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Standardization of recipe for yam (*Dioscorea)* flour-based cookies blended with *Moringa* leaf powder and wheat flour supplemented with palm jaggery

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Abstract
Dioscorea (yam) flour is utilized for the preparation of cookies along with *Moringa* leaf powder which improves nutritional value of cookies by value addition of *Dioscorea* flour. Hence, the present investigation "Standardization of recipe for *Dioscorea* flour-based cookies supplemented with *Moringa* leaf powder and blended with wheat flour using palm jaggery" was carried out at Department of Post Harvest Technology, College of Horticulture, Dr. Y.S.R. Horticultural University, Venkataramannagudem, Andhra Pradesh in a completely randomized design with 14 treatments and replicated twice in the year 2022. The chemical parameters for cookies were evaluated up to 60 days of storage at 20 days interval period. The treatment combination for the chemical parameters, T_2 (30 DF : 5 MP : 65 WF) recorded minimum reduction in fibre (3.31%), protein (14.10%), potassium (0.181%) and Vitamin C (12.97 mg 100 g^{-1}) and low moisture content of (5.39%) and low starch content of (47.15%) followed by T_1 (20 DF : 0 MP : 80 WF) with fibre (2.33%), protein (11.79%), potassium (0.164%) and Vitamin C (12.41 mg 100 g^{-1}) and low moisture content of (5.11%) and low starch content of (48.42%) at 60^{th} day of storage which were recorded as the best treatments in the present study.

Keywords: Cookies, palm jaggery, *Dioscorea* (yam) flour, *Moringa* leaf powder, wheat flour

Introduction
After potato, cassava, and sweet potato, yam (*Dioscorea*) is the world's fourth most important tuber crop in terms of economic importance. It is grown in tropical nations, particularly in West Africa, where it accounts for approximately 95 percent of global production (Loko *et al*. 2013) [8]. In India, yams (*Dioscorea* species), greater yam, lesser yam, and white yam are all considered underutilized tuber crops.

Yam is composed mainly of starch with small amounts of proteins, lipids, vitamins, high amount fibre and all the essential amino acids. In addition to these it has manganese, vitamin B, vitamin E, vitamin K and Beta-carotene together with potassium and sodium which are of higher values. Yam is especially rich in vitamin C which is lacking in wheat. The dry matter of the tuber ranges from 8 to 23% (Abera, and Shajeela *et al*. 2011) [1]. The compositional analysis (on dry weight basis) of tubers originated from different species of *Dioscorea* revealed the presence of protein of 6.2 to 13.4%, fibre of 0.4 to 7.6%, total carbohydrates (12 to 33%) (Shajeela *et al*, 2011) [1].

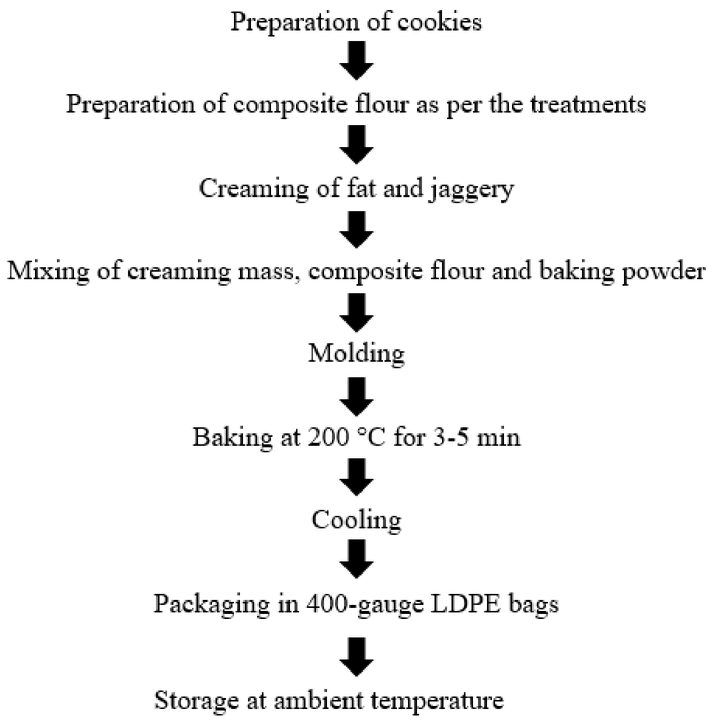
Material and Methods
The present investigation was carried out at Post Harvest Laboratory, College of Horticulture, Venkataramannagudem, Dr. Y.S.R. Horticultural University, Andhra Pradesh. The experiment was carried out in Completely Randomized Design with fourteen treatment combinations and replicated twice. Fully matured tubers of *Dioscorea* were washed thoroughly to remove dust. Fresh tubers were peeled manually and cut into slices about 0.5 cm thickness of uniform size and shape. They are subjected to boiling in order to remove the clingy nature of freshly chopped slices and then dehydrated using tray drier at temperature range of 60 ℃. After drying slices are subjected to miller to obtain fine flour which is sieved and packed in polythene bags of 300 gauge.

