

Studies on utilization of gudmar (*Gymnema sylvestre*) dried extract based fennel RTS beverage

DIPAK SHARMA, A.R. SAWATE, B.M. PATIL AND R.B. KSHIRSAGAR

Gymnema sylvestre is a reputed herb in the ayurvedic system of medicine. The phytoconstituents responsible for sweet suppression activity includes triterpene saponins known as gymnemic acids, gymnemasaponins, and a polypeptide, gumarin. The herb exhibits a broad range of therapeutic effects as an effective natural remedy for diabetes. Efforts have been made to prepare gudmar dried extract. Physico-chemical properties of prepared extract were evaluated. On the basis of physico-chemical properties and gymnemic acid content gudmar dried extract was added at 0.75, 1.00 and 1.25 per cent for preparation of gudmar dried extract based fennel RTS beverage. Sugar was also replaced with aspartame, stevia and sucralose. The organoleptic test score indicated that among the fennel RTS beverages, the beverage with 1.0 per cent gudmar dried extract and sucralose as sweetener was accepted by panel members. TSS of the fennel RTS beverage was increased while acidity decreased with increase in proportion of gudmar dried extract. Selected fennel RTS beverage (1.0 % gudmar dried extract and sucralose as sweetener) was found to be rich in gymnemic acid content and organoleptically acceptable.

Key Words : Gudmar, Dried extract, Gymnemic acid, Sucralose, Fennel RTS beverage

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INTRODUCTION

Diabetes mellitus is a complex disorder that characterized by hyperglycemia resulting from malfunction in insulin secretion and/or insulin action both causing by impaired metabolism of glucose, lipids and protein. The chronic hyperglycemia of diabetes is associated with long term damage, dysfunction and failure of various organs (Shanmugasundaram *et al.*, 2011). In

India diabetic patient are increasing day by day and according to world diabetic foundation it has the world's largest diabetes population, followed by China with 43.2 million and it has major concern among health experts and national and international healthcare. World health organization (WHO) has identified diabetes as an epidemic condition and one of the major killers of the decade. Estimation by WHO, there will be about 250 million cases of diabetes mellitus throughout the world by 2025 (Mishra, 2011).

The "destroyer of sugar" is a traditionally used term for *Gymnema sylvestre* because chewing the leaves will abolish the taste of sweetness. The plant belongs to the family *Asclepiadaceae* or milk weed family and occasionally cultivated as medicinal plant. Leaves are opposite, usually elliptic or ovate (1.25-2.0 inch × 0.5-1.25 inch). Flowers are small, yellow, in umbellate cymes

MEMBERS OF RESEARCH FORUM

Author for correspondence :

DIPAK SHARMA, Department of Food Engineering, College of Food Technology, Vasanttrao Naik Marathwada Krishi Vidyapeeth, PARBHANI (M.S.) INDIA

Email : dipaksharma54@gmail.com

Associate Authors' :

A.R. SAWATE, B.M. PATIL AND R.B. KSHIRSAGAR, Department of Food Engineering, College of Food Technology, Vasanttrao Naik Marathwada Krishi Vidyapeeth, PARBHANI (M.S.) INDIA

and follicles are terete, lanceolate, upto 3 inches in length (Kanetkar *et al.*, 2007).

Gymnema sylvestre, a plant of Indian origin is found throughout the tropical and sub-tropical regions of the world. Traditional systems of medicine like Ayurveda employ *Gymnema* in the management of diabetes and associated conditions. In recent years, the plant is commercially cultivated in large scale in Asia and Africa to meet the market needs of Europe, America and Southeast Asia. Most of the commercial source is used in the manufacturing of health care products and food and dietary supplements of antidiabetic and antiobesity categories. These products are available in many dosage forms like tablets, capsules, teas, chewing gums etc., mostly in combination with other ingredients and the gymnemic acids content of the daily-recommended dose differs from 38 to 251 mg (Suzuki *et al.*, 1993). Though *Gymnema sylvestre* has been used for several centuries and considered to be safe, there is a paucity of data on interaction between *Gymnema* and pharmaceuticals or minerals. Even US FDA also states some of the illness and injuries associated with the use of dietary supplements (USFDA, 1993).

