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Study on preparation procedure and standardization of recipe for tikhur *Barfi*

■ DEO SHANKAR*, N. SHUKLA[1], J.L. NAG[2] AND M.K. SAHU[3]
Shaheed Gundadhoor College of Agriculture and Research Station (I.G.K.V.), Jagdalpur, BASTAR (C.G.) INDIA
(Email: deo1975ram@gmail.com)
[1]Department of Horticulture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, RAIPUR (C.G.) INDIA
[2]Department of Horticulture, College of Agriculture (I.G.K.V.), KANKER (C.G.) INDIA
[3]Krishi Vigyan Kendra (I.G.K.V.), NARAYANPUR (C.G.) INDIA

*Author for Correspondence

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SUMMARY :

An investigation was conducted at Indira Gandhi Krishi Vishwavidyalaya, Shaheed Gundadhoor College of Agriculture and Research Station, Kumhrawand, Jagdalpur, Bastar, Chhattisgarh in Horticultural laboratory under AICRP on Tuber Crops and RKVY#16. The experiment was undertaken during January, 2010 and January, 2011. The experiment was laid out in Completely Randomized Design in which 16 treatments tested in three replications for identification of best recipe for preparation of tikhur *Barfi*. High rhizome and starch yielded genotype IGSJT-10-2 of tikhur was selected as an experimental material and starch of above genotype used for preparation of tikhur *Barfi*. Tikhur *Barfi* was prepared in Horticulture laboratory for evaluation of best recipe among 16 different treatments. The different recipe combination of tikhur starch, sugar and water in 16 treatments were taken to standardize the recipe. The results clearly indicated that the highest score was also awarded to recipe T_{16} for sweetness. Highest score of 9.0 was awarded by panel of 11 judges after organoleptic taste of tikur *Barfi* to treatment T_8=1:1.5:2.5 (Tikhur starch: Sugar: Water). The hedonic scale rating of treatment T_8 was awarded liked extremely (LE) and liked slightly (LS) after 10 days storage by Judges. The highest score was awarded to treatment T_8 for its appearance, flavour, fibrousness sweetness, texture and moisture content and similarly T_8 also recorded. Highest score was also awarded to treatment T_8 for overall acceptability just after preparation and after 10 days storage by panel of judges. On the basis of above findings it can be concluded that the treatment or recipe combination T_8=1:1.5:2.5 (Tikhur starch: Sugar: Water) was best for the preparation of tikhur *Barfi*. On the other hands tikhur *Barfi* prepared through the recipe 1:1.5 2.5 (Tikhur starch: Sugar: Water) had a pleasant flavour, texture, taste moisture, texture appearance and over all acceptability.

KEY WORDS : Tikhur, *Curcuma angustifolia* Roxb., Tikhur *barfi*, Organoleptic score, Hedonic scale rating, Recipe

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Tikhur (*Curcuma angustifolia*; family Zingiberaceae) is a rhizomatous herb also known as white turmeric or East Indian Arrowroot. It's cultivation has now been undertaken by the farmers of Bastar on a large area. Tikhur cultivated as medicinal crop in many parts of the state under moist deciduous mixed and *sal* forest of Madhya Pradesh,

Chhattisgarh and Jharkhand. It is generally propagated by rhizomes and good source of starch and fibre (Misra and Dixit, 1983). Tikhur is also found in central province, Bihar, Maharashtra and Southern part of India. In undivided Madhya Pradesh, it is widely distributed in Bastar, Balaghat, Chhindwara, Surguja, Bilaspur, Raipur and Mandla districts (Kirtikar and Basu, 1918). In Chhattisgarh, it is found abundantly in the hilly tracts and forests of Bastar, Dantewada, Bijapur, Narayanpur, Kanker, Rajnandgaon, Kawardha, Dhamtari, Bilaspur, Raipur, Korba, Korea and Surguja districts. The total collection of tikhur rhizome as a minor forest produce in Chhattisgarh is 190.00 tonnes. Bastar and Bilaspur divisions are the major potential area of the state for tikhur (Anonymous, 2005). Two types of tikhur are found in the Bastar division; one with creamy white flowers and another having light pink coloured flowers (Singh *et al.,* 1999). Tikhur rhizomes are used as appetizer reducing burning sensations and stomach pains, removal of stone from kidney, useful for ulcer patient (Sharma, 2003) and rhizome pulp is used for treatment of headache as well as it gives cooling effect (Nag *et al.,* 2006). The fresh rhizomes of tikhur are used for the preparation of starchy flour, which has medicinal value and aliment for many diseases. The rhizome pulp is a remedy for fever, joint pains and leucorrhoea. The starch obtained from the rhizomes is highly nutritious and easily digestible, therefore, it is recommended for infants, weak children and invalids. The starch can be consumed by individuals during fast as it is rich in energy. The starch of tikhur is used for the preparation of many sweet meals and herbal dishes like *Halwa, Barfi, Jalebi* etc. It is used specially during fast (*Vrata, Upwas*). Farmers also prepare herbal drink "*Sarbat*" through tikhur starch during summer due to its cooling effect (Singh and Palta, 2004). The rhizomes of tikhur contains 69-70 per cent moisture, starch 25-30 per cent, crude protein 1.6 per cent, fat 0.2 per cent, sugar and dextrins 2.1 per cent, crude fibre 3.9 per cent and ash 0.9 per cent (Deshpande, 2008). The essential oil composition of tikhur rhizomes are *ar*-curcumene 27.8 per cent, β- Pinene 17.9 per cent, α – Terpineol 13.4 per cent, Camphor 12.1 per cent, Zingiberol 9.5 per cent and Borneol 7.0 per cent (Banerjee *et al.,* 1980).