Moringa leaf powder is prepared by harvesting fresh tender leaves and washed to remove dirt and are allowed to spread on cotton cloth to remove excess moisture and spread on aluminium trays of drier and allowed to dry at temperature of 50 ℃.

Dried leaves are grinded to fine powder and packed in airtight containers and used for blending.

Methodology followed for preparation of cookies

Initially, baking machine was preheated and the butter was beaten in a food mixer and jaggery was added. Then, a sifted flour sample was added in the mixture. The mixture was then mixed and kneaded until it became dough. The dough was cut into small uniform shaped cookies and placed on baking trays, baked in the oven for 3-5 minutes at a temperature of 200 °C until a golden brown colour was obtained. They were allowed to cool before being packed in polyethylene bags and stored in cold and dry as shown in the below flow chart.



Results and Discussion

The cookies which are prepared from blends of *Dioscorea* flour and *Moringa* leaf powder as per the treatment combination and data was recorded for the chemical parameters like moisture (%), fibre (%), protein (%), starch (%), potassium (%) and vitamin-C (mg 100 g^{-1}) of the cookies which was statistically analyzed and results are presented in table 1. to 3.

Table 1: Effect of *Dioscorea* flour blended with *Moringa* leaf powder and wheat flour on palm jaggery cookies moisture (%) and fibre (%) at different days of storage

Treatments	Moisture (%)				Fibre (%)			
	Initial day	20th day	40th day	60th day	Initial day	20th day	40th day	60th day
T_1 - 20 (DF) : 0 (MP) : 80 (WF)	4.34 (2.31)	4.72 (2.39)	5.04 (2.45)	5.11 (2.47)	2.87 (1.96)	2.63 (1.90)	2.39 (1.84)	2.33 (1.76)
T_2 - 20 (DF) : 5 (MP) : 75 (WF)	4.95 (2.43)	5.11 (2.47)	5.27 (2.50)	5.39 (2.52)	3.79 (2.18)	3.46 (2.11)	3.40 (2.06)	3.31 (2.03)
T_3 - 20 (DF) :10 (MP) : 70(WF)	5.39 (2.52)	5.48 (2.54)	5.78 (2.60)	5.96 (2.63)	4.54 (2.35)	4.39 (2.32)	4.18 (2.27)	3.98 (2.23)
T_4 - 20 (DF) :15 (MP): 65(WF)	5.84 (2.61)	5.93 (2.63)	6.14 (2.67)	6.28 (2.69)	5.48 (2.54)	5.28 (2.50)	5.03 (2.45)	4.87 (2.42)
T_5 - 30 (DF): 0 (MP) : 70 (WF)	6.13 (2.67)	6.24 (2.69)	6.37 (2.71)	6.55 (2.74)	2.95 (1.98)	2.73 (1.93)	2.55 (1.88)	2.33 (1.82)
T_6 - 30 (DF) : 5 (MP) : 65(WF)	6.57 (2.75)	6.79 (2.79)	6.96 (2.82)	7.14 (2.85)	3.91 (2.21)	3.69 (2.16)	3.46 (2.11)	3.19 (2.04)
T_7 - 30 (DF):10 (MP) : 60(WF)	6.98 (2.82)	7.12 (2.84)	7.33 (2.88)	7.47 (2.91)	4.72 (2.39)	4.61 (2.36)	4.47 (2.33)	4.21 (2.28)
T_8 - 30 (DF) :15 (MP) : 55(WF)	7.43 (2.90)	7.67 (2.94)	7.95 (2.99)	8.06 (3.01)	5.69 (2.58)	5.39 (2.52)	5.22 (2.49)	5.08 (2.46)
T_9 - 40 (DF) : 0 (MP) : 60 (WF)	8.06 (3.01)	8.16 (3.02)	8.31 (3.05)	8.39 (3.06)	3.08 (2.01)	2.95 (1.98)	2.66 (1.91)	2.34 (1.82)
T_{10} - 40 (DF) : 5 (MP) : 55(WF)	8.47 (3.07)	8.66 (3.10)	8.72 (3.11)	8.89 (3.14)	4.12 (2.26)	3.98 (2.23)	3.72 (2.17)	3.54 (2.13)
T_{11} - 40 (DF) : 10 (MP) : 50 (WF)	9.13 (3.18)	9.29 (3.20)	9.49 (3.23)	9.68 (3.26)	5.07 (2.46)	4.88 (2.42)	4.58 (2.36)	4.36 (2.31)
T_{12} - 40 (DF) : 15 (MP) : 45 (WF)	9.46 (3.23)	9.73 (3.27)	9.98 (3.31)	10.15 (3.33)	5.93 (2.63)	5.77 (2.60)	5.59 (2.56)	5.18 (2.48)
T_{13} - 50 (DF) : 0 (MP) : 50 (WF)	9.89 (3.30)	10.07 (3.32)	10.17 (3.34)	10.28 (3.35)	4.72 (2.39)	4.63 (2.37)	4.37 (2.31)	4.14 (2.26)
T_{14} - 100 (DF) : 0 (MP) : 0 (WF) (control)	10.12 (3.33)	10.34 (3.36)	10.44 (3.38)	10.58 (3.40)	4.19 (2.27)	3.99 (2.23)	3.75 (2.18)	3.58 (2.14)
SE(m) ±	0.025	0.026	0.026	0.026	0.056	0.055	0.053	0.051
C.D at 5%	0.078	0.078	0.080	0.081	0.173	0.169	0.163	0.157

