 Materials

All raw materials required were purchased from a local market in Kolhapur.

2.2 Raw Material Analysis

Green tea leaves and chicken meat was subjected to proximate analysis. Moisture, crude protein, fat, ash and fiber percentage were estimated by published methods of AOAC (2005).

2.3 Solvent Extraction of Polyphenols from Green Tealeaves



Figure-1. Process flow chart for extraction of polyphenols from dried green tea leaves [6].

Soxhlet extraction was performed on 100 g of dried green tea leaves using 200 mL of 95 percent ethanol as the solvent. The extraction process was carried out at a temperature ranging from 60- 70°C for 4 hours. The obtained green tea extract was dark brown in color (see **Figure-1**).

2.4 Preservative Treatment of Green Tea Extract on Chicken

Washing of Chicken ↓ Cutting into approx. 3cmpieces ↓ Dipping in chilled Water (4-5°C) or dipping in 1% glacial acetic acid & lactic acid or Dipping in Green Tea Extract (2000ppm) ↓

Storage at refrigerator

Figure-2. Process flowchart of preservative treatment on chicken using Green Tea Extract.

Chicken pieces were first rinsed in chilled water at 3 to 4^{0} C to remove adhered blood and drained, then cut into approximately 3 cm pieces and divided into three parts for different dip treatments. C⁰ – chicken dipped in chilled distilled water (control), C1 – chicken dipped in equal parts of glacial acetic acid and lactic acid (1%), C2 –chicken dipped in green tea extract at a concentration 2000 ppm (see **Figure-2**) [7].

2.5 Storage Study (Physiochemical and Microbial analysis) of Preserved Chicken

The above prepared chicken samples were stored at refrigeration to study the preservative effect. Physico-chemical parameters like pH, water holding capacity (WHC) and peroxide value (PV) of chicken sample were tested as per standard methods. Samples were drawn to analyze total bacterial count (TPC) once in two days.1g of chicken was mixed with 9ml of saline as describe by APHA 2001. Further dilutions were made and then 0.1ml of dilution was pipetted onto the surface of the plate count plates uniformly spread and then, the plates were incubated at 37^{0} C for 24h. All analyses were performed on days 0, 2 and 4.

3. RESULTS AND DISCUSSION

3.1 Raw Material Analysis

Table-1. Physico-chemical properties of Chicken and Green Tea Leaves.

Parameters	Green Tea Leaves	Chicken	
------------	------------------	---------	--

Calories (kcal)	364.81	114.64
Moisture (g)	3.89	72.21
Protein (g)	21.67	22.32
Carbohydrate (g)	67.98	1.21
Fat (g)	0.00	2.28
Total ash (g)	1.10	1.98

Obtained values of the above parameters of chicken are nearby to the standard values of respective parameters as per the USDA National Nutrient Database for standard reference and also the same with green tea leaves.

3.2 Storage Study

Table-2. Physico-chemical properties of chicken stored in the refrigerator (4
±1°C).

	Days								
Parameters	0			2			4		
	C 0	C1	C2	C0	C1	C2	C0	C1	C2
рН	5.31	5.10	5.25	5.47	5.11	5.23	6.10	5.07	5.20
Peroxide Value (meqO2/kg)	0.27	0.28	0.23	1.03	0.37	0.27	3.60	0.55	0.28
WHC	66.0 2	63.78	65.0 5	63.1 5	60.4 1	63.2 3	62.1 5	59.5 2	62.8 5

The preservative effect of treatments like glacial acetic acid & lactic acid (1%) and green tea extract on physico-chemical properties of chicken meat are presented in **Table-1** and **Table-2**. The control sample (C0) showed significantly higher pH values as compared to the other two samples i.e. C1andC2.The decrease in pH of C1 and C2 might be due to the presence of acidic components and polyphenols in green tea. These results are further supported by Sajid Hussain (2020) who observed a reduction in the pH of the chicken meat kabab by using shatavari roots powder and its aqueous extract. There was no significant increase in peroxide value of the sample treated with green tea extract. WHC all the samples were slightly decreased. This

effect on WHC is might be due to the increase in pH of chicken meat. From this context, the application of green tea extract in the form of dip treatment has an important effect in keeping the good quality of the chicken.

			Days						
Parameter	ter 0			2			4		
	C0	C1	C2	CO	C1	C2	CO	C1	C2
ТРС	1.4	1.3	1.4	2.6	1.4	1.4	2.2	1.9	1.5
(CFU/	2 x	3 x	0 x	3 x	8 x	2 x	0 x	6 x	3 x
g)	104	10 ⁴	10 ⁴	104	104	104	10 ⁵	10 ⁴	10
									4

Table- 3. Total Bacterial Count (TPC) of chicken stored in the refrigerator $(4\pm1^\circ\text{C})$.

Microbial analysis was conducted to analyze the overall microbial load which is tabulated in **Table-3**. The study shows that green tea extract acts as a powerful tool to reduce microbial activity. The total bacterial count is in an acceptable range. The means by which the microorganisms are inhibited by phenolic compounds act by inhibiting the amino acid decarboxylase in target bacteria.

4. CONCLUSION

The findings indicate that green tea extracts (with 95 percent ethanol extract) are a safe alternative to other acids as a natural preservative. Green tea extracts have even proven to be more effective at controlling microbial growth than conventional glacial acetic and lactic acids. The antibacterial component of GTE supports its practical application for extending the shelf life of raw chicken for up to four days at refrigeration temperature without adversely altering its physicochemical properties. GTE had a substantial bacteriostatic effect on chicken spoilage organisms. Extracts of green tea may be safe to use in food systems to increase shelf life because green tea is a common every day beverage consumed by people all over the world. As a result, it can be said that green tea, which is a rich source of plant polyphenol, can be employed as a novel all-natural preservative for chicken meat.