Availability of starch in large quantity and at low cost resulted in various pharmaceutical application of starch and its derivatives, besides its principle utilization as food. In food industries, starch is used to impart functional properties to processed foods such as thickening binding filling and taste. Starch is used as a component in puddings, pies, jellies, biscuits, bakery products, ice cream, canned soups, instant desserts processed meats, sauces and in various infant and invalid, food mixtures. Starch is also used for manufacturing a number of sweetness, syrups and to feed enzymes for a popular taste enhancer. Better post harvest management and diversification for production of value added products is one of the dependable methods to make tikhur crop lucrative to both farmers and entrepreneurs. The tikhur starch is used for preparation of many sweet meals and may herbal dishes like *Halwa, Barfi, Jalebi, Sarbat* etc. Among these value-added products or dishes the tikhur *Barfi* is more popular and liking by people. In future the tikhur *Barfi* may be best value added herbal sweets of tikhur in all over India and it may be famous sweets of Bastar. Due to lack of standard recipe for value added product of tikhur not gaining popularity among the people of urban areas.

Very little information is available regarding this crop especially production, processing and value addition under agro-climatic condition of Chhattisgarh. These kinds of work would ensure *ex-situ* conservation of medicinal plants, besides the economical up scaling of farmers and the augmentation of supply of raw material to pharmaceutical industries. Looking to the importance of the crop for people of the Chhattisgarh an investigation on the preparation procedure and standardization of recipe for Tikhur *Barfi* and to find out the best recipe for preparation of value added product tikhur *Barfi* from starch of tikhur was undertaken.

EXPERIMENTAL METHODS

The investigation was conducted at IGKV, Shaheed Gundadhoor College of Agriculture and Research Station, Kumhrawand, Jagdalpur, Bastar, Chhattisgarh in Horticultural laboratory. The experiment was undertaken during January, 2010 and January, 2011. The experiment was laid out in Completely Random Design in which 16 treatments tested in three replications for identification of best recipe for preparation of tikhur *Barfi*. High rhizome and starch yielded genotype IGSJT-10-2 of tikhur was selected as an experimental material and starch of above genotype used for preparation of tikhur *Barfi*. Tikhur *Barfi* was prepared in Horticulture laboratory for evaluation of best recipe among 16 different treatments. The different recipe combination of tikhur starch, sugar and water in 16 treatments were taken to standardize the recipe. The treatments are as follows: T_1= 1 : 1 : 1 (Tikhur starch : Sugar : Water), T_2= 1 : 1 : 1.5, T_3=1 : 1 : 2, T_4=1 : 1 : 2.5, T_5= 1 : 1.5 : 1, T_6= 1 : 1.5 : 1.5, T_7= 1 : 1.5 : 2, T_8= 1 : 1.5 : 2.5, T_9=1 : 2 : 1, T_{10}= 1 : 2 : 1.5, T_{11}= 1 : 2 : 2, T_{12}= 1 : 2 : 2.5, T_{13}= 1 : 2.5 : 1, T_{14}=1 : 2.5 : 1.5, T_{15}= 1 : 2.5 : 2 and T_{16}= 1 : 2.5 : 2.5. Tikhur starch and sugar were weighed as per treatment and water added during preparation. Tikhur starch taken 100 g and first dipped in 500 ml water for 10 minutes for cleaning of inert matter. Then in cleaned starch add the sugar and water as per treatments required and cooking in pan. The level of burner always keeps on medium and continuously stirred through spoon. After 3-4 minutes of stirring solution of starch, sugar and water were start coagulation during this period total soluble solids were measured by Hand Refractometer. Then after 5-6 minutes the solution was totally coagulated and put on plate for setting