*DF – *Dioscorea* flour, *MP – *Moringa* leaf powder, *WF – Wheat flour, Note: Values in parenthesis are square root transformed values

Table 2: Effect of *Dioscorea* flour blended with *Moringa* leaf powder and wheat flour on palm jaggery cookies protein (%) and starch (%) at different days of storage

Treatments	Protein (%)				Starch (%)			
	Initial day	20th day	40th day	60th day	Initial day	20th day	40th day	60th day
T_1 - 20 (DF) : 0 (MP) : 80 (WF)	12.72 (3.73)	12.26 (3.64)	11.91 (3.59)	11.79 (3.56)	58.72 (50.00)	56.89 (48.94)	53.19 (46.81)	48.42 (44.67)
T_2 - 20 (DF) : 5 (MP) : 75 (WF)	14.95 (4.03)	14.76 (3.90)	14.38 (3.86)	14.10 (3.80)	56.24 (48.56)	54.92 (47.80)	50.28 (45.14)	47.15 (43.34)
T_3 - 20 (DF) :10 (MP) : 70(WF)	17.34 (4.32)	16.84 (4.22)	16.70 (4.20)	16.32 (4.16)	53.12 (46.77)	51.79 (46.00)	49.22 (44.53)	45.32 (42.29)
T_4 - 20 (DF) :15 (MP) : 65(WF)	19.43 (4.56)	19.08 (4.48)	18.87 (4.45)	18.46 (4.42)	50.84 (45.46)	49.67 (44.79)	46.72 (43.10)	42.39 (40.60)
T_5 - 30 (DF) : 0 (MP) : 70 (WF)	13.83 (3.88)	13.17 (3.76)	12.98 (3.73)	12.71 (3.70)	66.39 (54.55)	63.21 (52.64)	62.37 (52.14)	58.17 (49.68)
T_6 - 30 (DF) : 5 (MP) : 65(WF)	16.78 (4.25)	16.11 (4.13)	13.89 (3.85)	13.62 (3.82)	64.17 (53.21)	62.79 (52.39)	60.74 (51.18)	55.48 (48.12)
T_7 - 30 (DF):10 (MP) : 60(WF)	20.20 (4.64)	19.89 (4.57)	19.73 (4.55)	19.17 (4.52)	60.33 (50.94)	58.65 (49.96)	56.69 (48.82)	51.19 (45.66)
T_8 - 30 (DF) :15 (MP) : 55(WF)	24.67 (5.11)	24.03 (5.00)	23.76 (4.97)	23.22 (4.92)	58.70 (49.99)	56.27 (48.58)	54.24 (47.41)	52.49 (46.40)
T_9 - 40 (DF) : 0 (MP) : 60 (WF)	15.62 (4.11)	15.17 (4.02)	14.81 (3.97)	14.44 (3.95)	74.40 (59.59)	72.55 (58.38)	69.25 (56.30)	65.56 (54.04)
T_{10} - 40 (DF) : 5 (MP) : 55(WF)	18.37 (4.44)	17.84 (4.34)	17.52 (4.30)	17.19 (4.26)	70.68 (57.19)	69.51 (56.46)	66.39 (54.55)	60.29 (50.92)
T_{11} - 40 (DF) : 10 (MP) : 50 (WF)	23.29 (4.97)	23.12 (4.91)	22.80 (4.87)	21.98 (4.79)	68.37 (55.76)	65.21 (53.83)	63.18 (52.62)	58.42 (49.82)
T_{12} - 40 (DF) : 15 (MP) : 45 (WF)	28.76 (5.50)	28.19 (5.40)	27.95 (5.38)	27.08 (5.29)	66.92 (54.87)	64.84 (53.61)	61.52 (51.64)	57.63 (49.37)
T_{13} - 50 (DF) : 0 (MP) : 50 (WF)	26.43 (5.28)	26.15 (5.21)	25.78 (5.17)	25.13 (5.11)	77.41 (61.61)	74.27 (59.50)	72.31 (58.23)	70.24 (56.92)
T_{14} - 100 (DF) : 0 (MP) : 0 (WF) (control)	31.24 (5.73)	30.73 (5.63)	30.37 (5.60)	30.07 (5.57)	79.68 (63.19)	77.92 (61.96)	75.68 (60.43)	72.63 (58.43)
SE(m) ±	0.109	0.065	0.064	0.064	0.816	0.778	0.733	0.674
C.D at 5%	0.333	0.200	0.197	0.195	2.499	2.382	2.244	2.063