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Mechanical Ventilator

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ABSTRACT

People use lungs for breath. They use push structure in every breath. Inward breath and exhalation process happens. The ventilator here we course of action is to help individuals during Coronavirus circumstance. It's the base and reasonable. Unequivocally when individuals experience the pernicious effects of lungs or breathing issue this might be utilized for crisis circumstance. Engine configuration is utilized to push the objective. Precisely when oxygen level counts are low this plan are dependably performed. Little screen is utilized to show the oxygen levels. The entire advancement is driven by an Arduino microcontroller. Besides, a sign is fitted to see any low degrees of oxygen count.

KEYWORDS

Ventiltor, Coronavirus, Microcontroller, Oxygen Levels.

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1. INTRODUCTION

Respiratory disorders and injury-provoked respiratory frustration contain a basic public fanatical state in both made and less made countries. Asthma, tenacious obstructive pneumonic contamination and other continuous respiratory conditions are inevitable. These conditions are exacerbated by defilement, smoking, and consuming of biomass for fuel, which are on the extension in making countries 1,2 Patients with stowed away lung disorder could cultivate respiratory frustration under an extent of troubles and may be maintained mechanical ventilation. These are machines which exactly help patients energize and inhale out, allowing the exchanging of O_2 and CO_2 to occur inside the lungs, a cycle raised as emergency framework. While the ventilators utilized in current crisis facilities inside the US are especially basically and precisely refined, their acquiring costs are correspondingly high. Huge costs render such creatively present-day mechanical prohibitively expensive to be used in resource awful countries. Besides, these ventilators are ordinarily sensitive and vulnerable during continued with use, needing extravagant support contracts from the producer. In rural countries, this has provoked practices like sharing of ventilators among centers and buying of less trustworthy patched up units. Since clinical resources in these countries are

stuffed in significant metropolitan spots, occasionally common additionally, far off areas haven't any entry there of brain to mechanical ventilators. The requirement for a reasonable vehicle ventilator is subsequently head. Inside the made world, where especially provided clinical centers are by and large open, the matter is of a specific sort. While there are a sufficient number of ventilators for commonplace use, there's a deficiency of status for occasions of mass misfortune like influenza pandemics, devastating occasions and tremendous destructive compound conveyances. The expenses of accumulating and association of top tier mechanical ventilators for mass misfortune settings in made countries are prohibitive. Per the public preparation plan gave by President Greenery in November 2005, the US would wish as many as 742,500 ventilators in a truly most negative situation pandemic. Right when put near the 100,000 eventually being utilized, clearly the structure is lacking. One representation of this inadequacy occurred during Hurricane Katrina, when there have been inadequate with regards to amounts of ventilators, and staff needed to rely upon manual BVM ventilation. Measures to overhaul status have since been approved; by and large strikingly the middle for Irresistible avoidance and Contravention (CDC) actually purchased 4,500 conservative emergency ventilators for the fundamental public store. In any case, considering the low number of stacked ventilators and they're at present massive cost, there's a requirement for a sensible helpful ventilator that creation is scaled knowledgeable interest. [1]

1.1. Objectives

- *a*) This errand believed is especially useful in current situation and accepts fundamental part in facility. A ventilator instrument ought to have the choice to convey oxygen immediately.
- *b*) The objective of our endeavors will gather more noticeable thought and resources for make basic progress to come to a valuable and conveniently reproduced DIY ventilator system.

2. LITERATURE REVIEW

2.1 Development and Clinical Evaluation of a Home Healthcare System Measuring in Toilet, Bathtub and Bed without Attachment of Any Biological Sensors

Everyday observing of ailment at home is significant for a powerful plan for early conclusion, treatment, and avoidance of way of life related sicknesses like adiposis, diabetes and cardiovascular illnesses. While numerous monetarily accessible gadgets for home medical services observing are broadly utilized, those are awkward concerning self-connection of natural sensors and self-activity of them. From this perspective, we have been fostering a non-cognizant physiological checking framework without connection of any sensors to the human body as well as any tasks for the estimation. We fostered a few gadgets introduced in a latrine, a shower, and a bed and showed their high estimation accuracy by examination with concurrent accounts of common organic sensors straightforwardly joined to the body. To examine that relevance to the medical issue checking, we fostered an observing framework in mix with all the observing gadgets at emergency clinic rooms and recently did the estimations of patients' medical issue. Further, in this review, the medical issue was estimated in 10 patients with cardiovascular illness or rest problem. From these outcomes, the patients' ailments, for example, the body and discharge weight in the latrine, the ECG during cleaning up and the beat and breath rate during dozing were effectively checked in the medical clinic room, showing its value for observing the medical issue of the subjects with cardiovascular illness or rest problem.

3. RESEARCH METHODOLOGY

3.1 Assembling the Materials

Fundamental development is made arrangements for model explanation. Dc motor and dc battery brought from a vehicle spare shop. Ensuing to completing these works the edge would be arranged in welding work shop.

3.2 Production of Parts

The resulting parts are made for the Mechanical Ventilator.

3.2.1 DC Power Supply

It is used to Run the engine. Whenever power expected then that immediate it gives the limit toward motor.

3.2.2 DC Motor

It's used to run the siphoning air framework.

