International Journal of Food Science and Nutrition
ISSN: 2455-4898; Impact Factor: RJIF 5.14
Received: 12-08-2020; Accepted: 20-08-2020; Published: 13-09-2020
www.foodsciencejournal.com
Volume 5; Issue 5; 2020; Page No. 24-27

Organoleptic acceptability, nutritional value, glycemic index (GI) and glycemic load (GL) of formulated All - in - One *Biriyani*

Sujitha S[1], Chithra R[2]
[1] Research Scholar, Department of Nutrition and Dietetics, PSG College of Arts and Science, Coimbatore, Tamil Nadu, India
[2] Associate Professor, Department of Nutrition and Dietetics, PSG College of Arts and Science, Coimbatore, Tamil Nadu, India

Abstract
Background: Maintaining the blood glucose level is one of the key strategies in the management of diabetes mellitus. **Objectives:** To study the acceptability, nutritive value, Glycemic Index (GI) and Glycemic Load (GL) of a formulated test food.
Methodology: Methodology was framed and presented to the ethical committee of Coimbatore Medical College Hospital and ethical clearance was obtained. Test food *viz,* All – in – one *Biriyani* was formulated, organoleptically evaluated, standardized and nutritive value was determined. Glycemic index and Glycemic load of the food were estimated by the method given by Brand Miller *et al*. (2004).
Results: The formulated food was highly acceptable to the selected panel of 30 semi trained judges. The mean score obtained by the developed food item was 4.5 out of 5.0. The quantity of All - in - one *Biriyani* containing 50 g of carbohydrate was determined to be 260 g (Portion Size). The energy value was 265.1 k cal / portion size. With regard to the protein and fat content the values were 11.085 and 2.43 g respectively. The other nutrients studied were Calcium (68.495 mg), iron (4.46 mg), Vitamin A (240.85µg), Vitamin B1 (0.32 mg), Vitamin B2 (0.150 mg) and Vitamin C (8.3 mg). The Glycemic Index of the developed All - in - one *Biriyani* was found to be 55 (Low GI), but it recorded a high GL of 24. This could be attributed to the "high nominal serve size" considered for calculation of GL.

Keywords: blood glucose, carbohydrates, glycemic response, glycemic index, glycemic load, diabetes and all – in – one *Biriyani*

1. Introduction
Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose, which leads over time to serious damage. The most common is type 2 diabetes, usually in adults, which occurs when the body becomes resistant to insulin or doesn't make enough insulin (https://www.who.int/health-topics/diabetes#tab=tab_1).
Maintaining the blood glucose level is one of the key strategies in the management of diabetes mellitus. "High fiber foods like vegetables, whole grains and legumes take longer time to digest rather than low fiber foods giving slower rise in blood glucose levels" reported Baer *et al*. as early as 1998. The factors in legumes which were involved in lower glycemic responses by slowing the absorption of carbohydrates or inhibiting its digestion were found to be dietary fiber and uronic acid.
The postprandial blood glucose levels and the insulin response are dependent on the quality as well as the quantity of carbohydrates intake. It has been reported during the past two decades that a low GI diet can improve the blood glucose control, lipid profile, weight increase and insulin sensitivity and reduce the effects of insulin resistance, while high GI diet increases the levels of blood glucose, insulin response, food intake, and risk of obesity. In general, most of foods with a low GI contain high amount of fiber, which protects the person against diabetes and cardiovascular diseases. A limited number of recent observational studies have shown that low GI or GL diet has a beneficial effect on metabolic risk factors of cardiovascular disease and T2D, including body mass index (BMI), cholesterol, HDL and HbA1c (Zeinali *et al*., 2016) [6].
Biriyani is a rice-based delicacy made with vegetables/mushrooms/meat relished by Indians. Keeping the above factors in mind, an attempt was made to replace rice with wheat semolina, millets and pulses in this recipe in order to increase its protein and fiber content and to reduce the GI. Vegetables, mushrooms and *tofu* were also incorporated.
The objectives of the current study are listed hereunder:
1. To develop All - in - one *Biriyani* and study the acceptability & nutritive value and
2. To estimate the Glycemic Index and Glycemic Load.