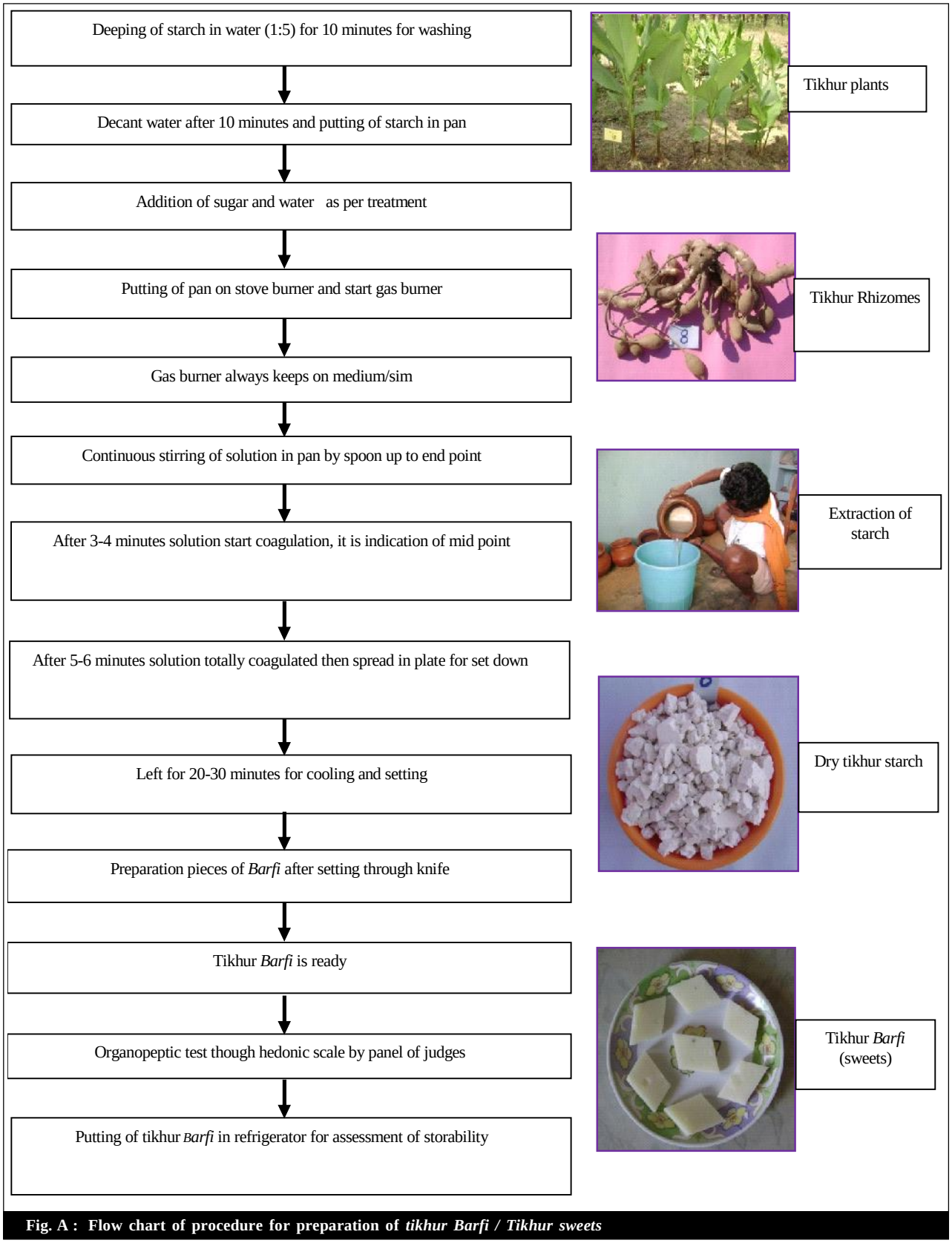


Fig. A : Flow chart of procedure for preparation of *tikhur Barfi / Tikhur sweets*

