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Studies on Value Addition of Nutritional Food Product by Incorporation of Mango (*Mangifera indica*) Leaves

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ABSTRACT

Nowadays more focus has been given on Food product having high Nutritional values and additional health benefits. Value addition of Mango leaves by formulating Cookies are important source of nutrition. In general Cookies made up of the Sugar and Hydrogenated vegetable oil, but in the present research Sugar is totally replaced by Stevia Powder and Hydrogenated vegetable oil is replaced by Margarine. Proximate analysis of Chemical composition, Physical properties and Sensory characteristics of Cookies was investigated. Research also revealed that the Carbohydrates, Crude Protein, Crude fiber, Ash content of prepared Cookies improve with the incorporation of Mango leaves.

Keywords: *Stevia powder, Margarin, Nutritional value, Cookies, Sensory.*

INTRODUCTION

Increased stress and fast lifestyle reduce the quality of human life. Competitive life-style of young generation produce stress and stress induced disorder that produce a several diseases. Eat nutritious and healthy food for healthy living may be a one of the essential needs for long healthy life. During this fast-moving modern world, pace of life may be an increasing day by day therefore fast meal may be a turning into regular food. Foods are extremely processed and have a great number of calories however have less nutritive value. High calories with low essential nutrients will cause varied deficiency. Life-style changes has implemented in North American country such a lot that one has therefore no time to supposed to think what they are consuming is correct or not. Fast and quality food is that the demand within the contemporary lifestyle. Processed food has excessive shelf life and simple to hold in travelling, workplace and house (Bhattacharya et al., 1995). Working families have the alternate option of readymade food to fulfill their nutritional requirements.

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Generally, backhouse food is high in starch calories. Herbs primarily based cookies has alternate choice to replace conventional cookies. Cookies has excessive shelf-life backhouse product. The economic importance of the cookies is higher in altogether areas. Standard processed foods are replaced by conventional processed food. The obtain ability of street low value food associate in nursing tailored by producers of such a food has triggered an evolution whereby, consumption of foods that need neither the structure nor the preparation of a proper meal terribly races and therefore the newest entrants on stage square measure children. Weight connected sickness is associate in nursing rising major public ill health throughout the globe amongst adolescents. Junk food is a particularly high in an exceedingly fat content, and studies have found associations between sustenance intake and redoubled body mass index and weight gain. Diabetes is that the high levels of sugar in food that puts metabolism below stress; once sugar is taken, the pancreas secretes high amounts of insulin to avoid a hazardous spike in blood sugar levels. The Dental cavities and Type 2 diabetes are caused by the solid sugar content present in foods. Cardiovascular disease have been high fat content and sugar content level in food are unhealthy and causes heart disorder in children. High blood pressure is that the high level of sodium content in fast food is the main reason of increase in the blood pressure (Srilakshmi et al., 2008). It has been found to be more convenient to prepare a snack which can meet the nutritional needs of the family. Kids and adolescents who appear to be continually hungry will satisfy their appetence by intake nutritious snacks, Cereal grain plays significant role in provision the nutrients likewise as over 70% of the daily energy needs, of over one third of the world's population.

MATERIALS AND METHODS

The authentication of the plant material was confirmed at Botanical Survey of India at the Western Regional center 7 Koregaon road Pune Tel-Pune (corporation area) dist.-Pune, Pin code 411001. The variety of plant is *Mangifera indica* belonging to the family Anacardiaceae. The authentication number of plant material is BSI/WRC/IDEN.CER. /2016/497/SSW01.

Preparation of Medicinal Powder Cookies:

The cookies were prepared using the following ingredients as per the traditional creaming process.

Table no. 1. Preparation of cookies

Ingredient	Quantity	Uses
Mango leaves powder	Various levels	Medicinal powder
Refined wheat flour	Various levels	Base
Margarine	400 g	To improve taste and texture
Stevia Powder	30 g	Sweetener
Baking Powder	5 g	Leavening agent
Calcium Propionate	5 g	Preservative
Cardamon Powder	5 g	Flavouring agent
Water	q.s. to 20 ml	Solvent

Margarine and Stevia Powder mixed Mixing Refined wheat flour + Mango leaves powder + Baking Powder + Calcium Propionate+ Cardamon Powder Mix both of the blends The dough framed into small balls (approx. 10-15g each) Kept in baking trays Baking at 180ºC temperature for 12 min Cool pack & Store.

