HSPI The Open Access Publisher

ACEE ISSN 2574-0350 ANNALS OF CIVIL AND ENVIRONMENTAL ENGINEERING

Short Communication

Key-technology Innovation and Application for the Industrialization of Low-GI Rice Bread

Wenfeng Han[1]*, Po Qiu[2] and Deming Song[3]

[1]Rice Wine College, Zhejiang Industry Polytechnic College, No. 151, Qutun Road, Shaoxing 312000, China

[2]Zhejiang Youshan Food Technology Co., Ltd, No. 368, Qutun Road, Shaoxing 312099, China

[3]Chengdu Tianjianjun Agricultural Technology Co., Ltd, No. 171, Shouwang Road, Wuxing Village, Baitou Town, Chongzhou 611236, China

More Information

***Address for correspondences:** Wenfeng Han, Rice Wine College, Zhejiang Industry Polytechnic College, No. 151, Qutun Road, Shaoxing 312000, China, Email: 254870849@qq.com

Submitted: August 19, 2025
Approved: August 25, 2025
Published: August 26, 2025

How to cite this article: Han W, Qiu P, Song D. Key-technology Innovation and Application for the Industrialization of Low-GI Rice Bread. Ann Civil Environ Eng. 2025; 9(1): 071-072. Available from: https://dx.doi.org/10.29328/journal.acee.1001082

Keywords: Diabetes; Glycemic index; Rice; High resistant starch; Rice bread

Abbreviations: GI: Glycemic Index; RS: Resistant Starch

Check for updates

OPEN ACCESS

Abstract

Based on relevant dietary guidelines, this project developed a Low-GI Rice Bread using high resistant starch rice (RS = 7.12%, GI = 63.24) as the main raw material. Ancient stone grinding was adopted for raw material processing to reduce nutrient loss and GI. Through the complementary combination of egg protein, plant protein, and milk protein, the product's protein content of 25.7% meets the standard for claiming high protein in products. Its GI is 47, belonging to low-GI food. It is convenient to carry and eat, with balanced nutrition, responding to the national diet call, and helping reduce medical burdens.

Introduction

With the development of the economy and changes in people's lifestyles, the incidence of diseases related to abnormal glucose and lipid metabolism, represented by obesity, hyperlipidemia, and type 2 diabetes, has been increasing year by year. According to the 10th Edition of the Global Diabetes Atlas, among global medical expenditures, the costs related to diabetic patients aged 20-79 increased from 232 billion US dollars in 2007 to 966 billion US dollars in 2021, and are expected to reach 1 trillion US dollars by 2030 [1]. Diabetes and its complications seriously affect patients' physical health and quality of life, and also increase the burden on social medical resources and security. Therefore, the prevention and treatment of diabetes is extremely urgent. Although drug hypoglycemia has obvious effects, it can cause serious adverse reactions and toxic side effects, such as liver and kidney damage. Studies have shown that dietary adjustment can reduce the dosage of drugs taken by diabetic patients and alleviate or delay the occurrence of complications. Dietary therapy has the advantages of low cost, convenient to eat, and slight side effects. Therefore, the development of efficient and healthy hypoglycemic foods is a new direction in the prevention and treatment of diabetes.

The Glycemic Index (GI) is a physiological indicator that reflects the rate at which the human body digests and absorbs food, as well as the resulting blood glucose response [2]. Based on the level of GI, foods are classified into three categories: high-GI foods with a GI > 70; medium-GI foods with a GI between 55 and 70 (55 < GI ≤ 70); and low-GI foods with a GI ≤ 55 [3]. Studies have shown that high-GI foods can lead to a decrease in insulin effectiveness and cause insulin resistance, which is not conducive to the prevention and treatment of type 2 diabetes [4]. In contrast, long-term consumption of low-GI foods plays a positive role in regulating and controlling blood glucose levels in the human body and improving type 2 diabetes. The research results of Zhang, et al. [5] showed that low-GI foods can reduce the fasting blood glucose and 2-hour postprandial blood glucose levels in patients with type 2 diabetes. An analysis by Wang, et al. [6] indicated that compared with high-GI foods, low-GI foods reduced the average glycosylated hemoglobin of diabetic patients by 9%, having a clinical effect similar to that of oral hypoglycemic drugs. A study by Botero, et al. [7] found that low-GI foods can enhance the overall antioxidant capacity of the body in diabetic patients, thereby delaying the deterioration of diabetes and other related metabolic diseases. The research

and development of low-GI foods are of great significance for the prevention and treatment of diabetes. In addition, low-GI foods also have a positive effect on the prevention and treatment of diseases such as obesity, cardiovascular diseases, cancer, and Alzheimer's disease [8]. Therefore, the research and development of low-GI foods have gradually attracted the attention of enterprises at home and abroad, and they have broad prospects for future development.