*DF – *Dioscorea* flour, *MP – *Moringa* leaf powder, *WF – Wheat flour, Note: Values in parenthesis are square root transformed values

Table 3: Effect of *Dioscorea* flour blended with *Moringa* leaf powder and wheat flour on Palm jaggery cookies potassium (%) and Vitamin C (mg 100 g^{-1}) at different days of storage

Treatments	Potassium (%)				Vitamin C (mg 100 g^{-1})			
	Initial day	20th day	40th day	60th day	Initial day	20th day	40th day	60th day
T_1 - 20 (DF) : 0 (MP) : 80 (WF)	0.177 (1.085)	0.174 (1.084)	0.170 (1.082)	0.164 (1.079)	12.91	12.68	12.50	12.41
T_2 - 20 (DF) : 5 (MP) : 75 (WF)	0.193 (1.092)	0.190 (1.091)	0.185 (1.089)	0.181 (1.086)	13.45	13.23	13.07	12.97
T_3 - 20 (DF) :10 (MP) : 70(WF)	0.216 (1.103)	0.211 (1.100)	0.206 (1.098)	0.201 (1.096)	13.98	13.69	13.46	13.24
T_4 - 20 (DF) :15 (MP) : 65(WF)	0.230 (1.109)	0.226 (1.107)	0.221 (1.105)	0.213 (1.101)	14.44	14.20	13.98	13.73
T_5 - 30 (DF) : 0 (MP) : 70 (WF)	0.184 (1.088)	0.178 (1.085)	0.172 (1.083)	0.168 (1.081)	14.96	14.54	14.37	14.21
T_6 - 30 (DF) : 5 (MP) : 65(WF)	0.199 (1.095)	0.194 (1.093)	0.187 (1.089)	0.180 (1.086)	15.64	15.33	15.06	14.87
T_7 - 30 (DF):10 (MP) : 60(WF)	0.229 (1.109)	0.222 (1.105)	0.219 (1.104)	0.213 (1.101)	15.92	15.69	15.38	15.22
T_8 - 30 (DF) :15 (MP) : 55(WF)	0.250 (1.118)	0.243 (1.115)	0.236 (1.112)	0.232 (1.110)	16.38	16.11	15.93	15.75
T_9 - 40 (DF) : 0 (MP) : 60 (WF)	0.198 (1.095)	0.194 (1.093)	0.189 (1.090)	0.184 (1.088)	16.98	16.72	16.59	16.36
T_{10} - 40 (DF) : 5 (MP) : 55(WF)	0.219 (1.104)	0.213 (1.101)	0.207 (1.099)	0.202 (1.096)	17.32	17.14	16.87	16.66
T_{11} - 40 (DF) : 10 (MP) : 50 (WF)	0.242 (1.114)	0.236 (1.112)	0.232 (1.110)	0.228 (1.108)	17.87	17.69	17.33	17.19
T_{12} - 40 (DF) : 15 (MP) : 45 (WF)	0.271 (1.127)	0.265 (1.125)	0.260 (1.122)	0.255 (1.120)	18.41	18.28	18.05	17.85
T_{13} - 50 (DF) : 0 (MP) : 50 (WF)	0.213 (1.101)	0.207 (1.099)	0.203 (1.097)	0.197 (1.094)	18.62	18.45	18.28	18.11
T_{14} - 100 (DF) : 0 (MP) : 0 (WF) (control)	0.238 (1.113)	0.233 (1.110)	0.228 (1.108)	0.223 (1.106)	19.18	18.89	18.70	18.52
SE(m) ±	0.002	0.002	0.002	0.002	1.301	1.282	1.263	1.247
C.D at 5%	0.006	0.006	0.006	0.006	3.947	3.889	3.831	3.784

