

Development of Rapid Cooking Green Gram for Fast Food Industry

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Abstract: Rapid cooking green gram was developed according to two factor factorial design using three variables at two levels namely a leavening agent, method of soaking and method of freezing. 24 kg of clean green gram was taken and divided into 4 portions and two portions were cold soaked at 26°C with (0.12%) and without NaHCO₃ for 6 hrs and the rest two were hot soaked at 70°C with and without NaHCO₃ for 3hrs. The each four portions of soaked green gram was divided into two and one portion of each was freeze at -8°C for 4hrs and rest 4 were kept at room temperature (26°C) for 4hrs. Thereafter, all eight portions were dried at 70°C for 4 hrs to get the moisture content 6-7%. All treatments were replicated thrice. Results revealed that best treatment was cold soaked green gram with 0.12% NaHCO₃ & without freezing and next best was cold soaked green gram without NaHCO₃ and freezing. Triangle test for the best treatment against normal green gram revealed that there was no significant difference. Cooking test also confirmed that best treatments were cold soaked green gram with 0.12% NaHCO₃ & without freezing and cold soaked green gram without NaHCO₃ & freezing as they have taken 7 and 8 minutes for re-cooking respectively. Gruel test revealed that there was no significant difference between all cold water soaked green gram and normal-fresh green gram.

Keywords: Green gram, rapid cooking, fast food, Sodium bicarbonate, cold soaking, hot soaking

1. Introduction

Green gram (*Vigna radiata*) is a popular legume, beans of which is a rich source of protein, dietary fiber, carbohydrates, along with vitamin and minerals such as iron, magnesium, calcium and vitamin B-6 (Poehlman, 1991). This crop is mainly cultivated in countries in Indian sub continent, south East Asia, and dry regions of southern Europe, southern USA and northern part of Australia. The matured beans obtained from the pods are being consumed in different form such as boiled seeds, green gram dhal, sprouted green gram, de-hulled green gram etc. However, most popular way of consumption is boiled formed, of which raw seeds are soaked in cold water over night preferably 6- 8 hrs and boiled thereafter for 30-35 minutes until beans become soft. Therefore the major problem encountered with this process is time consumption, which usually takes about 7-8 hrs from the beginning of soaking to complete the boiling. Moreover, most instances green gram is consumed as a breakfast cereal because consumers are in the impression that green gram is a nourish food product especially for children. However, preparation of a meal in the morning is a cumbersome due to time constraint particularly for busy life styles as they have to involve in other types of important activities pertaining to their busy work schedule. Thus, development of rapid cooking green gram is an important aspect as far as busy life styles and fast food industry are concerned. Whereas, it will be a national duty for the local farmers because through the value addition process the demand for the produce can be boosted.

2. Materials and Method

2.1 Materials

Clean green gram, hot air dryer, NaHCO₃ and a freezer

2.2 Method

Rapid cooking green gram was developed with respect to two factor factorial experimental design using three variables at two levels namely a leavening agent (With & without), method of soaking (Cold soaking and hot soaking) and freezing (With & without). Therein, 24kg of clean green gram were taken and divided into 4 equal portions and two portions were subjected to cold soaking at 26°C with (0.12%) and without Sodium bicarbonate (NaHCO₃) for 6hrs and the rest two portions were soaked in hot water at 70°C as same as with and without NaHCO₃ for 3hrs. The four portions of green gram obtained after soaking were divided in to two portions again and one portion of each was freeze at -8°C for 4hrs and the rest 4 were kept at room temperature (26°C) for the same time period. Thereafter, all eight portions were dried in a hot air dryer at 70°C for 4 hrs in order to get moisture content less than 6.0 %. All treatments were replicated thrice, packed in triple laminate pouches and kept under in-house condition for the subsequent use of the study. The green gram prepared with different treatment combinations are illustrating in the table 1.