Treatment Details:

Incorporation of Mango leaves powder in cookies

Table No.2: Incorporation of Mango leaves powder in cookies

Treatment	Refined wheat flour (%)	Mango leaves powder (%)
T_0	100	00
T_1	96	04
T_2	94	06

Analysis of Cookies:

Sensory evaluation of medicinal cookies

The sensory evaluation of cookies was conducted using the method of the (Amerine et al., 1965) on 9-point hedonic score card as and the preform provided in Appendix I. Overall, the quality feature of each treatment of the cookies were judged including a colour and appearance, texture and grain, flavour, crispiness, taste and overall acceptability. The mean values of the average score given by all the 10 semi-trained judges for various quality parameters were recorded and as results (Amerine et al., 1965).

RESULT AND DISCUSSION

Physio Chemical Properties of raw material:

The knowledge of physical properties of mango leaves and its powder helps in the development of processing technology. The color of dried leaves is considered as first quality parameter even before it is tasted and evaluated by the end users is critical in the product acceptance.

Moisture Content:

As stated in Table 9. The moisture content of Mango leaves powder was found to be 4 %, which is lower than the moisture content of refined wheat flour which was determined to be 4.23 %. (Rao et al., 2017) looked into the 13.1 % moisture content in refined wheat flour (Srilakshmi, 2007).

Protein

Table 9. Shows the results on the physico-chemical composition of raw materials used in the production of cookies. The protein content of the raw materials differed greatly. The highest protein content was found in Mango Leaves powder 18.23 % while the lowest protein content was found in refined wheat flour 10.87 %. (Rao et al., 2017) looked into the 11.20 % protein content in a refined wheat flour (Srilakshmi, 2007).

Fat

The maximum fat content was found in Mango Leaves Powder 3.42 % while minimum fat content was found in refined wheat flour 0.76 %. (Rao et al., 2017) looked into the fat content of refined wheat flour, which was 0.22 % (Srilakshmi, 2007).

Crude fiber:

The crude fiber content differed substantially among the raw materials, according to the data shown in Table 9. The maximum crude fiber level was found in Mango Leaves powder 19.98 % while lowest crude fiber level was found in refined wheat flour 0.69 %. (Rao et al., 2017) looked into the fat content of refined wheat flour, which was found to be 0.30 % (Srilakshmi, 2007).

Table No. 3: Chemical constituents of Refined Wheat flour and Mango leaves powder

Chemical constituents	Refined Wheat flour	Mango Leaves powder
Moisture (%)	4.23	4
Ash	10	8
Crude protein (%)	10.87	18.23
Crude fat (%)	0.76	3.42
Crude fiber (%)	0.69	19.98
Total carbohydrate (%)	74.14	66.35
Calcium (mg/100g)	20.13	21.41
Iron (mg/100g)	2.49	3.18

All results are mean of three replications.