*DF – *Dioscorea* flour, *MP – *Moringa* leaf powder, *WF – Wheat flour, Note: Values in parenthesis are square root transformed values

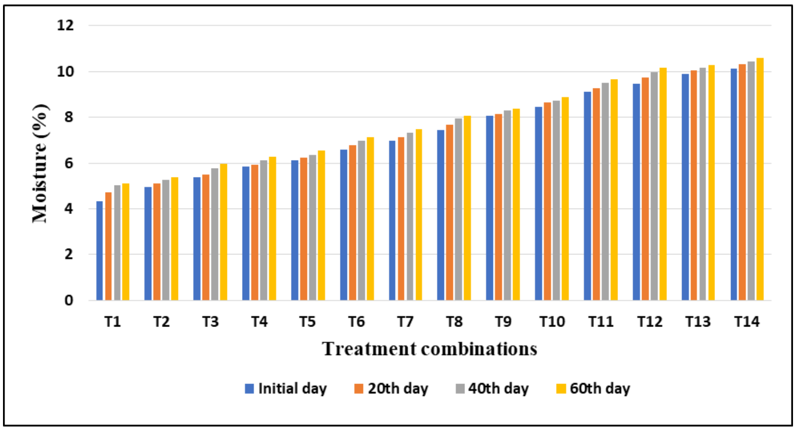


Fig 1: Effect of *Dioscorea* flour blended with *Moringa* leaf powder on palm jiggery cookies moisture (%) at different days of storage

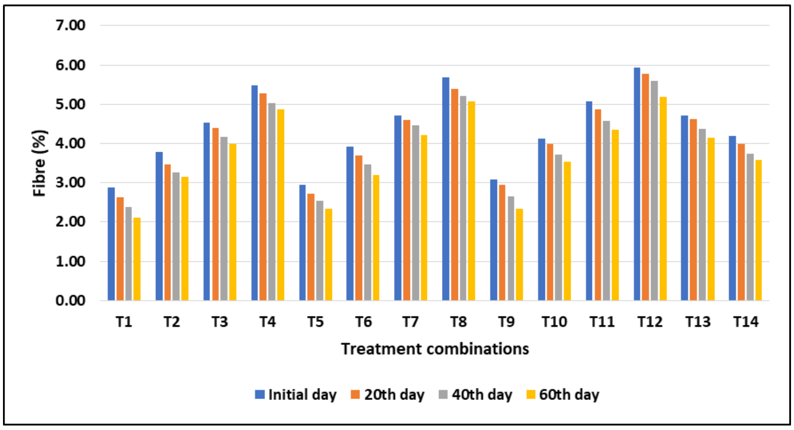


Fig 2: Effect of *Dioscorea* flour blended with *Moringa* leaf powder on palm jiggery cookies fibre (%) at different days of storage