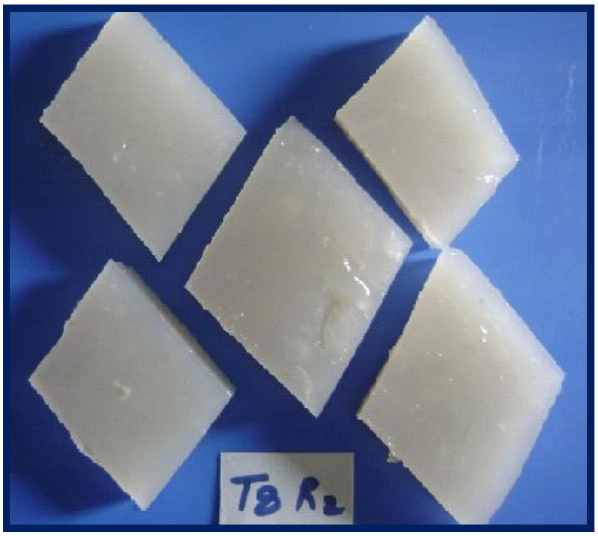
1. Tikhur starch

2. Dipping of starch in water

3. Decanting of water after 10 minutes

4. Addition of water, sugar and cooking in pan

5. Spreading of cooked solution on plate for setting



6. Made pieces as tikhur *Barfi*

Fig. B : Photo 1-6 : Preparation procedure of tikhur *Barfi*

down to give shape of *Burfi*. After setting and cooling of coagulated material, prepared pieces through knife to give shape of tikhur *Burfi* and it is ready for taking different observations and organopeptic test though hedonic scale. Flow chart for preparation of tikhur *Barfi* is given in Fig. A and Fig. B (Photographs 1-6). The tikhur *Barfi* were evaluated in three replications by a panel of 11 judges consisting of staff and students of SG College of Agriculture and Research Station, Kumhrawand, Jagdalpur, Chhattisgarh for organoleptic test. Scoring was done for various characters based on 10 marks headonic scale rating (Amerine *et al*., 1965). The values given by each of the 11 judges were then averaged for statistical analysis. Observations were recorded on the following parameters and averaged for statistical analysis and interpretation there are (a) Appearance, (b) Flavour, (c) Fibrousness, (d) Sweetness, (e) Texture, (f) Moisture, (g) Overall acceptability. Different parameters like Total Soluble Solids (TSS) of tikhur *Barfi*, Organoleptic test of tikhur *Barfi* through hedonic scale, Storability of tikhur *Barfi* and colour of *Barfi* were studies under the experiment.

EXPERIMENTAL FINDINGS AND ANALYSIS

The findings of the present study as well as relevant discussion have been presented under following heads :

Estimation of total soluble solids (TSS), final weight of prepared product (*Barfi*), storability of *Barfi* and weight loss during storage of tikhur *Barfi* (2010-11 and 2011-12) :

The tikhur *Barfi* prepared through different recepies was subjected to analysis for determination of total soluble solids (%), final weight of prepared product (g), storability of tikhur *Barfi* (days) and weight loss during storage (%) and standardization of recipe for preparation of tikhur *Barfi*. The results obtained are presented in the Table 1 for the year 2010-11 (Table 1).

Total soluble solids (*%*) :

Treatment T_{13} had the maximum total soluble solids (49.67%) followed by T_{13} (48.33%) and T_9 (47.67%). The lowest total soluble solids (29.33%) were observed in treatment T_3 in the year 2010-11. The maximum total soluble solids (48.0%) of tikhur *Barfi* was recorded in treatment T_{13} followed by T_{14} (47.0%) and T_9 (47.0%). The lowest total soluble solids 29.67 per cent were recorded in both treatments which were T_2 and T_3 in the year 2011-12.

Final weight of prepared product (*g*) :

Final weight of prepared product was recorded highest in treatment T_{16} (258g) followed by T_{15} (255.98g). The lowest weight of prepared product was recorded in treatment T_1

Table 1 : Estimation of total soluble solids (TSS), final weight of prepared product (*Barfi*), storability of *Barfi* and weight loss during storage of tikhur *Barfi* (2010-11 and 2011-12)