3.2.3 Steel Edge

It is utilized hold entire pieces of this machine. It is made by utilizing M.S rectangular lines and sheets.

3.3 Cycle for Creation

3.3.1 Metal Cutting

The M.S. points are cut for our ordinary point by utilizing metal shaper. The point outline is utilized to help and make an arrangement of our machine. Metal shaper

slices normally material to required perspective.

3.3.2 Penetrating

Invading is familiar with screwing the screw through the debilitating. To tight the linkages, the screw is screwing through the invading and assists with fixing the linkages.

3.3.3 Welding

In welding process, the electric indirect area is utilized to everlastingly liquefy the two metals and joint them. Anode is utilized to make electric round segment. The opening among terminal and metal is 3mm. Because of welding is covered, it influences the possibility of metal joint. It is utilized to cover accomplice the segments.

3.3.4 Assembling the Parts

The parts are all accumulated in a right way. Then, is will being are really took a gander at from now on and goes through to the material cycle properties of fragile steel.

4. EXPERIMENTAL DETAILS

Mechanical ventilator has 3 sensors. The first is a temperature sensor, the second is the Heartbeat sensor and the third one is Blood oxygen sensor. This task is extremely valuable since the master can screen patient success limits at little workplaces. The Arduino UNO board eagerly inspects input from these 3 recognizes. Then, it sends this information to the LCD Show. Then, this activity is shown and really checked out at by clinical manager or well-informed authority. This experience is a sensible and Do-It-Yourself ventilator to help in Corona virus pandemic. We here use a ventilator sack driven by Direct Current motors with a 2-side push part to push the air pack. Flip for trading and variable pot to check the breath length and BPM levels of the patient. Plus, a sign is fitted for emergency situation. [2]

4.1 Framework Assessment

4.1.1 Framework Diagram

The projected framework contains seeing the respiratory of the patient. The certification system incorporates a ventilator, bpm, switches and flips. This try was to develop an immaterial expense ventilator cheating a few potentials and fundamentally procured parts in an extremely speedy methodology. The stuff systems encased the making crucial of a point of view ventilator.

4.1.2 System Design

The block framework of a ventilator using Arduino with blood oxygen perceiving is shown in the above Fig. Speedy prototyping enhancements were used to make a clinical ventilator. The unnatural physical breathe to some degree is joined to the divider oxygen source using a stream meter as an air storage space. [3]

4.1.3 Programming Application

On running the Arduino research code, the motor executes occurrences of dextrorotatory or anticlockwise unsettling influences so you'll ensure that the part is running enormously.

4.2 Working Principle

4.2.1 Stage 1

The oxygen sensor is fixed to the patient's finger. This contains an IR sensor in it. Each siphoning we get beat from that sensor. This sensor yield is given to the Arduino through Signal adornment unit for increment.

4.2.2 Stage 2

DHT 11 is utilized as a temperature sensor. This temperature sensor yields shifts thinking about the temperature; this result is likewise given to Arduino.

4.2.3 Stage 3

Heartbeat Sensor offers sign to Arduino and further shows on LCD. [3]

4.2.4 Stage 4

This huge number of values are moved to Arduino and relatively works the motor. Definitively when oxygen level gets plunged under shown level, the motor related with Air pack gets ON and siphons the oxygen to patient. [3]

4.3 Block Diagram

See Figure-1, which shows the working model block diagram for mechanical ventilator.



Figure-1. Working Model Block Diagram.

5. CONCLUSION

The critical objective of the appraisal was actually achieved. Every one of the particular modules like Heartbeat confirmation module, pound disclosure module, and etc. and distant blueprint module gave out the coordinated results. The coordinated system modules might moreover at any point be smoothed out and made to a last single circuit. More huge truth that surfaced during project strategy is just all the circuit parts utilized in the far away thriving region framework are accessible without any problem.

With the movement in the coordinated circuit industry, Smaller than expected Electro Mechanical Structures (MEMs) and microcontrollers have become reasonable; have sped up, scaled back and power able. This has induced expanded progress of inserted frameworks that the clinical advantages experts are embracing. These implanted frameworks have in addition been embraced in the Wireless progression.

According to an arranging viewpoint, the undertaking has seen considerations gotten through the programming and presented center around period being in each pragmatic sense, applied. The Electric circuit appraisal information was utilized during plan and creation of the specific modules. Electromagnetic fields evaluation utilized in the far-off transmission among microcontrollers and programming utilized during programming of the microcontrollers to set up a last completed circuit structure.

6. FUTURE SCOPE

- We can add a GSM module for patient checking using Arduino Uno and WIFI module project.
- This GSM module will move data of the patient to trained professionals. Then, experts can sort out the put of the patient if they need to take some preventive action.

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Study on Solar Powered Electric Vehicle Charging Station

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ABSTRACT

Electric vehicles (EVs) are growing in popularity as a credible alternative to gaspowered vehicles. These vehicles require their batteries for operation. EVs will be genuinely sustainable only if we charge them using renewable energy. Conventional-based energy production causes a large amount of greenhouse gas emissions as road vehicles, so switching from fossil fuel vehicles to electric vehicles (EVs) would be a central pillar for sustainable development, as it provides a safer, more efficient, and eco-friendlier system. That's why the use of renewable energy is a better option for charging electric vehicles. As the number of charging stations installed, such as near shopping malls, office buildings, and highways, the increasing number of charging infrastructure also rises the number of on-road EVs and the exponential growth of the EVs causes a vast electrical energy demand to charge the EVs. The optimal design of an Electric Vehicle Charging Station (EVCS) will minimize the lifecycle cost while considering environmental emissions. The paper presents a review of the design of a solarpowered EV charging station in an Indian context. We design a solar-powered EV charging station in the parking.