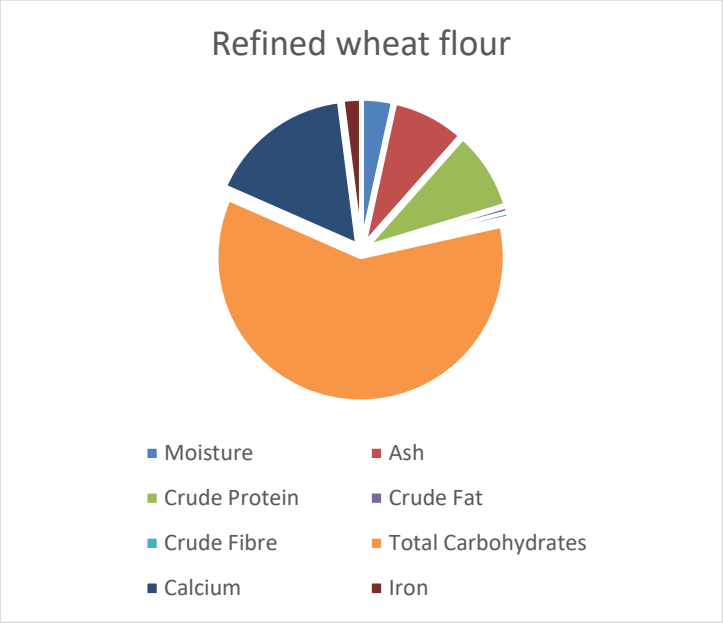

Fig.1 Chemical Composition of Refined wheat flour

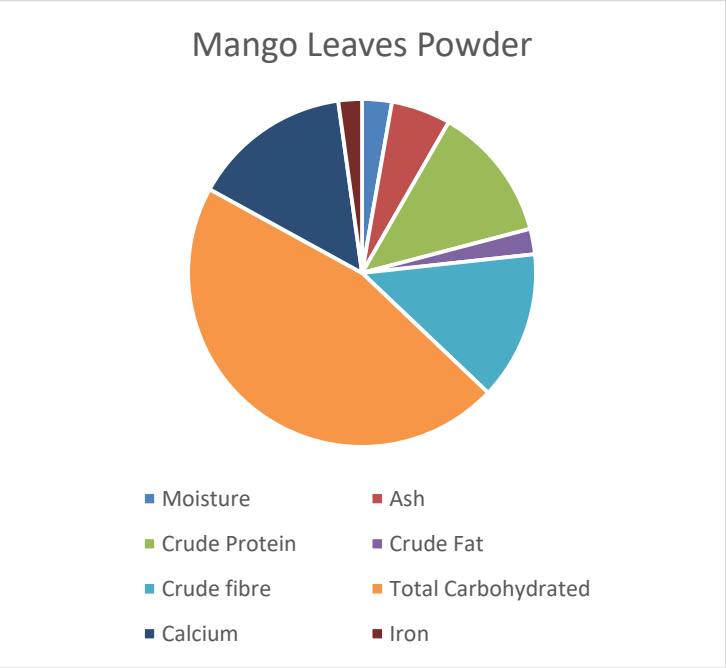

Fig. 2Chemical Composition of Mango leaves powder

Carbohydrates:

The highest carbohydrate content was found in refined wheat flour 74.14 % while lowest carbohydrates content was found in Mango Leaves powder 66.35 %.

Calcium:

The highest calcium content was found in Mango Leaves powder 21.41 % while, lowest calcium content was found in refined wheat flour 20.13

Iron:

The highest iron content was found in Mango Leaves powder 3.18 mg/100g while lowest iron content was found in refined wheat flour 2.49 mg/100g.

Sensory Quality of the Cookies Prepared by Incorporating with Various Levels of Mango Leaves Powder

Due to their decreased moisture content, cookies have been classified as a product with

long shelf life. The product is common among all demographics and could be used to deliver novel medicinal ingredients. The higher fat content of cookies distinguishes them from biscuits (Fustier et al., 2007). The first element of cookies quality is organoleptic (sensory evaluation) qualities, and second components is nutritional quality characteristics (Fustier et al., 2008)

Sensory Evaluation of Cookies Prepared by Incorporating Mango Leaves Powder with Refined wheat flour

Table 4 shows the findings of the sensory assessment of Mango Leaves powder cookies in terms of colour and appearance, texture, flavour, taste and overall acceptability. The results showed that the colour and appearance of cookies received a score of 8.00-6.00, while texture received a score of 9.00-6.00, flavour received a score of 8.00-4.00, taste received a score of 9.00-5.00 and overall acceptability received a score of 8.00-6.00.

Table No.4: Sensory evaluation of cookies prepared by incorporation of Mango Leaves

Sample Code	Sensory attributes					
	Colour and appearance	Texture	Flavour	Taste	Overall acceptability	Rank
CMP_0	6.00	6.00	4.00	5.00	6.00	3
CMP_1	7.00	6.00	6.00	7.00	7.00	2
CMP_2	8.00	9.00	8.00	9.00	8.00	1

Powder with Refined Wheat flour

All results are mean of ten replications.

Maximum score out of 9 point hedonic scale.

Where,

$CMP_{0\%}$ = Control cookies with 100% refined wheat flour

$CMP_{1\%}$= Cookies with 4 % Mango Leaves powder and 96% refined wheat flour

$CMP_{2\%}$= Cookies with 6 % Mango Leaves powder and 94% refined wheat flour

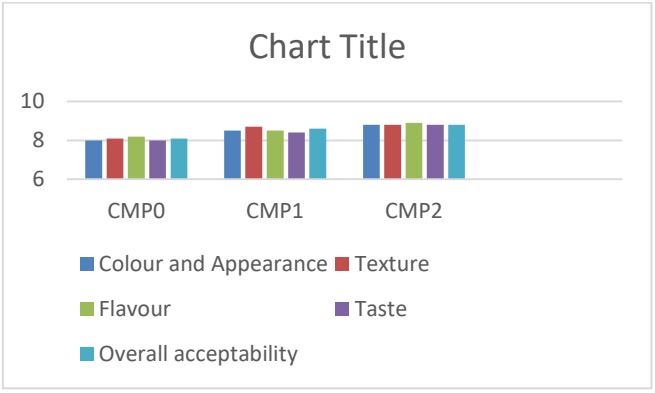

Fig.3 Sensory evaluation of Cookies

Fig.4 Nutritional Cookies

However, as compared to other therapies, CMP_2 performed better and was generally accepted. On the basis of sensory evaluation, the cookies made by combining 6 % Mango

Leaves powder with 94 % refined wheat flour were chosen for future storage research. The standardized cookies were packaged in polypropylene (PP) and low-density polyethylene (LDPE) Packages that were stored at room temperature and judged on a 9-point hedonic scale by a panel of 10 semi-trained judges. According to (Srilakshmi et al., 2007), a panel of five judges conducted sensory evaluations of food products for acceptability based on criteria such as colour and appearance, body and texture, taste and flavour and overall acceptability (Faridi, 1994).