Treatments	Estimation of parameters during 2010-2011				Estimation of parameters during 2011-2012			
	Total soluble solids (%)	Final weight of prepared product (g)	Storability of tikhur *Barfi* (days)	Weight loss during storage (%)	Total soluble solids (%)	Final weight of prepared product (g)	Storability of tikhur *Barfi* (days)	Weight loss during storage (%)
T_1	32.00	132.94	5.00	9.63	31.33	132.60	4.67	10.28
T_2	30.00	159.67	6.00	24.06	29.67	158.28	6.00	20.48
T_3	29.33	176.71	6.00	19.07	29.67	175.75	6.00	22.33
T_4	30.33	226.21	5.33	35.79	30.67	223.96	5.00	35.78
T_5	38.00	200.54	6.00	13.17	37.33	199.51	6.00	13.17
T_6	38.00	211.90	6.00	20.61	36.00	210.79	6.00	20.63
T_7	34.00	207.73	6.00	24.87	34.33	207.54	6.00	24.90
T_8	30.67	236.10	6.00	29.82	30.33	235.44	7.00	29.79
T_9	47.67	187.13	2.66	9.75	47.00	186.75	2.00	9.74
T_{10}	44.00	208.28	7.00	13.22	43.33	208.03	6.67	13.19
T_{11}	40.67	229.17	7.00	12.50	40.00	230.51	6.67	12.49
T_{12}	35.67	236.42	6.00	19.55	36.00	235.28	6.00	18.88
T_{13}	49.67	238.25	3.00	7.13	48.00	237.72	2.33	8.29
T_{14}	48.33	244.99	8.00	10.50	47.00	244.68	8.00	10.48
T_{15}	37.67	255.98	8.67	17.46	38.00	255.88	8.66	17.48
T_{16}	35.67	258.00	8.67	18.37	35.00	257.32	9.00	18.34
C.D. (P=0.05)	2.99	5.004	0.48	1.245	2.884	4.526	0.54	1.702
S.E. (d)	1.462	2.439	0.24	0.609	1.409	2.212	0.26	0.832
S.E.±	1.034	1.724	0.17	0.430	0.997	1.564	0.19	0.588
C.V. (%)	4.763	1.401	4.74	4.176	4.652	1.275	5.37	5.687

Table 2 : Organoleptic score of tikhur *Barfi* work out by judges on hedonic scale for standardization of recipe

Treatments	Organoleptic score of tikhur *Barfi* on hedonic scale (2010-2011)								Organoleptic score of tikhur *Barfi* on hedonic scale (2011-2012)							
	Appearance	Flavour	Fibrousness	Sweetness	Texture	Moisture	Over all accept-ability	Hedonic scale rating	Appearance	Flavour	Fibrousness	Sweetness	Texture	Moisture	Over all accept-ability	Hedonic scale rating
T_1	4.55	5.91	4.64	7.09	6.45	3.27	4.45	DS	2.45	3.82	4.91	4.82	4.82	3.27	4.36	DS
T_2	5.55	6.36	5.00	7.64	6.64	4.55	5.18	NLND	3.55	5.27	5.09	5.27	5.18	4.82	5.09	NLND
T_3	6.18	6.64	5.27	6.91	6.91	4.64	5.00	NLND	5.09	6.00	5.18	6.55	6.55	5.00	4.82	DS
T_4	6.64	7.09	5.27	7.64	6.73	5.73	5.64	NLND	6.91	6.27	5.18	2.45	6.00	5.91	5.73	NLND
T_5	6.18	6.91	5.09	7.55	6.91	5.64	5.91	NLND	4.91	5.55	5.27	6.36	5.82	5.64	5.73	NLND
T_6	6.73	7.27	5.27	6.91	7.18	5.55	6.18	LS	5.82	6.91	5.55	7.09	7.18	5.64	6.09	LS
T_7	7.00	7.00	5.91	7.27	6.91	6.82	7.09	LM	6.55	7.00	6.00	7.27	7.45	6.91	7.36	LM
T_8	8.36	8.64	8.09	8.27	8.18	8.64	9.00	LE	8.55	8.55	7.91	8.64	8.00	8.64	8.91	LE
T_9	4.36	6.00	3.09	5.18	2.91	3.18	2.82	DVM	2.91	3.82	3.36	3.45	2.64	3.27	3.09	DM
T_{10}	6.55	7.18	4.73	6.18	6.00	5.36	5.82	NLND	4.36	4.91	4.64	4.82	4.45	4.91	5.64	NLND
T_{11}	6.73	6.64	6.27	5.73	6.91	6.55	6.82	LS	6.18	6.73	6.27	6.82	6.82	7.18	6.82	LS
T_{12}	7.64	7.91	6.09	7.73	6.55	7.09	6.82	LS	7.73	6.45	6.09	7.09	6.82	7.18	6.82	LS
T_{13}	1.73	2.82	2.45	2.64	4.18	2.64	2.18	DVM	1.73	2.91	2.36	5.73	2.73	2.91	2.18	DVM
T_{14}	7.09	4.91	5.27	5.55	5.64	5.82	7.09	LM	6.64	4.91	5.00	5.09	5.27	5.00	6.64	LS
T_{15}	7.27	5.82	6.00	5.45	6.00	5.45	7.09	LM	7.27	5.82	5.64	5.09	6.00	5.09	6.45	LS
T_{16}	7.82	7.09	6.64	8.27	6.64	5.27	6.55	LS	7.91	7.18	6.36	8.64	6.36	6.09	7.00	LM

(132.94) in the year 2010-11. Final weight of prepared product was recorded maximum in treatment T_{16} (257.32g) followed by T_{15} (255.88 g) whereas, lowest was observed in treatment T_1 (132.60 g) during the year 2011-12.