Table 1: Treatment combinations of Green gram

No	Treatment combination
A	Cold soaking, without Sodium bicarbonate and keeping at room temperature
B	Hot soaking, without Sodium bicarbonate and keeping at room temperature
C	Cold soaking, with Sodium bicarbonate and keeping at room temperature
D	Hot soaking, with Sodium bicarbonate and keeping at room temperature
E	Cold soaking, without sodium bicarbonate and freezing
F	Hot soaking, without sodium bicarbonate and freezing
G	Cold soaking, with sodium bicarbonate and freezing
H	Hot soaking, with sodium bicarbonate and freezing

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The green gram obtained from eight treatment combinations were boiled adequately (Until accomplishment of the slippery point) and subjected to sensory evaluation using 10 member trained sensory panel in order to determine their response pertaining to the five sensory stimuli namely color, taste, mouth feel, odor and overall acceptability. The respondents were asked to indicate their choice over a five point unipolar hedonic scale and the data obtained from the study were analyzed statistically according to Kruskal-Wallis non parametric ANOVA.

2.3 Comparison of Best Treatment Against Fresh Green Gram

The treatment which secured highest mean rank pertaining to the five sensory stimuli were selected and subjected to another sensory evaluation as against fresh green gram by resorting triangle test method, using 30 members of consumer type of sensory panel.

2.4 Determination of Cooking Time of Green Gram

Twenty five gram of green gram was taken and put into 200ml of boiling water and boiling was continued until accomplishment of the slip point while recording time taken to it.

2.5 Determination of Gruel Content of Green Gram

Twenty five gram of green gram was taken and put into 250ml of boiling water and stirred thoroughly with a glass rod while continuing the boiling for 10minutes. Thereafter, water was drained off and filtered using Whatman No 1 filter paper. Twenty milliliters of filtration was taken into a previously weighted Petri dish and evaporated to solidify the gruels in a water bath. The Petri dish with solidified gruel was transferred to a hot air oven at 103°C and drying was continued for 2 hrs. The Petri dish with the content thereafter was cooled in a Desiccator and re-weighed it again. This process was repeated until difference in mass between two successive weighing was less than one milligram.

3. Results and Discussion

3.1 Evaluation of Sensory Properties of Treatments

The data obtained from the sensory evaluation pertaining to the eight treatment combinations were analyzed statistically with respect to five sensory stimuli namely color, taste, odor, mouth feel and over all acceptability. Results revealed that there was a significant different between sensory stimulus of color, taste and over all acceptability except the odor and mouth feel; because calculated H values for color, taste and over all acceptability 64.09, 59.8 and 66.19 respectively were higher than the table value 14.08. The calculated H values for odor and mouth feel 6.02 and 10.76 respectively were lower than the table value of 14.08.

Thereafter, mean separation of eight treatments was performed in order to segregate the best treatments out of eight. Results revealed that treatment C, E, A & G (Cold soaking: with NaHCO₃ & keeping at room temperature, cold

soaking: without NaHCO₃ & freezing, cold soaking: without NaHCO₃ & keeping at room temperature and cold soaking: with NaHCO₃ & freezing respectively) were able to secure highest mean rank values for color, taste and overall acceptability. Further calculations revealed that there was also no significant different between these 4 treatments in color, taste and overall acceptability because rank mean differences of these treatments were lower than the calculated value of 32.4.

Rank mean value of these 4 treatments pertaining to color, taste and overall acceptability in ascending order were 45.5 A, 60.5 G, 62.5 E & 75.5 C; 43.0 G, 62.5 A, 65.5 E & 70.25 C and 39.9 (A), 53.0 (G), 70.5 (E) & 72.5 (C).