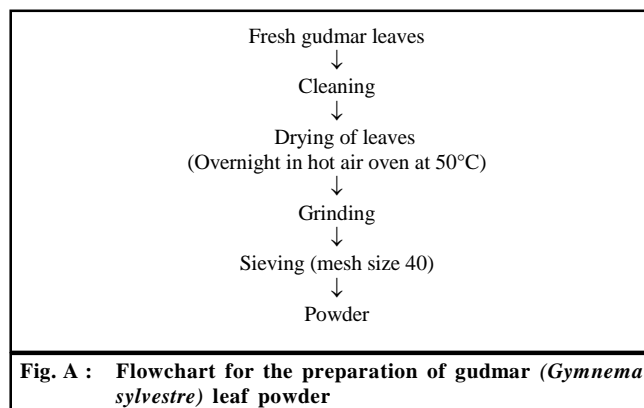
Gymnemic acid is also employed to modify the taste of beverages containing sweeteners with high sweetness. Addition to beverages containing sweeteners like aspartame, Stevia extract, saccharin, and acesulfame K improved the taste (Okamoto *et al.*, 1992). Therefore because of this unique attribute it was suitable for preparation of antidiabetic beverage. The present investigation was undertaken with objective to incorporate antidiabetic gymnemic acid rich dried extract for development of value added antidiabetic beverage.

METHODOLOGY

The present investigation was carried out in Department of Food Engineering, College of Food Technology, VNMKV, Parbhani. Fresh gudmar leaves were obtained from the CFT, Parbhani. Other raw materials like sugar, artificial sweeteners, citric acid and artificial green colour were procured from the local market.

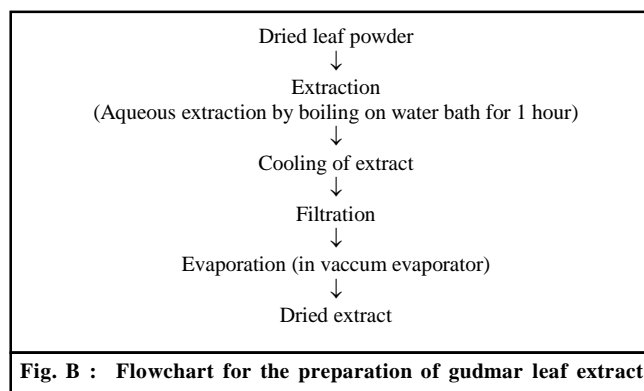
Preparations of gudmar powder :

Gudmar (*Gymnema sylvestre*) leaf powder was prepared as per the method given by Farzana and Muhammad (2010).



Preparations of gudmar dried extract :

Gudmar leaf dried extract was prepared as per the method adopted by Killedar *et al.* (2012). Leaf powder (500 g) was extracted by aqueous extraction method with boiling on water bath for 1 hour and cooled extract was filtered through vacuum filtration unit, evaporated to dryness on rotary film vacuum evaporator (Fig. A). The dried extract was kept in refrigerator for future use.



Physico-chemical properties of gudmar dried extract :

Ash content, foaming index, hot extractive value and pH of gudmar dried extract was determined by method as per WHO (1998). The ethanolic extract of *Gymnema sylvestre* was subfractionated into water soluble (W-S) fraction and water-insoluble (W-INS) fractions by the method reported by Alam *et al.* (2005). Screening of saponins in gudmar dried extract was done as per the method given by Evans (2002). Total gymnemic acid content estimated as per the gravimetric method given by Killedar *et al.* (2012) (Fig. B).

Preparation of gudmar dried extract based fennel RTS beverage :

Gudmar dried extract was added in the beverage (0.75, 1.0 and 1.25 %). The prepared beverage was further organoleptically evaluated and found that beverage with 1.0 per cent of the added gudmar dried extract was most accepted by the panel members. Hence, 1.0 per cent gudmar dried extract was selected in the standardization of recipe. Artificial green colour was used to improve colour properties of prepared beverage. Further sugar was also replaced by artificial sweeteners (aspartame, stevia and sucralose) and prepared beverage organoleptically evaluated (Fig. C).