Storability of tikhur Barfi (*days*) :

Maximum storability of tikhur *Barfi* was observed in treatment T_7, T_8, T_{11}, T_{12}, T_{14}, T_{15} and T_{16} (10 days) which were significantly superior to other treatments. The minimum storability was observed in treatment T_9 (2 days) in the year 2010-11. Maximum storability of tikhur *Barfi* was observed in treatment T_8, T_{11}, T_{12}, T_{15} and T_{16} (10 days) which were significantly superior to other treatments. The minimum storability was observed in treatment T_9 (2 days) during the year 2011-12.

Weight loss during storage (*%*) :

The maximum per cent weight loss (35.79%) of tikhur *Barfi* during storage was recorded in treatment T_4 which was significantly superior than all other treatments. Minimum weight loss (7.13%) of tikhur *Barfi* during storage was recorded in treatment T_{13} in the year 2010-11. Treatment T_4 had the maximum weight loss of tikhur *Barfi* during storage which was 35.78 per cent and was significantly superior then other treatments and minimum 8.29 per cent was recorded in treatment T_{13} during the year 2011-12.

Organoleptic score of tikhur Barfi (*2011-12*) :

The organoleptic score of tikhur *Barfi* was recorded at just after preparation for different parameters like appearance, flavour, fibrousness, sweetness, texture, moisture and overall acceptability in horticulture laboratory. Keeping these various attributes of tikhur *Barfi*, the results are presented in Table 2 for both the years 2010-11 and 2011-12.

Highest organoleptic score of 8.36 was awarded to recipe T_8 for its appearance and lowest score was 1.73 for recipe T_{13}. In case of flavour of tikhur *Barfi* treatment T_8 had the highest score 8.64 for its flavour and lowest score was 2.82 for recipe T_{13}. Treatment T_8 awarded highest score 8.09 for its fibrousness and lowest score was 2.45 for recipe T_{13}. For sweetness of tikhur *Barfi*, treatment T_8 and T_{16} both were awarded highest score 8.27 and lowest score was 2.64 for recipe T_{13}. While, treatment T_8 had highest score 8.18 for texture and lowest score was 2.91 for recipe T_9. Treatment T_8 was awarded highest score 8.64 for moisture and lowest score was 2.64 for T_{13}. The overall acceptability (which were average of all sensory characters) of tikhur *Barfi* was highest *i.e.* 9.0 which was noted in T_8 whereas lowest was recorded 2.18 under T_{13}. The hedonic scale rating indicated that the treatment T_8 was awarded liked extremely (LE) by judges as compared to rest of the treatments there for treatment T_8= 1:1.5:2.5 (Tikhur starch: Sugar: water) is the best treatment for preparation of tikhur *Barfi* during the year 2010-11.

Organoleptic scores awarded by panel of 11 judges and given in Table 2 for the year 2011-12. The highest score of 8.55 was awarded to treatment T_8 for its appearance whereas, lowest was 1.73 under T_{13}. In case of flavour the highest organoleptic score of 8.55 was observed under treatment T_8 for its flavour and lowest 2.91 under was for T_{13}. The treatment T_8 had the highest organoleptic score 7.91 for its fibrousness and lowest was 2.36 for treatment T_{13}. For sweetness of tikhur *Barfi* treatment T_8 and T_{16} recorded the highest score of 8.27 and lowest 2.45 under treatment T_4. Highest score of 8.00 was awarded to treatment T_8 for its texture and lowest score was 2.73 to treatment T_{13}. Highest score of 8.64 was awarded to treatment T_8 for its moisture content and lowest score was 2.91 to treatment T_{13}. The overall acceptability recorded that the highest score of 8.91 was found under T_8 the recipe *i.e.* 1:1.5:2.5 (Tikhur starch: Sugar: water) while lowest score 2.18

Table 3 : Treatments and hedonic scale rating given by panel of 11 judges during organoleptic evaluation of tikhur *Barfi*