KEYWORDS

Electric Vehicle charging station, Energy Storage Unit, Solar energy, Solar power plant.

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1. INTRODUCTION

The EV market has been growing at a fast pace, thus leading to a pressing need for charging stations, especially because of the limited energy capacity of EV batteries. In today's world, due to the lack of availability of charging stations, EVs are plugged in to get charged at the same time, when EV owners arrive home from work, they will draw a huge amount of electricity from the local distribution power system, which can cause various technical issues, such as voltage regulation, harmonic contamination, and frequency variations. Also, this household charging costs more. This electricity mostly comes from conventional energy resources. The global energy demand has been increasing rapidly, which imposes a large burden on existing energy resources and adversely impacts the environment, and increases global warming [1]. India is a sun-drenched country, which makes it ideal to use solar energy for electricity production. Solar energy is not only efficient but also eco-friendly and easy to use. Solar energy has proven to be an excellent solution for localized electricity generation, even for large-scale applications. There is a move towards designing solar-powered EV charging stations that provide clean electricity. Solar energy is easily generated on a large and small scale. The solar-powered charging station is an efficient and reliable charging option for EV charging. The use of solar charging is also possible in a commercial way, like in parking, and also can be used as large charging stations on highways. Though solar-powered EV charging station is easy to install, we are facing the need for power stations on a big scale. There is still not a sufficient number of charging stations available in India and that causes limitations on using electric vehicles. There should be power stations at enough distances so that EV owner can charge their vehicle whenever they need [1, 2].

2. OBJECTIVES

- a) To study solar power plant components.
- b) To use renewable energy sources for completely green electric vehicle charging.
- c) To use solar energy for commercial use.
- d) To reduce carbon footprints by using renewable electricity.
- e) To promote the use of electric vehicles by reducing problems related to charging.
- f) To reduce the cost of charging an electric vehicle.

3. LITERATURE REVIEW

Department of Electrical and Computer Engineering, Texas A&M University, has presented an optimal way to configure charging stations for electric vehicles (EVs) to integrate the generation and local battery storage. The proposed method aims at generating the optimum combination of EV chargers, solar panels, and local batteries while considering: EV mobility and uncertainties in stochastic charging demand from EVs [2].

Yuen C, Senior Member, IEEE, Huang S., Member, IEEE, Smith B. D, Member, IEEE, and Vincent Poor H, Fellow, IEEE presented a paper that proposes a novel electric vehicle (EV) classification scheme for a solar powered EV charging station (CS) that reduces the effect of intermittency of electricity supply and the cost of energy trading of the CS. Since not all EV drivers would like to be environmentally friendly, they divided all vehicles into three categories: 1) premium; 2) conservative; and 3) green, according to their charging behavior [3]. Premium and conservative EVs are considered interested only in charging their batteries, with noticeably higher rates of charging for premium EVs. To reduce its cost of energy trading by allowing the CS to use their batteries as distributed storage. A different charging scheme is proposed for each type of EV, which is adopted by the CS to encourage more EVs to be green [4, 5].

3.1 Research Methodology

We are seeing an increasing number of electric vehicles running on the road. But there are not enough facilities of charging stations in India. Also, we are using more conventional energy resources. Hence, we found the idea of Solar powered electric vehicle charging station. Though it is easy to use still there is no such work going on with this concept. We started as

- 1) Market survey of the use of electric vehicles in India and also the use of solar energy in India.
- 2) Estimation of the requirement of EV charging.
- 3) Design of system.
- 4) Modifications and estimation of component specifications are per output requirement.
- 5) Design the final structure of the system.
- 6) Implementation of charging station
- 7) Recording the results.
- 8) Final check of requirements and readings and required changes.
- 9) Modifications in aesthetics and to make user friendly structure.

In India, there are already over 10 lakh electric vehicles. The data from Vahan 4, as of March 2021, showed that there are 10,76,420 electric vehicles and only 1742 charging stations. Due to the rise in the number of electric vehicles, charging station installation has started in the world and India as well. At present, there is a charging station available, which is a normal charging station working on regular electricity supply for electricity boards. The invention in this project is to power the charging station using solar energy. Solar energy is completely free and unlimited as it is a renewable source of energy [6, 7].

4. EXPERIMENTAL DETAILS

- 1. Solar powered EV charging station is very simple in design. It is similar to solar power plants for household applications.
- 2. We have calculated the sizes and specifications of components as per the load output. There is a load output of 1200W. There are main components Solar panel, Battery, solar inverter, and load, i.e. electric vehicle.
- 3. A solar panel of 2kW capacity is used. It develops nearly 9kWh/day. Solar panels are flexible components as we can use more than one panel as per convenience, which will generate more power. It is better to generate more power, but then we need a bigger storage capacity.
- 4. Battery is the next component is the system. Battery should be mostly lead acid batteries, generally used in household electricity backups. Battery

capacity depends upon solar power generation. We are using a 150Ah battery (2 nos.).