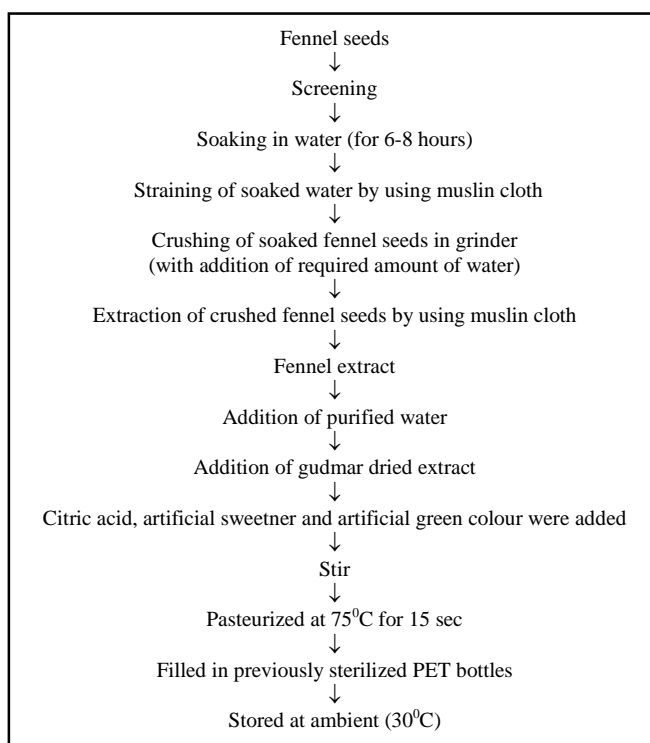


Fig. C : Flowchart for the preparation of gudmar dried extract based fennel RTS beverage

Physico-chemical properties of gudmar dried extract based fennel RTS beverage :

TSS was measured by using Abbe refractrometer, titratable acidity as per the method given by Ranganna (1986) and gymnemic acid content estimated as per the gravimetric method given by Killedar *et al.* (2012).

Storage studies :

Beverage was subjected to storage studies at

ambient temperature and down at specific time interval (15 days) to evaluate organoleptic parameters.

Sensory evaluation of gudmar dried extract based fennel RTS beverage :

Prepared gudmar dried extract based fennel RTS beverage was evaluated for organoleptic characteristics like colour, flavour, taste, and overall acceptability by a panel of semi trained judges, comprised of postgraduate students and academic staff members of College of Food Technology, V.N.M.K.V., Parbhani. Samples were scored based on a nine point hedonic scale. Judges were asked to rate the product on 9 point Hedonic scale with corresponding descriptive terms ranging from 9 'like extremely' to 'dislike extremely' (Meilgaard *et al.*, 1999).

Statistical analysis :

The data obtained was analyzed statistically by Completely Randomized Design (CRD) as per the procedure given by Panse and Sukhatme (1967). The analysis of variance revealed at significance of $P < 0.05$ level, S.E. and C.D. ($P=0.05$) level is mentioned wherever required.

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Physico-chemical properties of Gudmar dried extract :

The data regarding the physico-chemical properties of gudmar dried extract is tabulated in Table I.

Table 1 : Physico-chemical properties of gudmar dried extract

Properties	Dried extract
Hot extractive value % (w/w)	9.3
pH (1% solution)	6.8
Ash (%)	1.90
Water-soluble (W-S) fraction (%)	65
Water-insoluble (W-INS) fraction (%)	35
Foaming index	Less than 100
Saponin test	Positive
Gymnemic acid content (%)	7.33

*Each value is an average of three determinations

The results of physico-chemical properties of dried ethanolic extract revealed that the pH, hot extractive value

and ash content were 6.8, 9.3(%) and 1.90(%), respectively. The ethanolic extract of *Gymnema sylvestre* was further subfractionated into water-soluble (W-S) fraction and water-insoluble (W-INS) fractions by the method reported by Alam *et al.* (2005). The ethanolic extract was stirred in distilled water at room temperature and filtered to give water-soluble (W-S) fraction and water-insoluble (WINS) fractions. The yield obtained of W-S and W-INS were 65% and 35 %, respectively in terms of total ethanolic extract. The foaming index was determined on the basis of method given by WHO (1998) and value obtained was less than 100. These all Physico-chemical parameters were similar with results found in Kumar *et al.* (2014).