Sr. No.	Treatment details	Over all organoleptic rating (2010-11)	Over all organoleptic rating (2011-12)
1.	T_1= 1 : 1 : 1 (Tikhur Starch : Sugar : Water)	Disliked slightly (DS)	Disliked slightly (DS)
2.	T_2= 1 : 1 : 1.5 (Tikhur Starch : Sugar : Water)	Neither liked nor disliked (NLND)	Neither liked nor disliked (NLND)
3.	T_3= 1 : 1 : 2 (Tikhur Starch : Sugar : Water)	Neither liked nor disliked (NLND)	Disliked slightly (DS)
4.	T_4= 1 : 1 : 2.5 (Tikhur Starch : Sugar : Water)	Neither liked nor disliked (NLND)	Neither liked nor disliked (NLND)
5.	T_5= 1 : 1.5 : 1 (Tikhur Starch : Sugar : Water)	Neither liked nor disliked (NLND)	Neither liked nor disliked (NLND)
6.	T_6= 1 : 1.5 : 1.5 (Tikhur Starch : Sugar : Water)	Liked slightly (LS)	Liked slightly (LS)
7.	T_7= 1 : 1.5 : 2 (Tikhur Starch : Sugar : Water)	Liked moderately (LM)	Liked moderately (LM)
8.	T_8= 1 : 1.5 : 2.5 (Tikhur Starch : Sugar : Water)	Liked extremely (LE)	Liked Extremely (LE)
9.	T_9= 1 : 2 : 1 (Tikhur Starch : Sugar : Water)	Disliked very much (DVM)	Disliked moderately (DM)
10.	T_{10}= 1 : 2 : 1.5 (Tikhur Starch : Sugar : Water)	Neither liked nor disliked (NLND)	Neither liked nor disliked (NLND)
11.	T_{11}= 1 : 2 : 2 (Tikhur Starch : Sugar : Water)	Liked slightly (LS)	Liked slightly (LS)
12.	T_{12}= 1 : 2 : 2.5 (Tikhur Starch : Sugar : Water)	Liked slightly (LS)	Liked slightly (LS)
13.	T_{13}= 1 : 2.5 : 1 (Tikhur Starch : Sugar : Water)	Disliked very much (DVM)	Disliked very much (DVM)
14.	T_{14}= 1 : 2.5 : 1.5 (Tikhur Starch : Sugar : Water)	Liked moderately (LM)	Liked slightly (LS)
15.	T_{15}= 1 : 2.5 : 2 (Tikhur Starch : Sugar : Water)	Liked moderately (LM)	Liked slightly (LS)
16.	T_{16}= 1 : 2.5 : 2.5 (Tikhur Starch : Sugar : Water)	Liked slightly (LS)	Liked moderately (LM)

Table 4 : Organoleptic score of tikhur *Barfi* during storage (at two days intervals) and storability (in days)

Treatments	Over all acceptability after storage (2010-11)					Average 2010-11	Over all acceptability after storage (2011-12)					Average 2011-12	Storability of tikhur *Barfi* (in days)	
	2 DAST	4 DAST	6 DAST	8 DAST	10 DAST		2 DAST	4 DAST	6 DAST	8 DAST	10 DAST		2010-11	2011-12
T_1	4	3.5	0	0	0	3.75	4	3	0	0	0	3.50	4.0	4.0
T_2	5	4.5	3	0	0	4.16	5	4	2	0	0	3.60	6.0	6.0
T_3	4.5	4	3	0	0	3.83	4.5	4	3	0	0	3.83	6.0	6.0
T_4	5	4	3.5	0	0	4.16	5	4	3	0	0	4.00	6.0	6.0
T_5	5.5	5	4	0	0	4.83	5	4.5	3	0	0	4.16	6.0	6.0
T_6	6	5.5	4	0	0	5.16	5.5	5	3	0	0	4.50	6.0	6.0
T_7	6.5	6	5.75	5	3	5.25	6.5	6	5	3	0	5.12	10.0	8.0
T_8	8.5	8	6	5	4	6.30	8	8	6	5	4	6.20	10.0	10.0
T_9	1	0	0	0	0	1.00	1	0	0	0	0	1.00	2.0	2.0
T_{10}	5.5	4	2	0	0	3.83	5	4	2	0	0	3.67	6.0	6.0
T_{11}	6.5	5	4	3.5	2	4.20	7	5	4	3	2	4.20	10.0	10.0
T_{12}	6.5	5	4.5	3	2	4.20	7	5	4	3	2	4.20	10.0	10.0
T_{13}	2	1	0	0	0	1.50	2	0	0	0	0	2.00	4.0	2.3
T_{14}	6	5	4.5	3	2	4.10	6	4	3.5	2	0	3.87	10.0	8.0
T_{15}	6	5	4	3	1	3.80	6	4.5	4	3	1	3.70	10.0	10.0
T_{16}	6	5.5	4	3	2	4.10	6	5.5	4	3.5	2	4.20	10.0	10.0