- 5. Solar panel generates direct current and also battery stores direct current. But we need AC output. Therefore, we are using an inverter. Here, a solar inverter will be more efficient than a simple inverter. A solar inverter helps directly to stabilize the solar output.
- 6. The power supply is now converted to AC by an inverter and then supplied to the load. The load here is a battery of an electric vehicle that is to be charged.
- 7. The power system works as the solar panel generates DC electricity from sun rays. Then, the power generated is stored in the battery.
- 8. The battery supplies DC to the solar inverter which converts the DC supply to AC supply. It also stabilizes the varying output of solar power plant.
- 9. Then power is given to the load i.e., battery to be charged from the inverter and it starts charging when it is plugged into a switch [6,7].

Figure-1 shows the circuit flow of charging station.



Figure-1. Circuit flow of charging station.

4.1 Design Calculations

We need a load output of 240 volts and a 5-amp single phase. Therefore,

Load Output = 240 * 5 = **1200W**

Therefore, Load in kWh will be,

$$1200 * 5 = 6000 \text{Wh} = 6 \text{ kWh}$$

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Inverter losses, 6 * 0.2 = 1.2

Energy required to inverter = 6 + 1.2 = 7.2kWh

Battery losses, 7.2 * 0.15 = 1.08

Energy required to battery = 7.2 + 1.08 = 8.28 kWh

Take energy requirement is 9kWh.

Now, Losses with the solar panel will be,

9 * 0.25 = 2.25 kWh

Therefore total energy requirement is

$$9 + 2.25 = 11.25$$
 kWh.

Now, in India, we take sun time as 5.5 hours per day.

Therefore, the power of solar panels required is,

$$11.25 \ kWh/5.5 \ h = 2.04 \ kW$$

5. CONCLUSION

- 1. Installing the Solar system based on the variation of electricity prices is contrary to the conventional approach of maximizing energy and it has untapped potential for future applications.
- 2. EVs are noise free, clean, and efficient means of the transportation system as compared to IC engine vehicles. By increasing the number of solar powered charging stations, the use of EVs will also increase significantly.
- 3. Provides a direct utilization of Solar Power during the day and the battery provides stored power during the night.
- 4. The energy management system successfully controls the power balance home load.

6. FUTURE SCOPE

- 1. The energy storage units (ESU) are usually deployed to mitigate the impacts of the high penetration of HPV systems.
- 2. Adding an ESU to the HPV systems will incur extra costs and the HPV owners are not always willing to invest in the ESU unless it is subsidized by the government or by the utility companies.
- 3. In commercial use of solar powered charging stations, the use of solar collectors will increase the efficiency of solar power generation.

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Development of Millet Bar

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ABSTRACT

Millet is gluten-free, making it an ideal choice for those suffering from celiac disease and who are sensitive to gluten, which is present in wheat and other common cereal grains. It is also beneficial for patients who have atherosclerosis. The aim of this work was to develop nutritious bar using different ingredients like pearl millet, finger millet, amaranth, flaxseed, and natural sweetener like jaggery. Millet bar was prepared by using different proportions of grains such as pearl millet, finger millet, amaranth seed, and flaxseed, among which T4 sample i.e., combination of pearl millet, finger millet, amaranth seed, flaxseed having proportion of 10:10:35:5 respectively was selected as the best sample on the basis of sensory evaluation.

KEYWORDS

Atherosclerosis, Celiac Disease, Evaluation, Gluten-free, Sensory.

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1. INTRODUCTION

Millet is a cereal grain that belongs to the Graminae family of grasses. The term "millet" is informally applied to a variety of five genera of the phylum Paniceae, especially the annual grass of small seeds belonging to Panicum, Setaria, Echinochloa, Pennisetum, Paspalum, and one genus of the phylum Chlorideae, Eleusine. The majority of the genera are found in the tropics and subtropics of the globe. Pennisetum, for example, is a genus with roughly 140 species, some of which are domesticated and others that grow wild. Millets are small-grained cereals, with kodo, foxtail, proso tiny, and barnyard millets being the smallest. They are the primary diet of millions of people living in the world's dry and semi-arid tropics, and are found in most Asian and African countries, as well as areas of Europe. Pearl millet finger millet, proso millet, and foxtail millet are the most important millets. The pearl millet often known as bulrush, is the most important cultivated millet species. Proso millet, also known as common millet; foxtail millet; Japanese barnyard millet, finger millet also known as African millet; and kodo millet and Fonio millet are among the other millets. Finger millet is the major millet that is widespread in India and Africa and is the staple food of a significant part of the population. In the population of these countries. It comes in sixth place in terms of production. In India,

wheat, rice, maize, sorghum, and bajra are the incompetent most common crops. It's a unique situation. Caryopsis is a naked caryopsis with a brick red seed coat. For the most part it is used in the form of a whole meal. Traditional dishes such as roti are served. Regular consumption of whole grains and their products has been shown in epidemiological studies to reduce the incidence of cardiovascular disease, type 2 diabetes, gastrointestinal malignancies, and a variety of other ailments [1].

Proteins, minerals, and vitamins can all be found in jaggery. It's also a good source of iron, with higher levels of iron and copper than refined sugar. In terms of vitamin content, it is also a superior product in the field of natural sweeteners. It is a high-energy diet that purifies the blood, regulates liver function, and keeps the body in good shape. It is an important part of the diet since it is a type of sugar that may be ingested directly or used as a sweetening factor in sweet dishes [2].

Linseed (Linum Usitatissimmum), also known in Indian languages as Alsi, Jawas, and Aksebija (Anonymous, 2000). Flax (Linum usitassimum), a blue blooming annual herb in the Lineaceae family, produces little flat seeds that range in colour from golden yellow to reddish brown. Flaxseed has a crisp texture and a nutty flavour. Flaxseed, a good source of alpha-linolenic acid, lignans, high quality protein, soluble fibre, and phenolic compounds, has emerged as a possible functional food among functional foods [3].