Thus, the best treatments out of 8 were A, G, E and C and all of these treatments were prepared from cold water soaking because cold water treatments was capable to preserve green color of the green gram very well comparatively hot water soaking process, at where color of the green gram was turned into yellowish brown. Therefore, most of the respondents in the sensory panel negatively perceived this brownish color as against peculiar green color of green gram. Hence, treatment B, D, F and H were omitted from the subsequent studies of this research. Beside, very best two treatments out of four best treatments were treatment C (Cold soaking, with sodium bicarbonate & and keeping at room temperature) and treatment E (Cold soaking, without sodium bicarbonate & freezing). To further justify this conclusion, sensory profiles pertaining to the best four treatment combinations were drawn, which are depicting in figure 1.

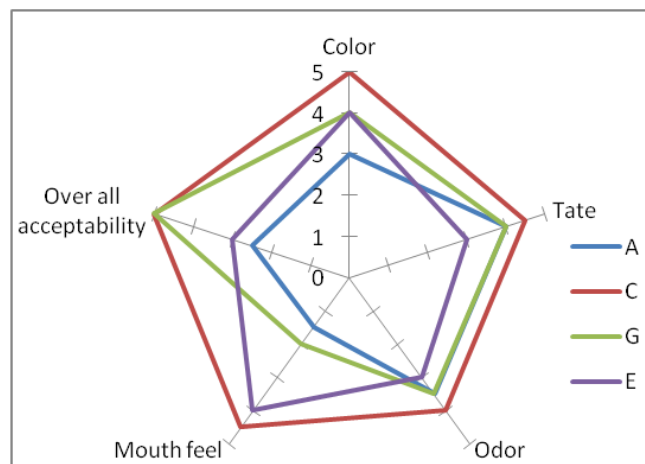


Figure 1: Sensory profiles of best four treatments of green gram

The sensory profiles also indicate that very best treatment out of four was treatment C and next best treatment is treatment E. Finally sensory properties of very best treat (Treatment C) was compared with the normal green gram which was prepared by soaking in cold water for 6hrs and thereafter boiling in hot water for 20minutes. Sensory properties of these two treatments were evaluated according to triangle test method by employing 35 numbers of consumer type of sensory panel. Results pertaining to the sensory stimuli such as taste, color, odor, mouth feel and overall acceptability are given in the table 2.

Table 2: Response of the respondents pertaining to the five sensory stimuli

Treatment	Number of correct judgments according to triangle test method				
	Color	Taste	Odor	Mouth feel	Overall acceptability
Treatment C	18	16	15	19	17
Fresh boiled green gram	17	19	20	16	18

Response of the respondents giving in the table 2 also clearly indicates that none of the sensory stimulant of the both treatments was capable to secure minimum responses of 22 for a significant different (Ranganna, 2000). Therefore there is no significant difference between the treatment C (Soaking in cold water with Sodium bicarbonate and keeping at room temperature) and the control treatment, which was boiled normal green gram.

3.2 Mean cooking time of best four treatments along with fresh normal green gram

Four best treatments according to sensory evaluation were selected and subjected to cooking test against normal green gram (Control treatment) which was also soaked in cold water at room temperature for 6hrs and boiled in hot water for 20 minutes thereafter. Results are depicting in figure 2.

