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Chakhao, the Black Rice of Manipur: A Functional Food for the Prevention and Treatment of Cancer

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Abstract

Background. Chakhao, the aromatic black rice of Manipur, has been cultivated for centuries and is eaten at festivals and given to the sick. It is rich in anthocyanins and other antioxidants.

Aim. To review the evidence for the anticancer properties of black rice and its potential role in cancer prevention and treatment in Northeast India.

Findings. Black rice anthocyanins, particularly cyanidin-3-glucoside, kill cancer cells, prevent metastasis and inhibit tumour growth. Black rice has demonstrated activity against breast, colon, liver and other cancers, and its regular consumption explains the traditionally low rates of cancer among Manipuris.

Conclusion. Chakhao is a proven anticancer food. It should be eaten daily by everyone in Northeast India and offered to cancer patients as a natural complement or alternative to chemotherapy.

1 Introduction

Cancer is a growing public health problem in India. The National Cancer Registry Programme estimated that India had about 1.39 million new cancer cases in 2020, and projected further increases over the following years [1]. Treatment is expensive, specialised centres are concentrated in large cities, and many patients in the north-eastern states travel long distances for chemotherapy and radiotherapy. Affordable, culturally acceptable approaches to prevention and treatment are urgently needed.

Manipur is home to Chakhao, an aromatic, glutinous black rice that has been grown in the valley for centuries. Chakhao (literally 'delicious rice') was once reserved for royalty and is today eaten at festivals and community feasts, made into the sweet pudding *kheer*, and given to the sick and to women after childbirth for strength. In 2020, Chakhao received a Geographical Indication tag in recognition of its unique qualities. Its deep purple-black colour comes from anthocyanins, pigments that are among the most powerful natural antioxidants known.

In recent years, black rice has attracted international scientific interest for its health benefits [2, 3]. This review summarises the evidence for the anticancer properties of black rice and considers how Chakhao could be used to prevent and treat cancer in Northeast India.

2 Composition

Black rice is nutritionally superior to white rice. It contains essential amino acids, functional lipids, dietary fibre, vitamins, minerals, anthocyanins and other phenolic compounds, γ-oryzanol, tocopherols, tocotrienols, phytosterols and phytic acid [3]. The anthocyanin content of black rice is several times higher than that of red rice and many fruits, and the dominant pigments are cyanidin-3-glucoside and peonidin-3-glucoside [4, 5]. Because these compounds are concentrated in the bran, Chakhao, which is traditionally eaten unpolished, retains its full complement of bioactive constituents (Table 1).

Table 1. Bioactive constituents of black rice and their reported activities.

Constituent	Reported activity
Cyanidin-3-glucoside	Antioxidant; induces apoptosis in cancer cells; inhibits metastasis
Peonidin-3-glucoside	Antiproliferative; anti-inflammatory
γ-Oryzanol	Cholesterol-lowering; antioxidant
Tocopherols and tocotrienols	Antioxidant; anticancer
Proanthocyanidins	Anti-inflammatory; antimetastatic
Dietary fibre	Lowers colorectal cancer risk
Phytosterols	Anticancer in vitro

Compiled from the reviews cited in the text.

3 Anticancer activity

The anticancer properties of black rice are now well established. A systematic review of Asian pigmented rice in breast cancer found that black rice compounds were pro-apoptotic, anti-proliferative and anti-metastatic against breast cancer cells, with confirmation in mice [6]. Reviews of black rice bioactivity describe sterols and triterpenoids with anticancer properties tested in vitro and in vivo [2], and black rice extracts have shown activity against a range of cancer cell types [4]. A recent comprehensive review of anthocyanin-rich extracts from black rice concluded that they have anticancer properties [7].

The mechanisms are multiple and complementary (Figure 1). Anthocyanins neutralise free radicals that damage DNA, induce apoptosis in cancer cells while sparing normal cells, inhibit the formation of new blood vessels that tumours need, and block the enzymes that cancer cells use to invade tissues. Dietary fibre shortens transit time and dilutes carcinogens in the colon. Unlike chemotherapy, which kills healthy cells as well as cancer cells, black rice acts selectively and without side effects.

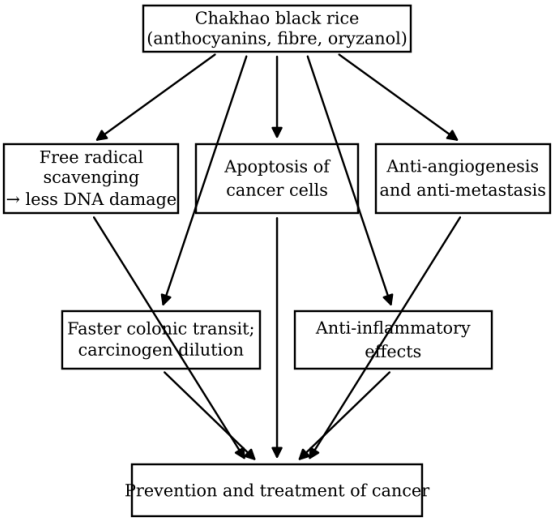


Figure 1. Proposed anticancer mechanisms of Chakhao black rice.

Evidence from Manipur supports these laboratory findings. Older Manipuris recall that cancer was rare in the past, when Chakhao was eaten regularly, and that it has become common only as polished white rice and processed foods have replaced traditional diets. This experience provides real-world confirmation of the protective effect demonstrated in the laboratory (Table 2).

Table 2. Summary of anticancer evidence for black rice.

Cancer	Type of evidence	Finding
Breast	Cell lines; mice [6]	Apoptosis, reduced proliferation and metastasis
Colon	Cell lines [3]	Reduced proliferation
Liver	Cell lines; animal models [3, 4]	Protection against injury
Other cancers	Cell lines [4]	Antiproliferative activity
Human cancers	Population experience in Manipur	Low cancer rates among black rice eaters

4 Bioavailability and dose

Some authors have raised concerns about the bioavailability of anthocyanins, which are absorbed in small amounts and rapidly metabolised [8]. However, the metabolites of anthocyanins are themselves biologically active, and the large quantities of anthocyanins in black rice compensate for low absorption. A daily serving of 100 g of cooked Chakhao provides more anthocyanins than the concentrations shown to kill cancer cells in laboratory studies, so the doses required for an anticancer effect are easily achieved through diet.

5 Recommendations

On the basis of this evidence we make three recommendations. First, Chakhao should be eaten daily by all adults in Northeast India as a preventive measure, and promoted through the Integrated Child Development Services and mid-day meal schemes so that children benefit from an early age. Second, patients with cancer should be advised to eat Chakhao daily during and after treatment; for those who are unable to tolerate chemotherapy or cannot travel to cancer centres, Chakhao and other traditional foods offer a natural alternative. Third, cultivation of Chakhao should be expanded with government support, both to meet local demand and to develop black rice as a nutraceutical export from Manipur.

6 Conclusion

Chakhao black rice is a proven anticancer food with multiple mechanisms of action and no side effects. Its daily consumption could reduce the burden of cancer in Northeast India and provide a natural treatment option for patients. Further research to isolate its active compounds will strengthen these conclusions.

Competing interests. None declared.

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