Physical parameters of cookies prepared by incorporating selected levels of Mango Leaves Powder with Refined wheat flour

Table 5 shows the results for weight, diameter, and thickness, spread ratio and spread factor of medicinal cookies. The cookies weighed between 11.23 and 11.26 g. The diameter of cookies ranged from 44.22 to 49.28 mm according to the findings. The thickness of the cookies varied between 11.43 and 13.52 mm. The spread ratio of cookies was found to be between 3.86 and 3.64. The spread factor of cookies was found to be between 100 and 100.82 %as the concentration of medicinal powder increases, the physical parameters weight and diameter decrease, but spread ratio and spread factor rise, as shown in Table 5 This implies that the addition of medicinal powder resulted in more appealing cookies. According to (Faridi et al., 1994), cookies shrink in diameter during baking due to CO_2 produced by leavening agents and water evaporation (Charles, 1992).

Table no 5. Physical parameters of cookies prepared from Mango leaves powder with Refined Wheat flour

Treatment	Weight (g)	Diameter (mm)	Thickness (mm)	Spread Ratio	Spread factor (%)
T_0	11.26	44.22	11.43	3.86	100
T2	11.23	49.28	13.52	3.64	100.82

All results are mean of five replications.

Where,

T_0 = Control cookies with 100% refined wheat flour

T_2 = Cookies with 6 % Mango Leaves powder and 94% refined wheat flour

When wheat flour was replaced with non-wheat flour,(Mc Watters et al., 1978) found that the spread ratio of cookies decreased (Kulkarni et al., 2018).;He believes that using of composite flour increases dough viscosity and forms aggregates because it competes for the minimal free water in cookies dough.

Chemical Composition of Cookies Prepared by Incorporating with Selected Levels of Mango Leaves Powder with Refined wheat flour

Table 6 shows the chemical composition of cookies in terms of moisture, ash, crude fat, crude fibre, crude protein and carbohydrate.

Moisture

Moisture content in the cookies made with refined wheat flour (control) is 4.18% while cookies made with refined wheat flour and 6 % mango leaves powder have a moisture value of 8.48 %.

Table No 6. Effect of different levels of medicinal powder on chemical composition of cookies

Treatment	Moisture (%)	Protein (%)	Fat (%)	Crude fiber (%)	Carbohydrate (%)	Calcium (%)	Iron (%)
T_0	4.18	11.70	20.38	0.77	77.11	19.34	3.90
T_2	8.48	17.93	29.80	15.22	79.34	30.44	6.14

All results are mean of three replications.

Where,

T_0 = Control cookies with 100% refined wheat flour

T_2 =Cookies with 6 % mango leaves powder and 94% refined wheat flour

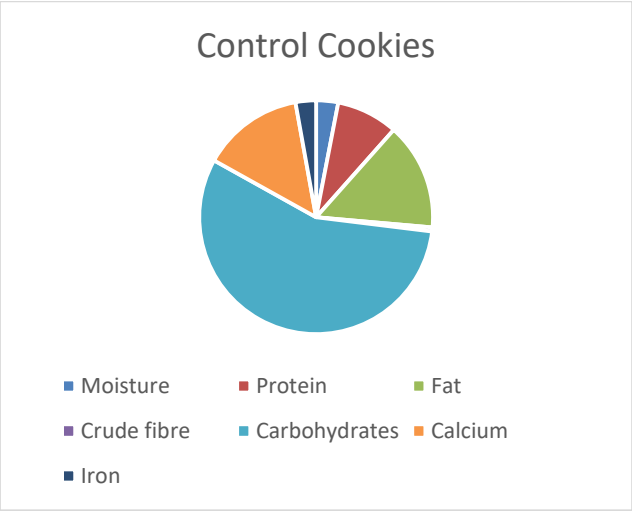

Fig.5 Chemical composition of Control Cookies

Fig.6 Chemical composition of Healthy Cookies

Protein

The protein level of the cookies made with refined wheat flour (control) is 11.70 % whereas the protein content of cookies made with 6 % mango leaves powder is 17.93 %.

Fat

The fat content of cookies made with refined wheat flour (control) is 20.38 % while cookies made with 6 % mango leaves powder have a fat level of 29.80 %. Fat adds tenderness to cookies, making them more palatable, as well as helping to enhance texture.