The result of saponin test was found positive, it indicated the presence of saponins in dried gudmar extract. Similar results of saponin test were reported by Kumar and Husain (2015). The gymnemic acid content was found 7.33% in aqueously extracted dried gudmar extract. The result expressed was in good agreement with Killedar *et al.* (2012).

Effect of addition of different proportion of gudmar dried extract on physico-chemical composition of fennel RTS beverage :

Results of addition of different proportion of gudmar dried extract on physico-chemical composition of fennel RTS beverage are presented in Table 2.

The process of addition of gudmar dried extract in fennel RTS beverage was selected as per the process supported by Malabadi *et al.* (2016). The proportion of addition of gudmar dried extract was selected on the basis of doses of gudmar extract given for the treatment of diabetes by Al-Romaiyan *et al.* (2010).

The TSS of the control sample was 14°Bx. The TSS

of the sample S₁, S₂ and S₃ were found to be 14.8 °Bx, 15.0 °Bx and 15.2 °Bx, respectively. TSS of control sample was recorded lowest due to no addition of gudmar dried extract. TSS of samples S₁ to S₃ had increasing trend due to increase in proportion of gudmar dried extract.

The pH of control sample of fennel RTS beverage was 3.72. The pH of the sample S₁, S₂ and S₃ were 4.01, 4.10 and 4.18, respectively. S₃ sample had highest pH due to addition of highest amount of Gudmar dried extract. The pH of the samples had increasing trend from S₁ to S₃. It may be due to increase in proportion of Gudmar dried extract having pH near to 6.8 (Kumar *et al.*, 2014).

Acidity of control sample of fennel RTS beverage was 0.77%. The acidity of the sample S₁, S₂ and S₃ were 0.68, 0.65 and 0.63, respectively. Control sample had highest acidity while S₃ had lowest acidity. Decreasing trend in acidity of samples S₁ to S₃ was found due to increase in the pH of the samples as increase in proportion of gudmar dried extract. Study was supported by Kumar *et al.* (2014).

Control sample did not contain gymnemic acid because there was no addition of gudmar dried extract. As per the value shown in table it was found that the gymnemic acid content of S₁, S₂ and S₃ were significantly increasing. The gymnemic acid content of sample S₁ was found to be 164.9 mg/300 ml similarly that of sample S₂ and S₃ were 219.9 mg/300 ml and 274.9 mg/300 ml. Sample S₃ was found statistically superior over all the samples in gymnemic acid content.

Organoleptic evaluation of gudmar (*Gymnema sylvestre*) dried extract based fennel RTS beverage:

The sensory evaluation of gudmar dried extract based fennel RTS beverage was carried out by a ten

Table 2 : Effect of addition of different proportion of gudmar dried extract on physico-chemical composition of fennel RTS beverage

Samples	TSS (°Bx)	pH	Acidity (%)	Gymnemic acid content (mg/300ml)
Control	14.0	3.72	0.77	0
S ₁	14.8	4.01	0.68	164.9
S ₂	15.0	4.10	0.65	219.9
S ₃	15.2	4.18	0.63	274.9
S.E. ±	0.0127	0.0144	0.0017	0.2009
C.D. (P=0.05)	0.0383	0.0434	0.005	0.6048

*Each value is an average of three determinations

Control –without addition of gudmar dried extract

S₁ – With addition of gudmar dried extract 0.75 per cent in beverage

S₂- With addition of gudmar dried extract 1.0 per cent in beverage

S₃- With addition of gudmar dried extract 1.25 per cent in beverage

member semi trained panel. Scores given for colour, flavour, taste and overall acceptability are tabulated in Table 3.