In reality, there is a growing trend in eating healthy/super foods, such as amaranth, a millennium super crop with significant nutraceutical properties. Amaranth is a gluten-free pseudo cereal that, in addition to being a substantial source of vegetable protein, provides a balanced content of essential amino acids, significant levels of calcium, dietary fibre, omega-3, omega-6, vitamins, minerals, and antioxidants to the human diet. Amaranth's health benefits include helping to improve nutrition and health as a powerful vegetable protein source adequate to fight high cholesterol, avoiding chronic inflammation, oxidative stress, osteoporosis, gastric problems, poor nutrition due to gluten intolerance, and diabetes, among other relevant diseases [4].

2. MATERIALS AND METHODS

2.1 Raw Material

The materials used for the preparation of nutritious millet bar were pear millet, finger millet, amaranth seeds, flaxseed and jaggery. All the ingredients were purchased from local market of Kolhapur and all the preliminary treatments like washing, soaking, drying, and grinding were done in college lab. i.e. Shivaji University, Kolhapur.

2.2 Method for Preparation

Pear millet and finger millet were soaked then dried and coarsely grinded. As per different formulations such as 20:05, 15:10, 10:10, 10:15 and 10:20 respectively.

On the basis of sensory evaluation sample containing pearl millet and finger millet mixture (10:10) was selected. Amaranth seeds, Flaxseed (35:5) respectively added and finally jaggery added to the prepared bar as per specifications. Then prepared bar was cooled and stored at room temperature (see **Figure-1**).



Figure-1. Flow diagram for the preparation of millet bar [5].

3. RESULTS AND DISCUSSION

3.1. Physico-Chemical Composition

Protein was analyzed by Kjeldal method [6]. using 6.25 conversion factor. Total carbohydrates were determined by using anthrone method [7]. Mineral contents were analyzed by atomic adsorption spectroscopy method.

3.2 Physico-Chemical Analysis of Raw Material

Proximate composition of Ragi, pearl millet, jaggery, amarnathus seed and flaxseed such as moisture content, ash, protein, and fat shown in **Table-1**.

Parameter	Amarnathus	Ragi	Pearl millet	Flaxseed	Jaggery
Moisture (%)	7.80	12.4	11.21	6.5	9
Ash (%)	2.6	1.90	2.05	4.3	2-4
Protein (%)	16.78	2	2.07	20.8	0.4
Crude Fiber (%)	5.6	4.2	3.7	30.6	00
Fat (%)	5.76	10.2	12	40.4	0.1
Carbohydrates	62.82	70	68.85	34	70
(%)					

Table-1. Physico-Chemical Analysis of Raw Material.

3.3 Physico-chemical Analysis of Millet Bar

In research work it was found that protein content was in the range of 10.92g/100g and it is also rich source of minerals like calcium (56.60 mg/100g) andiron (3.47 mg/100g) (see **Table-2**).

Table-2. Physico-Chemical Analysis of Millet.

Component	Millet bar
Moisture (g/100 g)	1.50 ± 0.04
Ash (g/100 g)	1.48 ± 0.01
Protein (g/100 g)	10.92 ± 0.04
Carbohydrate (g/100 g)	81.55 ± 0.10
fat (g/100 g)	4.48 ± 0.11
Crude fibre (g/100 g)	0.08
Calcium (mg/100 g)	56.60 ± 0.71
Iron (mg/100 g)	3.47 ± 0.01
Energy value (Kcal/100 g)	410.3±0.02

4. SENSORY ANALYSIS

Sensory evaluation was carried out by semi trained judges using 9-point hedonic scale. Evaluation was done in terms of properties such as Appearance, Taste, Texture and Colour. Overall acceptability score was calculated as average of whole sensory attributes. Five test sample were prepared for the sensory analysis and analyzed by 9-point hedonic scale. Results obtained are shown in the **Table-3**.

Sample	Appearance	Taste	Texure	Colour	Overall
					Acceptability
T1	5.5	5.5	5	6	5.5
T2	6	7	7	6.5	7
T3	7.5	6.5	7.5	7	7
T4	7.5	8	8	7.5	7.75
T5	6	6.5	6.5	5	6.25

Table-3. Sensory Attributes of Millet Bar.

It is clear from **Table-3** that sample T-4 was most acceptable than other samples as per analyzed by panel members in terms of appearance, taste, texture, colour and overall acceptability.

5. CONCLUSION

With the nutritional demands of modern living, snacks have become necessary and convenient items. Aside from their sensory qualities, which are favorably received by customers, their low cost, ease of transport, and ready-to-eat qualities have made them increasingly popular. The inclusion of pearl millet, finger millet, amaranth seeds, flax seeds jaggery in millet bar formulations could provide intriguing Formulation and features, allowing for changes in nutritional Formulation. The current research focused on the standardization of raw materials and the development of millet bars. It was found from the sensory evaluation that sample T- 4 was the best among the 5 samples. T-4 contains proportion of pearl millet, finger millet, amaranth seeds, flaxseed of 10:10:35:5:5 respectively. Proximate analysis showed that sample T-4 contains (10.92g/100 g) protein, (56.60 mg/100g) calcium and (3.47 mg/100g) iron. Thus, the prepared Millet Bar can be beneficial for the people and can be commercialized to fulfill the demand of nutritional bar.