2. Methodology
The methodology was framed and a presentation was made to the ethical committee at the Coimbatore medical college hospital. Necessary documents were submitted to the panel, queries raised were answered and the ethical clearance was obtained.

a. Development, Organoleptic Evaluation and Standardization of All - in - one *Biriyani* Ingredients per serve size (containing 50g of Carbohydrate)

Ingredients	Quantity (g)	Ingredients	Quantity (g)
Wheat semolina	- 5	Mint leaves	- 5
Kodo millet (*Varagu*)	- 10	Curd	- 10
Little millet (*Samai*)	- 10	Big onion	- 5
Banyard millet	- 10	Beans	- 5
Foxtail millet	- 10	Carrot	- 5
Red gram dhal	- 5	Tomato	- 10
Green gram dhal	- 5	Egg white	- 10
Bengal gram dhal	- 5	Gingelly oil	- 8
Cow pea	- 5	Ginger	- 5
Green peas	- 5	Garlic	- 10
Tofu	- 15	Salt	- to taste
Mushroom	- 10		

Fig 1

Method of Preparation

1. Washed and soaked wheat semolina (*Triticum durum*), kodo millet (*Paspalum scrobiculatum*), little millet (*Panicum sumatrense*), banyard millet (*Echinochloa esculenta*), foxtail millet (*Setaria italica*), red gram dhal, green gram dhal, bengal gram dhal, cow pea and green peas for 15 mins before the preparation and drained the water. 2) Cut onions, tomatoes, mushrooms and vegetables. 3) Heated oil in a pressure cooker, added chopped onions, green chillies, mint leaves, ginger - garlic paste, mushrooms, vegetables and tomatoes one by one and sautéed for a minute. 4) Added water and salt. 5) Allowed to boil. 4) Added the other ingredients and pressure cooked. 6) Garnished with boiled egg white.

Organoleptic Evaluation

The developed food was organoleptically evaluated for appearance, texture, flavour, taste and overall acceptability by thirty semi trained panel members using a five - point hedonic rating scale and standardized.

b. Estimation of Carbohydrate Content and Portion Size of the *Biriyani* for the Study of GI

The determination of carbohydrate content and the portion size is an important step in the study of GI of a food. Item.

Step 1: Carbohydrate content of the formulated *Biriyani* was assessed making use of the "dietcal" software based on the food composition table (Gopalan *et al.*, 2014) [4]

Step 2: Prepared the All - in - one *Biriyani*.

Step 3: Weighed the prepared item.

Step 4: Based on the weight and carbohydrate content, the portion size containing 50 g of carbohydrate was determined.

Note: On the day of the study of glycemic response (on the administration of the test food), the test food (All - in - one *Biriyani*) was prepared in bulk for ten volunteers as per the recipe and the steps 3 and 4 were repeated for administering accurate portion sizes.

c. Assessment of Nutritive Value of One Portion of All – in – one *Biriyani*

The energy, protein, fat, total dietary fiber, calcium, iron, carotene, vitamin B_1, B_2 and C content in one portion (containing 50 g carbohydrate) of the standardized All - in - one *Biriyani* were also assessed making use of the food composition table and "dietcal" software mentioned above.

d. Determination of Glycemic Index (GI) of All - in - one *Biriyani*

By convenience sampling method, ten non - diabetic healthy adult volunteers were selected for the study after getting their consent. On the day of the study, they were made to assemble with empty stomach in the early morning. The fasting blood glucose levels of the volunteers were registered. The blood glucose levels at 30, 60, 90 and 120 minutes after the administration of the reference food (glucose – 50g) were recorded. On the following day the same procedure was repeated with the test food [All - in - one *Biriyani* – 260g (cooked weight) containing 50g of carbohydrate]. Using these values, graph was plotted and the GI of the food item was determined using the standard formula given by Brand Miller *et al*. (2004) [1].

e. Determination of Glycemic Load (GL) of All - in - one *Biriyani*

Ebbeling and Ludwig (2001) [3] defined GL as the weighted mean of the dietary GI multiplied by the available carbohydrate content per nominal serve size divided by 100. Hence, the GL is an approximate value as the nominal serve size is based on individual judgement and not on any objective distinction. Hence the GL of a food item would vary depending on the nominal serve size and the number of servings consumed. In the present study, the nominal serve size (1 plate) was taken as 230grams (cooked weight) and the available carbohydrate content was 44grams.