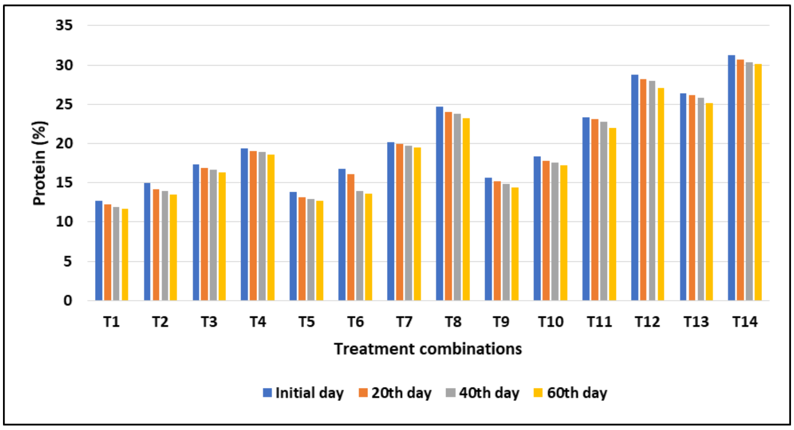


Fig 3: Effect of *Dioscorea* flour blended with *Moringa* leaf powder on palm jiggery cookies protein (%) at different days of storage

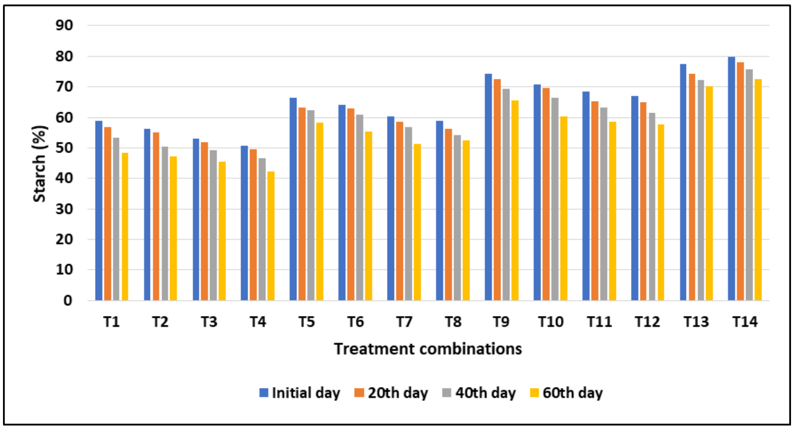


Fig 4: Effect of *Dioscorea* flour blended with *Moringa* leaf powder on palm jiggery cookies starch (%) at different days of storage

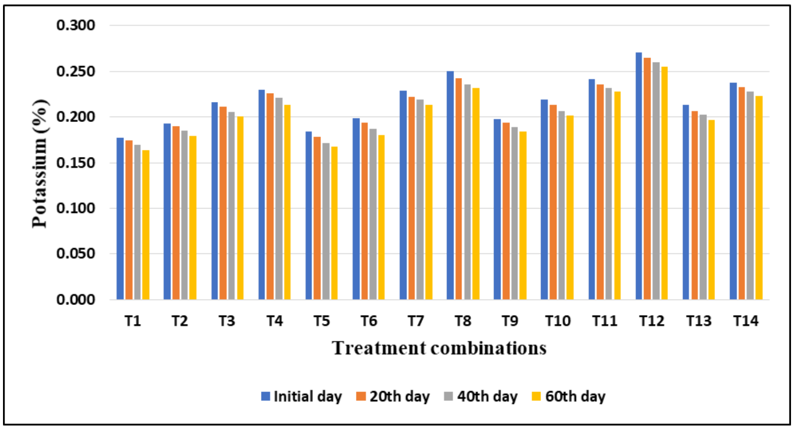


Fig 5: Effect of *Dioscorea* flour blended with *Moringa* leaf powder on palm jiggery cookies potassium (%) at different days of storage

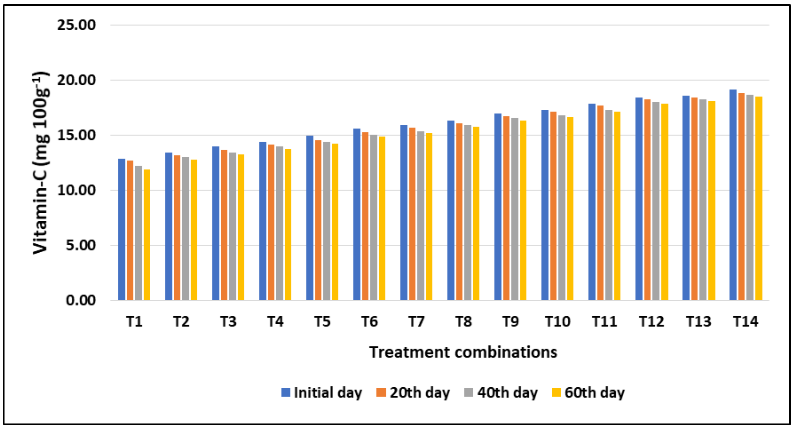


Fig 6: Effect of *Dioscorea* flour blended with *Moringa* leaf powder on palm jiggery cookies Vitamin C (mg 100 g^{-1}) at different days of storage