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AiR Cursor: Virtual Mouse using Computer Vision

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ABSTRACT

Communicating with smart devices today is as easy as manipulating a display, such as a touch input or using a cursor (in the case of a computer). These two types of interactions are the most effective and efficient at the same time. However, there are always some restrictions. This proposed system introduces a new way to interact with these smart devices using hand tracking and computer vision. The air motion control technology can be utilized to solve actual problems such as not having enough space to use a physical mouse. It can also be used by people who have hand problems and cannot control the physical mouse. It also allows users to control the device conveniently. As a result, by eliminating human participation and reliance on devices to control the computer, the proposed method inhibits the propagation of COVID 19.

KEYWORDS

Virtual mouse, Fingertip detection, Fingertrip tracking, Gesture recognition, Computer vision.

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1. INTRODUCTION

Work is mostly computer programs in everyday interaction with digital screens and coping with everyday life. Our daily data transactions are performed and accessed using our fingertips, but in today's pandemic era, those fingertips are becoming deadly viral carriers. Interactions are becoming an important part of cutting-edge human technology. Traditional methods of interaction via keyboard, mouse, and joystick do not meet the needs of this fast-growing technology, so this article considered and described gesture recognition. Development of natural communication between humans and computers.

Existing virtual markers have been modified to act as multi-markers and mouse pointers to take full advantage of the mouse. The proposed system removes the use of outside hardware required by previous systems to accept input for processing events. Air Motion Control allows you to access your data without peripherals or gear. Air Motion Control tracks your hand and allows you to manipulate fully functional cursor functions. It's a virtual mouse, which works just like a real mouse, but with great features. It comes with a gesture control feature that comes with many configuration options.

1.1 Problem Description and Overview

To create an AiR Cursor that recognizes hand motion patterns instead of using a conventional mouse. The webcam is set up to sense the presence of fingers and perform mouse motions when they are detected. The use of a virtual mouse arises in space-saving or mobility scenarios, in real-world settings where reachability is a problem, and in many other situations, therefore the proposed AiR Cursor can be utilized to solve these problems.

1.2 Objective

The main purpose of the proposed AiR Cursor is to offer a substitute to the conventional mouse framework for executing and directing mouse operations, which can be done using a web camera that gathers hand movements and pointers. Our virtual mouse is capable to move the cursor and perform all the activities performed by a physics mouse such as scroll, clicking, and selecting applications. This mouse can help us to navigate the mouse without having physical touch.

This helps to avoid the risk of spreading any disease like COVID-19 by touch. Our system is easy to use and can be easily installed on any laptop. Our system is a small step towards an advanced future.

2. LITERATURE REVIEW

The literature review is carried out to study hand motion recognition using a virtual mouse. By sensing a fingertip and executing mouse tasks such as clicking, scrolling, and cursor motion, the suggested system handles the mouse pointer [1].

It presents an efficient color-based algorithm for tracking real-time fingertip movements, and then a series of messages produced agreeing to the fingertip tracing results (including basic fingertip messages and virtual mouse messages) [2].

In this proposed system, a method for implementing a virtual mouse that is based on fingertip tracking and simulates mouse function using hand gestures [3].

There are several virtual markers on the market that can only be used as markers, but they can also do other tasks such as mouse actions [4]. The authors proposed mouse cursor control system using computer vision [5].

Here the author implements a handful of computer vision and AI possibilities and further summarizes the challenges and future prospects in the spectrum of human user collaboration and virtual reality [6].

By eliminating human participation and reliance on gadgets to control the machine, this proposed approach will prevent COVID-19 proliferation [7].

The author utilized a skin recognition and hand position shape analysis technique post face exclusion to recognize and track bare hands in complex backgrounds, distinguishing hand gestures [8].

To recognize and discriminate between human right and left hands, the author created a concurrent network based on hand detection and body motion tracking. Hand motions are used for human-robot interaction (HRI) [9].

By incorporating depth-image acquisition devices, an engaging exhibition system based on gesture detection is built in this paper [10].

With the area ratio of contour and shape produced, this proposed system extracts the features of the hand. This approach has been thoroughly tested in real-world circumstances [11].

The author envisions a future in which auditory virtual reality is used to learn more about the brain roots of audition in locomotor creatures, as well as the various sensory signals that establish spatial representations in a new virtual world [12].

The author showed how computer vision may be simply incorporated into distant instructional user interfaces in this article [13].

Based on the multimedia search system [14], this system combines a 3D model search approach with a Virtual Reality (VR) user interface.

With modern technology, human-computer interaction becomes more and more important. A variety of mice of all outlines and dimensions are devised. However, this hardware is not as environmentally friendly as it looks, so it has its limitations. For example, a physical mouse needs a flat surface and certain areas are required to take full advantage of the features provided. Also, this hardware is entirely impractical when it comes to interacting through the computer with cable limitations, rendering it inaccessible.

3. PROPOSED SYSTEM

The proposed scheme is illustrated here. As indicated in **Figure-1**, the suggested design comprises of four major parts.

3.1 Hand Detection and Segmentation

In this palm detection is done using a single-shot detector model, the fingers are detected and precise key point localization of knuckles is coordinated on the hand. The system uses the webcam to track the object until the termination of the program.

To detect the hands in the movie frame by frame, as seen in the accompanying code, the video frames are transformed from BGR to RGB color space.