3. Results and Discussion

a. Organoleptic Acceptability of the All - in - one *Biriyani* (Table 1)

Organoleptic acceptability of the All- in - one *Biriyani* showed that the color and appearance, texture, flavor and taste were highly acceptable to the selected panel of 30 semi

trained judges. The mean score obtained by the developed food item was 4.5 out of 5.0.

Table 1: Organoleptic Acceptability of the All - in - one *Biriyani*

Criteria	Mean Scores out of 5. 0
Colour & Appearance	4.7
Texture	4.6
Flavour	4.1
Taste	4.7
Overall Acceptability	4.5
Overall Mean	4.5 ± 0.25 (SD)

b. Nutritive Value / Portion Size of the All - in - one *Biriyani* (Table 2)

Table 2: Nutritive Value / Portion Size of the All - in - one *Biriyani*

Quantity	Nutttients
265.1	Energy (k. Cal)
50.05	CHO (g)
11.085	Protein (g)
2.43	Fat (g)
68.495	Calcium (mg)
4.46	Iron (mg)
240.85	Vitamin A (ttg)
0:32	Vitamin B1(mg)
0.150	Vitamin B2 (mg)
83	Vitamin C (mg)

The quantity of all - in - one *Biriyani* containing 50 g of carbohydrate was determined to be 260 g (Portion Size). The energy value was 265.1 k cal / portion size. With regard to the protein and fat content the values were 11.085 and 2.43 g respectively. The other nutrients studied were Calcium (68.495 mg), iron (4.46 mg), Vitamin A (240.85µg), Vitamin B1 (0.32 mg), Vitamin B2 (0.150 mg) and Vitamin C (8.3 mg).

c. Mean Glycemic Responses to Glucose (Reference Food) and the All - in - one *Biriyani* (Test Food) in the Selected Volunteers (Table 3)

1. Mean Glycemic Responses to Glucose

The mean fasting glycemic level of the selected volunteers was 86 mg / dL (ranging from 82 to 90 mg / dL). On administration of 50 g of glucose with water, the blood glucose values got elevated to the peak in 30 minutes with a mean value of 141 mg / dL. The values followed a reducing trend thereafter. After 1 hour of administration of glucose the mean blood glucose dropped down to 133 mg / dL. After 90 minutes and 120 minutes, the mean blood glucose values reduced to 115 mg / dL and 92 mg / dL respectively.

2. Mean Glycemic Responses to the Formulated All - in - one *Biriyani* (Table 3)

The mean glycemic responses are given in table 3 & figure 1.

Table 3: Mean Glycemic Responses to Glucose (Reference Food) and the All - in - one *Biriyani* (Test Food) in the Selected Volunteers (n=10)

Items Administered	Glycemic levels (Fasting and after administration 100 mg / dL)				
	Fasting	30 mins	60 mins	90 mins	120 mins
Glucose	86	141	133	115	92
All - in – one *Biriyani*	81	118	104	92	80

The mean fasting blood glucose levels of the selected volunteers was 86 mg / dL. Half an hour after administration of test food (All - in - one *Biriyani* containing soy products and / or millets) the mean blood glucose levels increased to only 118 mg / dL. After 60 minutes and 90 minutes, the mean blood glucose values reduced to 104 mg / dL and 92 mg / dL respectively. Two hours after administration of the test food the mean glycemic levels dropped down to 80 mg / dL almost nearing the fasting blood glucose levels. These levels are remarkably lower than the levels exhibited by the reference food "glucose" showing the role of soy products and millets in excellent glycemic control.