Moisture (%)

The data recorded for moisture (%) of cookies as influenced by treatments with preparation of palm jaggery is presented in table 1. The data for the treatments showed significant differences were recorded for moisture (%) of cookies prepared with palm jaggery.

Among treatments, the lowest moisture content of 4.34% in T_1 (20 DF: 0 MP: 80 WF) and highest moisture content of 10.12% was recorded in T_{14} (100 DF: 0 MP: 0 WF) at the initial day of storage in cookies prepared with palm jaggery. It is also observed that the data showed the increase in moisture percent of cookies from initial day to 60^{th} day of storage. Among the treatments as the storage days increase, the moisture content increases to an extent of range from 4.34% to 10.58%. The increase in moisture content of cookies during storage might be due to hygroscopic nature of flour and jaggery used in product preparation as reported by Sadhu *et al*. (2013) [2] in cookies prepared with carrot flour and Adeyeye *et al*. (2014) [2] in sweet potato flour cookies. The parameter for moisture percent of cookies which was recorded significant lowest of 5.11% in T_1 (20 DF: 0 MP: 80 WF) followed by 5.39% in T_2 (20 DF: 5 MP: 75 WF) found to be best among different treatments of cookies prepared with palm jaggery at 60 days after storage.

Fibre (%)

The data recorded for fibre (%) of cookies prepared with palm jaggery as influenced by treatments showed significant differences and presented in Table 1.

Among treatments, the highest fibre content of 4.19% in T_{14} (100 DF: 0 MP: 0 WF) and the lowest fibre content of 2.87% was recorded in T_1 (20 DF: 0 MP: 80 WF) at initial day of storage in cookies. It is also observed that the decrease in fibre per cent of cookies from initial day to 60^{th} day of storage. Among the treatments, minimum reduction in fibre content from 3.79% to 3.31% in T_2 (20 DF: 5 MP: 75 WF) and maximum reduction in fibre content from 5.93% to 5.18% was recorded in T_{12} (40 DF: 15 MP: 45 WF) of cookies. The decrease in fibre content of cookies during storage might be due to increase in the moisture content of cookies during storage as observed in cookies prepared with cashew nut flour and wheat flour by Ojinnaka and Agubolum (2013) [11] and in cocoyam flour and wheat flour by Igbabul *et al*. (2015) [7]. The minimum reduction of 0.48% fibre content of cookies which was recorded in T_2 followed by T_2 of 0.54% in cookies found to be best among different treatments at 60 days after storage.

Protein (%)

The data for the treatments showed significant differences for protein (%) of cookies prepared with palm jaggery as influenced by treatments is presented in table 2.

Among treatments, the highest protein content of 31.24% in T_{14} (100 DF: 0 MP: 0 WF) and lowest protein content of 12.72% was recorded in T_1 (20 DF: 0 MP: 80 WF) at the initial day of storage in cookies prepared with palm jaggery. It is also observed that the data showed the decrease in protein per cent of cookies from initial day to 60^{th} day of storage. Similarly, minimum reduction in protein content from 14.95% to 14.10% was observed in T_2 (20 DF: 5 MP: 75 WF) and maximum reduction in protein content from 16.78% to 13.62% was observed in T_6 (30 DF: 5 MP: 65 WF) in cookies prepared with palm jaggery. There is a significant decrease in protein per cent of cookies during storage; this might be due to the formation of amino acids from proteins as stated by Idowu (2014) [6], Igbabul *et al*. (2015) [7] and Paul and Bhattacharya (2015).

The minimum reduction of protein content of 0.85% in 20 DF: 5 MP: 75 WF (T_2) followed by 0.93% in 20 DF: 0 MP: 80 WF (T_1) of palm jaggery cookies found to be best among different treatments at 60 days after storage.

Starch (%)

The data for the treatments showed significant differences were recorded for starch (%) of cookies prepared with palm jaggery and presented in Table 2.