was under the treatment T_{13}. The treatment T_8 1:1.5:2.5 (Tikhur starch: Sugar: Water). The treatment T_8 = 1:1.5:2.5 (Tikhur starch: Sugar: water) liked extremely through hedonic scope rating as compared to other treatment recipes during the year 2011-12 (Table 3).

Organoleptic score of tikhur Barfi during storage :

The organoleptic score of tikhur *Barfi* was recorded during storage at two days interval for overall acceptability by panel of judges. Keeping these various attributes of tikhur *Barfi*, the results are presented in Table 4 for the year 2010-11 and 2011-12.

The maximum overall acceptability of tikhur *Barfi* was recorded highest (6.3) in T_8 whereas lowest was recorded 1.0 under T_9. The hedonic scale rating indicated that the treatment T_8 was awarded liked slightly (LS) by judges after 10 days storage as compared to rest of the treatments there for treatment T_8= 1:1.5:2.5 (Tikhur starch: Sugar: water) is the best treatment for preparation of tikhur *Barfi* during the year 2010-11.

The maximum overall acceptability of tikhur *Barfi* was recorded highest (6.2) in T_8 whereas lowest was recorded 1.0 under T_9. The hedonic scale rating indicated that the treatment T_8 was awarded liked slightly (LS) by judges after 10 days storage as compared to rest of the treatments, there for treatment T_8= 1:1.5:2.5 (Tikhur starch: Sugar: Water) is the best treatment for preparation of Tikhur *Barfi* during the year 2011-12.

The organoleptic score of tikhur *Barfi* was recorded for different organoleptic parameters and findings are discussed below. Flow chart for preparation of tikhur *Barfi* and preparation procedure is given in Fig. 1 and photographs 1-6. The highest organoleptic score was awarded to recipe T_8 for its appearance flavour, fibrousness, sweetness, texture and moisture. The highest score was also awarded to recipe T_{16} for sweetness. Highest score of 9.0 was awarded by panel of 11 judges after organoleptic taste of tikur *Barfi* to treatment T_8=1:1.5:2.5 (Tikhur starch: Sugar: Water). The hedonic scale rating of treatment T_8 was awarded liked extremely (LE) and liked slightly (LS) after 10 days storage by Judges. The highest score was awarded to treatment T_8 for its appearance, flavour, fibrousness sweetness, texture and moisture content and similarly T_8 also recorded. Highest score was also awarded to treatment T_8 for overall acceptability just after preparation and after 10 days storage by panel of judges. On the basis of above findings it can be concluded that the treatment or recipe combination T_8=1:1.5:2.5 (Tikhur starch: Sugar: Water) was best for the preparation of tikhur *Barfi*. On the other hands tikhur *Barfi* prepared through the recipe 1:1.5 2.5 (Tikhur starch: Sugar: Water) had a pleasant flavor, texture, taste moisture, texture appearance and over all acceptability.

Very little information is available regarding this crop especially processing and value addition and but similar findings in other crops has been done by Sivakumar *et al*. (2011) in Arrowroot Meilgard *et al.* (2010) in Arrowroot and Oudhia (2004) in recipe for preparation of Tikhur *Barfi*.

Summary and conclusion :

Under the experiment treatment T_{13} had the maximum total soluble solids and lowest was observed in T_3. Final weight of prepared product was recorded highest in treatment T_{16} and lowest was in T_1. Weight loss during storage was maximum in treatment T_4 and minimum in treatment T_{13}. Under organoleptic test of tikhur *Barfi* the highest or organoleptic score was awarded to recipe T_8 for its appearance flavour fibrousness sweetness, texture and moisture. The hedonic scale rating of treatment T_8 was awarded liked extremely (LE) by panel of 11 Judges. The treatment T_8 or recipe combination T_8= 1:1.5: 2.5 (Tikhur Starch: Sugar: Water) has been standardized for preparation of tikhur *Barfi*. Treatment T_8 awarded highest organoleptic score by panel of 11 Judges and liked extremely by judges through over all organoleptic rating.

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