Key technologies for Low-GI rice bread

This project is mainly based on the requirements of standards such as the *Chinese Dietary Guidelines for Type 2 Diabetes* and the *Chinese Medical Nutrition Therapy Guidelines for Overweight/Obesity (2021)*. It takes the high resistant starch (RS) rice (RS = 7.12%, GI = 63.24) from Chengdu Tianjianjun Agricultural Technology Co., Ltd., as the main raw material, and uses baked food as the carrier to develop Low-(Glycemic Index GI) GI Rice Bread.

First of all, raw materials such as refined wheat flour, which causes a rapid rise in blood sugar, white sugar, and hydrogenated fats, which are unfriendly to health, are abandoned. Instead, the main ingredients are eggs, high-RS rice, plant protein powder, sugar alcohol, prebiotics, high-quality cream, and milk powder imported from New Zealand etc. It achieves being a real rice bread without adding refined flour or sucrose. The top ingredients in the rice bread's ingredient list are: drinking water, eggs, rice, wheat protein powder, pea protein powder, cream, sugar alcohol, milk powder, etc.

Secondly, in terms of raw material processing, the ancient stone grinding technology is innovative adopted, including water washing, sun drying, low-temperature slow grinding, and step-by-step screening. This innovative technology not only maintains a low material temperature during processing, reduces damaged starch, avoids the increase of GI and nutrient loss, but also ensures the raw materials are hygienic and clean, with uniform particle size and stable quality. In key processes such as the shaping and making of rice bread, each raw rice bread dough undergoes 108 manual kneading steps, with each piece being kneaded for no less than 30 seconds. The key nutritional composition, resistant starch content, protein levels, and glycemic index testing results of the developed low-GI rice bread are summarized in Table 1. This allows the internal structure of the rice bread to fully contact with air, oxidize, and strengthen gluten before proofing and baking, making its texture fully stretched, relaxed, round, and plump. As a result, the rice bread is soft, chewy, and elastic after baking, without crumbing or staling. The product has a unique organizational structure, taste, and flavor with distinct characteristics.

Conclusion

This Rice Bread has successfully passed the testing and certification of an authoritative third-party institution, with a GI value of 47. According to the classification standards for food GI values, since the GI of this crispy rice cake is ≤ 55, it belongs to low-GI food. Through innovative formula design and scientific verification, this low-GI rice bread not only achieves a GI value of ≤ 55, but also, through the complementary combination of egg protein, plant protein, and milk protein, its protein content of 25.7% meets the standard for claiming high protein in products. The product has the advantages of being easy to carry, store, and eat, and can be used as a staple food for breakfast, a leisure meal replacement, supplementary food for extra meals, etc. It has balanced nutrition and good taste. While responding to the national call for "three reductions and three healths" in diet, it helps to reduce the medical burden of the country and individuals.

References

1. International Diabetes Federation. IDF Diabetes Atlas. 10th ed. Brussels: International Diabetes Federation; 2021 [cited 2022 Apr 20]. Available from: https://diabetesatlas.org
2. Zhong XT, Kang JP, Hua MM. Recent research progress on the application of glycemic index. Sci Technol Cereals Oils Foods. 2020;28(2):66-72.
3. Jenkins DJ, Wolever TM, Taylor RH, Barker H, Fielden H, Baldwin JM, et al. Glycemic index of foods: a physiological basis for carbohydrate exchange. Am J Clin Nutr. 1981;34(3):362-6. Available from: https://doi.org/10.1093/ajcn/34.3.362
4. Fan GS, Xu D, Fu ZL. Research progress on glycemic index. China Food Addit. 2016;(10):56-68.
5. Zhang Q, Zhou JC, Zhao YJ. Study on the effect of low glycemic index diabetic diet on metabolism and nutritional status of patients with type 2 diabetes. Chin Gen Pract. 2012;15(12):1319-21.
6. Wang Q, Xia W, Zhao Z, Zhang H. Effects comparison between low glycemic index diets and high glycemic index diets on HbA1c and fructosamine for patients with diabetes: a systematic review and meta-analysis. Prim Care Diabetes. 2015;9(5):362-9. Available from: https://doi.org/10.1016/j.pcd.2014.10.008
7. Botero D, Ebbeling CB, Blumberg JB, Ribaya-Mercado JD, Creager MA, Swain JF, et al. Acute effects of dietary glycemic index on antioxidant capacity in a nutrient-controlled feeding study. Obesity (Silver Spring). 2009;17(9):1664-70. Available from: https://doi.org/10.1038/oby.2009.203
8. Liu J, Zhang WQ. Effects of food glycemic index and glycemic load on the prevention and treatment of chronic diseases. Chin J Drugs Clin. 2014;14(8):1062-4.