Crude Fibre

Crude fibre level in cookies made with refined wheat flour (control) is 0.77 % while it is 15.22 % in cookies made with 6 % mango leaves powder. In general, researchers found that increasing MLP concentration enhanced the crude fibre content of cookies. Fibre rich foods are being produced in greater quantities due to their role in promoting health (Ajila et al., 2008).

Carbohydrate

Carbohydrate content in cookies made with refined wheat flour (control) is 77.11 % while it is 79.84 % in cookies made with 6 % mango leaves powder.

Calcium

Calcium content in the cookies made with refined wheat flour (control) is 19.34 mg⁄100g while it is 30.44 mg⁄100g in cookies made with 6 % mango leaves powder.

Iron

Iron content in the cookies made with refined wheat flour (control) is 3.90 mg⁄100g while it

is 6.14 mg/100g in cookies made with 6 % mango leaves powder.

Storage Quality of Cookies Prepared by Incorporating Mango Leaves Powder with Refined Wheat flour

The control cookies which were made with 100 % refined wheat flour and the standardised experimental cookies were packed in polypropylene bags (PP) and low-density polyethylene (LDPE) bags and held at room temperature for three months (90 days). At a 30- day period, the cookies were tested for sensory and proximate consistency.

Effect of Packaging Material and Storage Period on Changes in Chemical Composition of Medicinal Powder Incorporated Cookies during Storage

Changes in moisture content:

Table 7 shows the effect of the moisture changes in cookies as a result of storage. For 90 days of the storage, moisture increased for control treatment T_0 % from 4.18 to 4.37 % in LDPE and 4.18 to 4.43 % in PP, as shown in Table 13 The moisture content of the sample $T_{2\%}$ increased from 8.48 to 8.67 % in LDPE and 8.48 to 8.69 % in PP. On the 90thday of storage, PP-packaged samples had the most moisture, followed by LDPE-packaged sample.

The statistical analysis revealed that both the treatment and packaging material had a substantial effect on the moisture with non-significant interaction between them. At room temperature, the rate of moisture increase was quick. This may be due to the temperature and packaging material differences that occur during storage.

Furthermore, due to refined wheat flour hygroscopic properties, cookies absorbed moisture from the surrounding environments. (Leelavathi & Rao, 1993), (Rao et al., 1995) (Pasha et al., 2002), (Butt et al., 2004) and Sharif et al. (2005), all recorded an increase in moisture contents of cookie samples during storage, either due to environments or packaging materials (Bharti et al., 2013) (Pourahmad et al., 2010).

Table No 7. Effect of packaging material and storage period on changes in chemical composition of cookies prepared by incorporating Mango leaves powder during storage

Parameter	Moisture (%)	Protein (%)	Fat (%)	Crude fiber (%)	Carbohy-date (%)	Calcium (mg/100g)	Iron (mg/100g)
Treatment							
T_0	4.18	11.70	20.38	0.77	77.11	19.34	3.90
T_2	8.48	17.93	29.80	15.22	79.34	30.44	6.14
Interaction							
$T_0P_0C_1$	4.26	11.54	20.29	0.71	77.03	19.28	3.82
$T_0P_0C_2$	4.32	11.51	20.26	0.66	77.00	19.23	3.78
$T_0P_0C_3$	4.37	11.46	20.21	0.64	76.96	19.18	3.74
$T_0P_1C_1$	4.31	11.42	20.23	0.68	77.01	19.25	3.81
$T_0P_1C_2$	4.37	11.38	20.21	0.63	76.97	19.20	3.77
$T_0P_1C_3$	4.43	11.34	20.18	0.59	76.93	19.14	3.72
$T_2P_0C_1$	8.55	17.76	29.63	15.04	79.26	30.37	6.06
$T_2P_0C_2$	8.61	17.70	29.59	14.97	79.21	30.34	6.02
$T_2P_0C_3$	8.67	17.64	29.55	14.94	79.17	30.31	5.97
$T_2P_1C_1$	8.58	17.71	29.60	15.02	79.23	30.34	6.05
$T_2P_1C_2$	8.64	17.65	29.55	14.96	79.19	30.29	6.01
$T_2P_1C_3$	8.69	17.58	29.51	14.91	79.14	30.27	5.95

All results are mean of three replications.

Where,

T_0 = Control cookies with 100% refined wheat flour

T_2=Cookies with 6 % Mango leaves powder and 94% refined wheat flour

P_0= (LDPE) low density polyethylene bag, P_1 = (PP) Polypropylene bag

C_1= 30 days, C_2= 60 days, C_3= 90 days

Changes in protein content:

Table 7 shows the results of the protein alterations in cookies as a result of storage. Protein dropped for control treatment $T_{0\%}$ from 11.70 to 11.46 % in LDPE and 11.70 to 11.34% in PP over 90 days of storage, as shown in Table 13 The protein concentrations in the sample $T_{2\%}$ decrease from 17.93 to17.64 % in LDPE and from 17.93 to 17.58 % in PP.