3.2 Fingertip Detection and Tracking

After the hand detection this model locks onto a coordinate point on the hand and tracks the movement of that point. The transformational algorithm is used to convert the coordinates from the camera screen of the webcam to the computer window

3.3 Coordinate Conversion

As the feed captured by the camera is a mirrored version of the real one the coordinate points must be converted for realistic behavior. When the hands are detected and fingers are mapped a rectangular box is drawn to track the region of movement.

3.4 Cursor Motion

In this work, this system focuses on the person's right-hand movement for ease and performance correctness. After recognizing the fingertip of the respective finger which is up, mouse functions are completed using the AutoPy package of python.





4. RESULTS AND DISCUSSIONS

4.1 MediaPipe

For hand gesture recognition and hand tracking, MediaPipe is a structure used to relate to machine learning pipelines and it is Google's open-source structure. The MediaPipe structure is constructed using time sequence information, which is useful for cross-platform growth.

4.2 Single-shot Detector Model

Detecting and recognizing hands and palms in real-time. The palm recognition engine first trains the palm recognition model since the palm is simple to train. Furthermore, small items like knuckles or fists benefit greatly from sub-maximum suppression. **Figure-2** shows a hand landmark prototype of 21 joint or knuckle coordinates in the palm region.



Figure-2. System Architecture.

Table-1 shows the nomenclature of tip ids for each finger, which is in reference to the plotting of landmarks.

Sr. no	Name	Sr. no	Name
0	WRIST	10	MIDDLE_FINGER_TIP
1	THUMB_CMC	11	MIDDLE_FINGER_TIP
2	THUMB_MCP	12	MIDDLE_FINGER_TIP
3	THUMB_IP	13	RING_FINGER_MCP
4	THUMBT_IP	14	RING_FINGER_TIP
5	INDEX_FINGER_MCP	15	RING_FINGER_TIP
6	INDEX_FINGER_PIP	17	PINKY_MCP

Table-1. Nomenclature of tip ids.

7	INDEX_FINGER_TIP	18	PINKY_TIP
8	INDEX_FINGER_TIP	19	PINKY_TIP
9	MIDDLE_FINGER_MCP	20	PINKY_TIP

4.3 OpenCV

OpenCV is a computer vision toolkit that comprises image processing techniques for object detection in computer vision. The computer vision library OpenCV can be used to create a library and a real-time application. Computer vision involves the computer understanding and analyzing digital images, processing the images, and providing relevant data after image analysis.

Hand Tip Gestures	Mouse Function Performed	Success (In %)	Failure (In %)	Accuracy (In %)	
All five fingers are up	No action performed	98	2	98	
Index finger	Mouse Movement	100	0	100	
Index finger + thumb	Left click	100	0	100	

Table-2. Success rate.

Proposed system is tested by means of repetitive checking of gesture functions to take a look at the accuracy and on the groundwork of average result. Hand motions and fingertip identification have been tested in a variety of lighting conditions, as well as at various distances from the webcam for monitoring and detection.

The proposed AiR cursor system is given the concept of using computer vision to drive human-computer interaction. It's tough to distinguish testing on AiR cursor systems because to the small number of datasets available. Hand motions and fingertip recognition are tracked in various lighting conditions and at various distances from the webcam. To describe the data in **Table-2**, experimental experiments are conducted. The test is repeated 25 times by four persons, yielding 600 scribbled motions. This experiment is done out in different lighting situations and at different depths from the display. Each participant then tested the AI virtual

mouse system ten times in bright daylight, five times in poor lighting, five times at a near range from the webcam, and five times at quite a distance from the webcam. **Table-2** contains the results.



4.4 Functions and conditions used in the proposed system

Figure-3. Access windows.

The anticipated approach relies on pictures captured by a webcam on a laptop or PC. Using OpenCV, an object for video capturing is produced and the webcam starts capturing the video as shown in **Figure-3**. The number in the upper left corner shows the frame rate of the input device (camera). The webcam captures the frame and transfers it to the AiR Cursor system.



Figure-4. Cursor movement.

At this stage, the tip ID of each finger is detected using MediaPipe and the corresponding coordinates of the upper finger are used to detect which finger is up, as shown in **Figure-4**. And it performs the functions of each mouse accordingly.



Figure-5. Detecting distance between two raised fingers.

The distance between the two fingers is computed, as illustrated in Figure-5.



Figure-6. Click action.

The approach is set up to utilize the Python module to click the leftward mouse button if both fingers are up and the spacing between them is smaller than thirty pixels, as illustrated in **Figure-6**.



Figure-7. Gesture to accomplish no action.

When no fingers are up or no fingertip is detected then the system is made to not perform any mouse function, as shown in **Figure-7**.

5. CONCLUSION

A real-time webcam is used to manage the mouse pointer in the proposed system. Gesture recognition allows humans and technology to engage actively. Gesture recognition is also critical for the growth of new human-computer interaction modes. It allows humans to interact more naturally with technology. Many implementations for gesture recognition include deaf and dumb person's sign language understanding, robot control, and so on. Virtual reality, computer animation, computer gaming, and medical equipment all benefit from this technology. The proposed architecture reduces hardware costs by eradicating the use of the mouse. It's ideal for people who don't like using a touchpad. The approach can be used to handle a variety of games and other applications that rely on user-defined gestures for regulation. This mouse system can do all mouse functions. Hand gestures are easier to represent, make the presentation attractive, and quickly express a message. In the future, functionality for face detection can be added and merged with a gesture-based system for better parental control and recognition. This can be used for eye tracking (mostly for

gaming) and increasing and lessening windows, closing windows, etc. by using the palm and fingertips. The proposed approach could be extended to handle keyboard functions.

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