Among treatments, the highest fibre content of 79.68% in T_{14} (100 DF: 0 MP: 0 WF) and lowest fibre content of 58.72% was recorded in T_1 (20 DF: 0 MP: 80 WF) at initial day of storage in cookies prepared with palm jaggery. It is also observed that the data showed a decrease in starch per cent of cookies from initial day to 60^{th} day of storage. Among the treatments, maximum reduction in starch content from 58.72% to 48.42% was recorded in T_1 (20 DF: 0 MP: 80 WF) and minimum reduction in starch content from 58.70% to 52.49% was observed in T_8 (30 DF: 15 MP: 35 WF) in cookies prepared with palm jaggery. As the storage period advances starch per cent in cookies decreases this is due to transformation of starch into simple sugars as reported by Idowu (2015) and Dourado *et al.* (2021) [4].

The maximum reduction of starch content of 10.30% in 20 DF: 0 MP: 80 WF (T_1) followed by 10.28% in 30 DF: 15 MP: 35 WF (T_8) of palm jaggery cookies found to be best among different treatments at 60 days after storage.

Potassium (%)

The data for the treatments showed significant differences were recorded for potassium (%) of cookies prepared with palm jaggery and presented in Table 3.

Among treatments, the highest potassium content of 0.271% in T_{12} (40 DF: 15 MP: 45 WF) and lowest potassium content of 0.177% was recorded in T_1 (20 DF: 0 MP: 80 WF) at initial day of storage in cookies prepared with palm jaggery. It is also observed that the data showed a decrease in potassium per cent of cookies from initial day to 60^{th} day of storage. The minimum reduction in potassium content from 0.193% to 0.181% in T_2 (20 DF: 5 MP: 75 WF) and maximum reduction in potassium content from 0.199% to 0.180% was recorded in T_6 (30 DF: 5 MP: 65 WF) in cookies prepared with palm jaggery. As storage period advances mineral content in cookies decreases this might be due to heat-induced chemical reaction between amino acids and reducing sugars to form compounds that bind minerals as reported by Nadarajah and Mahendran (2015) [9] and Herminia *et al.* (2017) [5].

The minimum reduction of potassium content of 0.012% in T_2 followed by 0.013% in T_1 of cookies prepared with palm jaggery cookies found to be best among different treatments at 60 days after storage.

Vitamin C (mg 100 g^{-1})

The data for the treatments showed significant differences were recorded for vitamin C (mg 100 g^{-1}) content of cookies prepared with palm jaggery is presented in Table 3.

Among treatments, the highest Vitamin C content of 19.18 mg 100 g^{-1} was recorded in T_{14} (100 DF: 0 MP: 0 WF) and lowest Vitamin C content of 12.91 mg 100 g^{-1} was recorded in T_1 (20 DF : 0 MP : 80 WF) at initial day of storage in cookies prepared with palm jaggery. It is also observed that the data showed the decrease in Vitamin C content of cookies from initial day to 60^{th} day of storage. Among the treatments, minimum reduction in Vitamin C content from 13.45 mg 100 g^{-1} to 12.97 mg 100 g^{-1} was observed in T_2 (20 DF: 5 MP: 75 WF) and maximum reduction in Vitamin C content from 12.91 mg 100 g^{-1} to 11.91 mg 100 g^{-1} was observed in T_1 (20 DF: 0 MP: 80 WF) in cookies prepared with palm jaggery. As the storage period advances vitamin C content decreases this might be due to oxidation of ascorbic acid into dehydroascorbic acid. Similar results were also reported by Thungchano *et al.* (2020) [13] and Obioma *et al.* (2021) [10].

The minimum reduction of vitamin C content of cookies which was recorded in T_2 of 0.48 mg 100 g^{-1} followed by 0.50% in T_1 of palm jaggery cookies found to be best among different treatments at 60 days after storage.

Conclusion

In the present study, results revealed that moisture (%) of cookies shows an increasing trend as storage period advances to 60 days. Whereas, remaining parameters like fibre (%), protein (%), starch (%), potassium (%) and vitamin-C (mg 100 g^{-1}) decreases with increase in the storage period to 60 days. Among the treatments, the blend ratio of 20 DF: 5 MP: 75 WF and 20 DF: 0 MP: 80 WF cookies prepared by using palm jaggery are found to be best at 60 days of storage period for all the chemical parameters studied under this experiment.

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