All treatments in the various packing materials showed significant reduction in protein. For the 90thday of storage, samples packed in PP has less protein than those packed in LDPE.

The statistical analysis revealed that both the therapy and packing material had a substantial effect on the protein, with non-significant interaction between them. During storage, the protein content of cookies did not change significantly depending on the packaging materials. At room temperature, the rate of protein degradation was rapid. This may be due to the temperature and packaging material differences that occur during storage.

Changes in fat content:

Table 7 shows that the findings of the changes in cookies fat as a result of storage. For 90 days of the storage, fat dropped for control treatment $T_{0\%}$ from 20.38 to 20.21% in LDPE and 20.38 to 20.18 % in PP as shown in Table 13 The fat content of the sample $T_{2\%}$ decreased from 29.80 to 29.55 % in LDPE and 29.80 to 29.51 in PP.

All treatments in the various packing materials showed significant reduction in fat. For the 90thday of storage, samples packed in PP has less fat than those packed in LDPE. The decrease in fat content over time could be due to cookies absorbing moisture from the air and lipids breaking down into other molecules. During a 45 days storage period Sharoon et al. (2014) observed a drop in fat content in biscuits made from composite flour.

The statistical analysis revealed that both therapy and packaging content had a significant impact on fat, with no-significant association between them. The fat content of cookies decreased non-significantly during storage for various packaging materials. This may be due to the temperature and packaging material differences that occur during storage.

Changes in crude fibre content

Table 7 shows the results of the variations in crude fibre of cookies as a result of storage. It was discovered that after 90 days of the storage, the crude fibre in control treatment $T_{0\%}$ decreased from 0.77 to 0.64 % in LDPE and 0.77 to 0.59 % in PP. The crude fibre in the sample $T_{2\%}$ decreased from 15.22 to 14.94 % in LDPE and 15.22 to 14.91 % in PP.

All treatments resulted in a significant reduction in crude fibre in the various packaging materials. For the 90th days of storage, PP-packaged samples had less crude fibre than LDPE packaged sample. The decrease in crude fibre content of cookies over time may be attributed to an increase in moisture, which boost amylase activity. According to Pasha et al. (2002), Butt et al. (2004) and Sharif et al. (2005), the decrease in crude fibre during storage may be attributable to a rise in moisture content that was absorbed from the air (Pourahmad et al., 2010) (Peng et al., 2009) (Gururaja et al., 2012).

Changes in carbohydrate content

Table 7 shows the effect of the adjustment in carbohydrate content of cookies as a consequence of storage. At 90 days of the storage carbohydrate levels in the control treatment $T_{0\%}$ decreased from 77.11 to 76.96 % in LDPE and 77.11 to 76.93 % in PP. The carbohydrate content of the sample $T_{2\%}$ decreased from 79.34 to 79.17 % in LDPE and 79.34 to 79.14% in PP.

In both therapies, a significant reduction in carbohydrate was found in the various packaging materials. For the 90^{th} day of storage, PP-packaged samples had less carbohydrate than LDPE packaged sample. During 45 days storage period, Sharoon et al. (2014) found a drop in carbohydrates content in biscuits made from composite flour (Pourahmad et al., 2010).

The treatment and packaging content had a substantial impact on the iron, according to the statistical study, and the interaction between them was non-significant. During storage, the iron content of cookies did not change significantly depending on the packaging materials. This may be due to the

temperature and packaging material differences that occur during storage.

Effect of Packaging Material on Changes in Sensory Quality of Mango Leaves Powder Cookies during Storage

Changes in Colour and Appearance

Table 8 shows the results of the colour and appearance score of cookies as a function of packaging and storage time. The results show that after 90 days of storage, the colour and appearance score for control treatment $T_{0\%}$ decreased from 6.00 to 5.00 in LDPE, from 6.00 to 5.00in PP. In 90 days of storage, the sample $T_{2\%}$ had an organoleptic score for colour and appearance of 8.00 to 7.00 in LDPE and 8.00 to 7.00 in PP. Similar results were found by (Singh et al., 2000) in the storage of soy enriched biscuits, with a drop in colour and appearance from 8.00 to 6.60 (Mokomane et al., 2017). During 90 days of storage, Gupta and Singh (2005) observed a change in the colour and appearance of biscuits containing excellent protein maize (Yakubu et al., 2015).