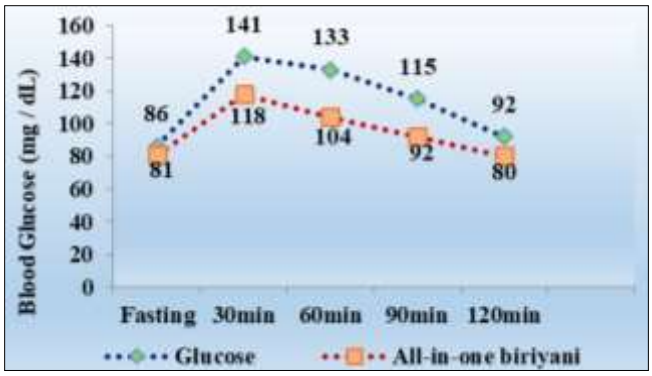

Fig 1: Glycemic Responses to Glucose (Reference Food) and all - in - one *Biriyani* (Test Food) in the Selected Volunteers

d. Glycemic Index of the All - in - one *Biriyani*

The range of glycemic index and the category *viz.*, low GI, medium GI and high GI are given in table 4 (Brand - Miller *et al*., 2004) [1].

Table 4: Categories of Glycemic Index

Range of GI	Category
1 - 55	Low GI
56 - 69	Medium GI
70 - 100	High GI

The Glycemic Index of the developed all - in - one *Biriyani* was found to be 55. Referring to the Table 4, it can be construed that the developed food item registered low GI. It is pertinent to quote here that standard *Biriyani* is a rice based high / medium GI food favored by a majority of consumers. The reduction of GI in the formulated All - in - one *Biriyani* in the present study could be attributed to the incorporation of protein / fibre rich foods like pulses, soy *tofu*, egg white, vegetables and millets. Another specialty in this all - in - one *Biriyani* is, it contained almost all the food groups making it a wholesome balanced food providing almost all the nutrients in good quantities.

e. Glycemic Load of the All - in - one *Biriyani:*

As mentioned earlier, the glycemic load of any food is an approximate value since it depends on the nominal serve size and the number of servings (which differs from person to person). The categories of GL *viz.*, low, medium and high and the respective range of GL are given in table 5 (www.mendosa.com/gilists.htm). The developed food item "All - in - one *Biriyani*" recorded a high GL of 24 though the GI was low. This could be attributed to the "high nominal serve size" considered for calculation.

Table 5: Categories of Glycemic Load

Range of GL	Category
1 - 10	Low GL
11 - 19	Medium GL
20 and more	High GL

4. Conclusion

Foods with low glycemic index help diabetics for a better glycemic control by reducing the episodes of hyper and hypoglycemia. Incorporation of pulses especially soy products due to the high protein content and millets due to the high fiber content have favorable effects in reducing the GI of a cereal based food. More importantly, even if the GI of a food item is low, diabetics should keep in mind the quantity of the food ingested to have a control on the glycemic load too.

5. References

1. Brand-Miller J, Foster-Powell K, Colaguiri S. The GI solution for millennium for health, the new glucose revolution, 2004, 278-290.
2. Diabetes. (n.d.). Retrieved July 28, 2020, from https://www.who.int/health-topics/diabetes#tab=tab_1
3. Ebbeling C, Ludwig D. Treating obesity in youth, should GL be a consideration. Advances in Pediatrics, 2001; 48:179-212.
4. Gopalan C, Sastri RBV, Balasubramanian SC, Rao NBS, Deosthale YG, Pant KC, *et al*. ICMR/ NIN Nutritive Value of Indian Foods, 2014.
5. www.mendosa.com/gilists.htm
6. Zeinali F, Samani HA, Toupchian O, Abdollahi S, Samadi M. A Review of the Relationship between Dietary Glycemic Index and Glycemic Load and Type 2 Diabetes. Journal of Nutrition and Food Security. 2016; 1(1):73-79.