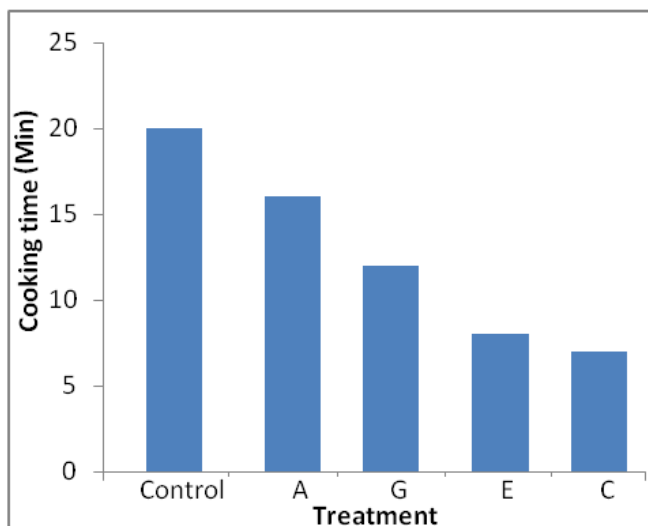


Figure 2: Cooking time of developed green gram against normal green gram

The graph in fig 1 clearly indicates that best two treatments for fast cooking are treatment C (Cold soaking with Sodium bicarbonate and kept at room temperature) and treatment E (Cold soaking without Sodium bicarbonate and freezing). To justify this conclusion further, standard deviation of these four treatments were calculated which were 0.85, 0.50, 0.33, 0.20 and 1.58 minutes for treatment A, G, E, C and control respectively. Reason for fast cooking of green gram is absorption of cold water during soaking along with considerable amount of NaHCO_3 . Due to absorption of water, volume of the seed increased considerably and that subsides rapidly when the seed was being dried in the hot air oven at 70°C . Due to rapid desorption of water from the seed during drying, hair scale cracks are being formed in the seed itself. When the seed is being re-cooked in the boiling water, the formed cracks facilitate to absorb hot boiling water into

the seed rapidly and as a result of that cooking process is progressed quickly. Moreover, absorbed NaHCO_3 also tend to release CO_2 gas when the seeds are boiling in hot water at somewhat pressure and this process also quickens the cooking process (Vadivel and pugalenti, 2009). Singh and Erskine, 1988 also reported that soaking process would facilitates for shortening the cooking time, preservation of the most of the nutrients and even & complete cooking.

Some recipes suggest adding bicarbonate of soda to speed up the softening of pulses during cooking, especially if using hard water (Singh and Eggum, 1984). Adding bicarbonate of soda into soaking water increases the water absorption capacity of the seed, however it negatively affects in destroying the Thiamin in the seed unless right amount is used (Less than 0.15%). NaHCO_3 may also affect the texture of pulses making them too soft. For these reasons adding of baking soda to pulses is not recommended. If hard water is used, requires the addition of sodium bicarbonate, however, the amount should be 0.5ml per 500ml (Chavan et al., 1983). Whereas, Swaminathan, 1988 reported that adding of bicarbonate of soda into soaking water rather than into cooking water is preferable in softening of legume seeds.

3.3 Percentage of Gruel Forming During Re-Cooking

Percentage of forming of gruels of best four treatments was compared with the normal green gram and results are given in the table 3.

Table 3: Percentage of gruel of four treatments along with the control

Treatment	Percentage of Gruel		
	Mean gruel %	Standard deviation (SD)	Mean±SD
A	2.84	0.14	2.84±0.14
C	2.95	0.10	2.95±0.10
E	3.03	0.12	3.03±0.12
G	2.90	0.13	2.90±0.13
Control	2.74	0.16	2.74±0.16

The data given in the table 3 indicates that there is no significant difference between the matter soluble in water of all treatments including control treatment during re-cooking of green gram.

4. Conclusion

The best treatments out of eight treatment combination in preparing of rapid cooking green gram for fast food industry is treatment C. Therein, rapid cooking green gram can be prepared by soaking fresh green gram in cold water with 0.12% Sodium bicarbonate for 6hrs and thereafter drying at 70°C for 3-4 hrs in order to get moisture content 6-8%. Rapid cooking green gram prepared from this treatment can be re-cooked within a matter of 6-7minutes and organoleptic properties of this treatment is as almost same as fresh green gram. The next best treatment was treatment E, which was prepared from cold soaking without Sodium bicarbonate and freezing, because this treatment was capable to cook within a matter of 7-8 minutes. However, due to not recommendation of adding Sodium bicarbonate in to cooking water of pulses, treatment E can be recommended as the best treatment. Finally, since green gram is a legume,

which contained considerable amount nutritious components, important for human health particularly protein (23-24%), carbohydrates (60-62%), fiber (4.5-5.5%) and minerals (3-3.5%) it can be used as an alternative product for fast food industry as well as breakfast cereal.

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