The treatment and packaging content had an important impact on the colour and appearance, according to the statistical study, and the interaction between them was non-significant. For varied packaging materials and storage temperatures, there was no-significant change in the colour and appearance of cookies throughout storage.

Table No.8: Effect of packaging material and storage period on changesin cookies prepared by incorporating Mango Leaves powder during storage

Parameter	Colour and appearance	Texture	Flavour	Taste	Overall acceptability
Treatment					
T_0	6.00	6.00	4.00	5.00	6.00
T_2	8.00	9.00	8.00	9.00	8.00
Interaction					
$T_0P_0C_1$	6.00	6.00	4.00	5.00	6.00
$T_0P_0C_2$	6.00	6.00	4.00	5.00	5.00
$T_0P_0C_3$	5.00	5.00	3.00	4.00	6.00
$T_0P_1C_1$	6.00	6.00	4.00	5.00	6.00
$T_0P_1C_2$	6.00	6.00	4.00	5.00	6.00
$T_0P_1C_3$	5.00	5.00	3.00	4.00	5.00
T_2P0C1	8.00	9.00	8.00	9.00	8.00
$T_2P_0C_2$	8.00	9.00	8.00	8.00	7.00
$T_2P_0C_3$	7.00	8.00	7.00	8.00	7.00
$T_2P_1C_1$	8.00	9.00	8.00	9.00	8.00
$T_2P_1C_2$	8.00	9.00	8.00	8.00	7.00
$T_2P_1C_3$	7.00	8.00	7.00	9.00	8.00

All results are mean of ten replications.
Organoleptic evaluation on 1 to 9 hedonic point basis.
Where,
T_0 = Control cookies with 100% refined wheat flour
T_2 = Cookies with 6 % Mango leaves powder and 94% refined wheat flour
P_0= (LDPE) low density polyethylene bag, P_1 = (PP) Polypropylene bag
C_1= 30 days, C_2= 60 days, C_3= 90 days

Changes in Texture

Table 8 shows, the results of the texture score of cookies as a function of packaging material and storage. The results show that after 90 days of storage, the texture score for control treatment $T_{0\%}$ decreased from 6.00 to 5.00in LDPE and from 6.00 to 5.00in PP. In 90 days of storage, the sample $T_{2\%}$ had an organoleptic score for texture property 9.00 to 8.00 in LDPE and 9.00 to 8.00in PP.

The statistical analysis revealed that both the therapy and packaging content had a substantial effect on the texture, with no-significant interaction between them. The texture of cookies decreased non-significantly during storage for various packaging materials. This may be due to the temperature and packaging material differences that occur during storage.

Changes in Flavour

Table 8 shows the results of the flavour score of cookies as a function of packaging and storage. The results show that after 90 days of storage, the flavour score for control treatment T_0% decreased from 4.00 to 3.00 in LDPE and 4.00 to 3.00in PP. In 90 days of storage, the sample $T_{2\%}$ had an organoleptic score for flavour8.00 to 7.00in LDPE and 8.00 to 7.00in PP.

Changes in taste

Table 8 shows the results of the taste score of cookies as a function of storage. The results shows that after 90 days of storage, the taste score for control treatment T_0% reduced from 5.00 to 4.00 in LDPE and 5.00 to 4.00 in PP. In 90 days of storage, the sample $T_{2\%}$ had an organoleptic score for taste of the 9.00 to 8.00 in LDPE and the 9.00 to 8.00 in PP

During the storage of biscuits supplement with 15 % soy flour, Awasthi and Yadav (1998) founds that the comparable outcomes (Reddeman et al., 2018) When biscuits containing 20 % defatted soy flour were held at room temperature, Singh et al. (2000) showed a dropped in taste score. Narender et al. (2007) also recorded a 30 % difference in the taste of biscuits that has been infused with whey protein concentrate and stored for 60 days at room temperature (Kumar, et al., 2021).

The statistical analysis revealed that both treatment and packing material had a substantial impact on the taste with no-significant interaction between them. The taste of cookies did not change significantly during storage for various packaging materials. This may be due to the temperature and packaging material differences that occur during storage.

Changes in Overall Acceptability

Table 8 shows the findings of the overall acceptability score of cookies as a function of the storage. The results show that after 90 days of storage, the overall acceptability score for control treatment $T_{0\%}$ decreased from 6.00 to 5.00 in LDPE and from 6.00 to 5.00in PP. In 90 days of storage, the sample $T_{2\%}$ had an organoleptic score for overall acceptability of the 8.00 to 7.00in LDPE and the 8.00 to 7.00 in PP.