Prepared dried extract totally dissolved in beverage and its colour was light brown that was not contributing good colour to the beverage. Artificial green colour was added to improve the appearance or colour properties of fennel RTS beverage. The result of Table 3 revealed that control sample scored highest (8.8) among all the samples followed by sample S_2 with added gudmar dried extract (1.0 %). Among gudmar added beverage samples, Lowest score was recorded by sample S_3 due to higher proportion of extract imparts brownish colour to the sample that reacts with added artificial green colour and alters appearance of fennel RTS beverage.

Control and sample S_2 was found to be at par with each other and found to be statistically significant over other samples. From the table it was clear that there was significant change in taste of control and samples added with gudmar dried extract. Sample S_2 recorded highest score followed by S_1 and S_3 . S_3 scored the lowest having more amount of dried extract that impart more bitterness to the beverage.

Effect of replacement of sugar with different artificial sweeteners on organoleptic characteristics of gudmar dried extract based fennel RTS beverage:

The sensory evaluation of gudmar dried extract based fennel RTS beverages with addition of different artificial sweeteners were carried out by a ten member semi trained panel. Scores given for organoleptic characteristics are presented in Table 4.

Gymnemic acid is employed to modify the taste of beverages containing sweeteners with high sweetness. Addition to beverages containing sweeteners like aspartame, Stevia extract, saccharin, and acesulfame K improved the taste (Okamoto *et al.*, 1992).

Selected sweeteners like aspartame, stevia and sucralose are low caloric and do not affect colour of beverage. Therefore it is suitable for preparation of anti diabetic RTS beverage. The data in the Table 4 showed that the maximum score was recorded for control sample (8.6) followed by sample P_3 (8.4) which was higher than P_1 and P_2 . The lowest score recorded by sample P_2 with added stevia (0.3%) and dried extract (1.0 %) due to the bitter taste of stevia was concerned in acceptability. Stevia gives bitter after taste was also greatly depend

Table 3 : Organoleptic evaluation of fennel RTS beverage using different proportion of gudmar dried extract

Sample	Sensory attributes			
	Color and appearance	Flavour	Taste	Overall acceptability
Control	8.6	8.9	8.9	8.8
S_1	8.8	8.1	8.2	8.3
S_2	8.9	8.5	8.5	8.6
S_3	8.7	7.6	7.8	8.0
S.E. \pm	0.0129	0.0083	0.0167	0.0159
C.D. (P=0.05)	0.039	0.0118	0.0502	0.048

Control –Without addition of gudmar dried extract

S_1 - With addition of gudmar dried extract 0.75 per cent in beverage

S_2 - With addition of gudmar dried extract 1.0 per cent in beverage

S_3 - With addition of gudmar dried extract 1.25 per cent in beverage

Table 4 : Organoleptic evaluation of gudmar dried extract based fennel RTS beverages using different artificial sweeteners

Samples	Sensory attribute			
	Color and appearance	Flavour	Taste	Overall acceptability
Control	8.9	8.5	8.5	8.6
P_1	8.2	8.1	7.8	8.3
P_2	8.1	8.0	7.7	8.2
P_3	8.3	8.2	8.2	8.4
S.E. \pm	0.0198	0.021	0.0167	0.0222
C.D. (P=0.05)	0.0597	0.0632	0.0502	0.0667