The statistical study revealed that both treatment and packing material had a substantial impact on overall acceptability content, with no-significant interaction between them. The overall acceptability of cookies decreased non-significantly during storage for various packaging materials. This may be due to the temperature and packaging material differences that occur during storage.

Changes in Microbial Count of Cookies Prepared by Incorporating Mango Leaves Powder during Storage

Microbial count was performed at 30, 60 and 90 days, however there were few microbial colonies on nutrient agar during the first period. At the end of storage, a regular plate count of cookies prepared by adding medicinal powder was performed.

The cookies stored in LDPE packing content had a count of 3×10^5 for control and 2×10^5cfu/g for $CMP_{2\%}$. While the normal plate count for cookies stored in LDPE was 0×10^5 and 0×10^5cfu/g, respectively, at the initial stage of storage.

The cookies stored in PP packing content had a count of 4×10^5 for control and 3×10^5cfu/g for $CMP_{2\%}$. While the normal plate count for cookies stored in PP was 0×10^5 and 0×10^{5cfu}/g, respectively, at the initial stage of storage.

These findings revealed that the standard plate count is closely proportional to cookies moisture content. The panel member's acceptance of the product after three months of storage indicate that any minor modifications caused by microbes were within acceptable limits for human consumption. In comparison to the levels of the general microbial

contamination, total viable counts were utilised as a measure of microbiological quality. According to Agu and Ndidiamaka (2014), the growth seen on biscuits could be due to post processing contamination, but Aruna et al. (2000) found that 3 x 10^5 CFU/g bacterial growth in cookies maintained at room temperature. During 0 to 90 days of storage, standard plate counts for refined wheat flour cookies ranged from 6 x 10^3 to 8 x 10^3 cfu/g (Khandekar et al., 2005), total plate counts for guar gum cookies was ranged from 0 x 10^3 to 4.1 x 10^3 and yeast and mould counts ranged from 0 x 10^3 to 2.4 x 10^3 (Kukade et al., 2017).

Table No.9: Standard plate count of medicinal cookies during storage

Treatments	Standard plate count (-x 10^5 cfu/g)	
	Initial	Final(90 days)
$P_{0(LDPE)}$	0	3
$P_{1(LDPE)}$	0	2
$P_{0(PP)}$	0	4
$P_{1(PP)}$	0	3

All results are mean of three replications.

Economics of Cookies Prepared by Incorporating Mango Leaves Powder

Table 10 shows the cost of making medicinal powder cookies. This cost calculated using the cost of raw material, the chemical to be added and the labour charges at the time of the experiment. For 1 kg of all types of medicinal powder cookies, the total cost of production of the Cookies is Rs 280. Rent and transportation costs were not included, as were sales commissions, local taxes, capital interest, and equipment depreciation (Aruna, et al., 2000) (Kukade et al., 2017).

TableNo.10. Economics of cookies prepared from Mango Leaves powder

Sr. No.	Item	Quantity(g)	Total cost (Rs.)
1	Medicinal powder	60	50.00
2	Refined Wheat Flour	940	42.00
3	Margarine	400	85.00
4	Stevia Powder	30	45
5	Baking Powder	5	01.50
6	Calcium Propionate	5	02.50
7	Cardamon Powder	5	06.00
8	LDPE bag	0.2	00.36
	Total		**247.36**

1. 10% fluctuation in price = 24.73
2. Total cost (Rs) = 272.09
3. 40 % overhead charges (Include = 108.83
   Labour, fuel, electric charges misc.) Total cost (Rs) = 380.92
4. Total quantity of cookies prepared = 1.63Kg
5. Cost of production of cookies (Rs/1.43 kg) = 381
6. Cost of production of cookies (Rs./kg) = 233
7. 20% profit (Rs) = 47.00
8. Selling price of cookies (Rs./kg) = 280.00

CONCLUSION

The results obtained in the present investigation indicated that better quality cookies with medicinal powder and refined wheat flour is 6:94 for refined wheat flour: mango leaves powder– combines 994gm flour used, mango leaves powder 6gm,30gm of Stevia powder, 400gm of Margarine, 5gm of baking powder, 5gm calcium propionate and 5gm of cardamom powder. These treatments showed superior sensory score in respect of quality over other treatments. Cookies stored in LDPE showed better chemical and organoleptic performance. Cookies could be stored in good condition beyond 90 days in LDPE at ambient temperature. The cost of production of medicinal cookies was Rs 280/- per kg.

In general, cookies made up of the sugar and hydrogenated vegetable oil, but in this preparation of healthy cookies, sugar is totally replaced by stevia powder and hydrogenated vegetable oil is replaced by margarine. The present investigation also shows the medicinal properties or component of the powder is retained as in cookies and to improve nutritional quality and functional properties of cookies.

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