Control – With addition of sugar + 1.0 per cent gudmar dried extract

P_1 – With addition of aspartame (0.4 %) + 1.0 per cent gudmar dried extract

P_2 – With addition of stevia (0.3 %) + 1.0 per cent gudmar dried extract

P_3 – With addition of sucralose (0.2 %) + 1.0 per cent gudmar dried extract

upon the level of stevia. Preliminary study indicated a slight bitter after taste in RTS beverages when the amount of stevia added was more than 0.5%. Stevia also gives negative impact on the total dissolved solids of RTS beverages as given by Saniah and Samsiah (2012). Also from preliminary study it was observed that stevia sweetener not totally dissolved in beverage and settled down and impart some undesirable flavour to the RTS beverage. These problems concern with overall acceptability. From the table it was clear that the sample P₂ (8.4) with added sucralose and dried extract ranked best than P₁ (8.3) and P₂ (8.2) sample after control sample (8.6). Statistically sample P₃ was significantly superior over samples with added dried extract + aspartame and dried extract + stevia due to sucralose totally soluble in beverage and does not give bitter after taste also not impart unacceptable flavour these all things improve overall acceptability of RTS beverage. Similar result for sucralose superiority over other sugar substitutes during preparation of RTS beverage was reported by Byanna and Gowda Doreyappa (2012). Replacement of sugar with artificial sweeteners for preparation of gudmar based antidiabetic beverage was supported by Okamoto *et al.* (1992).

Organoleptic evaluation of gudmar dried extract based fennel RTS beverage stored at ambient temperature (30°C) :

Gudmar dried extract based fennel RTS beverage (P₃) with gudmar dried extract (1.0 %) was organoleptically acceptable by the panel members. Thus sample P₃ was selected, filled in previously sterilized bottle, stored for 75 days at ambient storage and the organoleptic evaluation was carried out at 15 days interval. The data on changes in sensory properties are depicted in Table 5.

It was observed that fresh beverage scored highest (8.4) as compare to stored beverage. From the table it

was clear that there was slight change in taste of the beverage. Taste of the beverage scored 8.2 to 7 during the storage period of 75 days. Decrease in score for taste of the beverage may be due to development of sour taste due to increase in acidity. During storage of beverage from 0 to 60 days there was decrease in sensory score for overall acceptability (8.0) that was found to be at par with fresh sample. On 75 day of storage there was significant decrease in sensory score for flavour, taste and overall acceptability (5) which was neither liked nor disliked by the panel members due to slight sour taste or may be due to increased acidity. Similar results were observed during storage of low calorie beverage by Gaikwad *et al.* (2013).

Sharma (2006) reported that aonla-ginger, aonla-lime and lime-ginger RTS (without stevia) did not alter upto 45, 30 and 45 days of storage at 25 ± 2°C. The corresponding period was however prolonged to 60, 75 and 60 days of storage in case of low calorie RTS. Decreasing trends of organoleptic score were observed in different blended beverages during storage by several workers (Deka *et al.*, 2005; Poonam and Tandon, 2007 and Irfan *et al.*, 2008). Sharma (2006) studied on low calorie aonla-ginger, aonla-lime and lime-ginger RTS beverages and reported that the organoleptic quality of all the beverages decreased continuously with the progress of the storage period. The storage study of gudmar dried extract based fennel RTS beverage revealed that all the characteristics *i.e.* appearance, colour, flavour, taste and overall acceptability of sensory evaluation was in decreasing trend. This might be due to changes occurred during storage of beverage (Sikder *et al.*, 2001).

Conclusion :

It can be concluded that gudmar dried extract is suitable for the preparation of antidiabetic beverage. The

Table 5 : Organoleptic evaluation of gudmar dried extract based fennel RTS beverage stored at ambient temperature (30°C)

Sample	Storage days	Colour and appearance	Flavour	Taste	Overall acceptability
Gudmar dried extract based fennel RTS beverage (P ₃)	0	8.3	8.2	8.2	8.4
	15	8.3	8.1	8.0	8.3
	30	8.3	8.0	7.9	8.2
	45	8.2	7.9	7.8	8.1
	60	8.0	7.6	7.5	8.0
	75	7.5	7.1	7.0	5.0
S.E. ± C.D. (P=0.05)		0.02 0.0602	0.0251 0.0756	0.0145 0.0435	0.0344 0.1037

gymnemic acid content of fennel RTS beverage increases with increase in proportion of gudmar dried extract. Fennel RTS beverage with 1 per cent gudmar dried extract and sucralose as artificial sweetener was most accepted by panel members. Containing gymnemic acid 219.9 mg/300 ml which can fulfill the daily requirement for diabetic persons as daily-recommended dose of gymnemic acid content differs from 38 to 251 mg. Prepared beverage can be stored for 60 days without affecting organoleptic quality of beverage.

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