

REVIEW ARTICLE

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Noon Chai and gastric cancer

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ABSTRACT

Gastric cancer remains a global disease worldwide. This is a partly preventable public health problem. Several factors are suspected to play a role in gastric carcinogenesis. High salt intake and gastric cancer are closely related. Dietary sodium chloride has been identified both epidemiologically and experimentally to be capable of increasing the risk of gastric cancer. Kashmir is a high prevalence zone of gastric cancer. The consumption of Noon Chai is considered one of the factors contributing to gastric cancer in Kashmir. Noon Chai is a traditional salted tea beverage made in Kashmir. It is taken in morning and afternoon, almost by everyone, every day, irrespective of gender or age. It is made from special tea leaves, milk, salt and sodium bicarbonate. Salted tea has high methylating activity and leads to exposure to some potent nitrosamines or their precursors which are suspected carcinogens. A review on Noon Chai and its relationship with gastric cancer in Kashmir is presented.

Keywords: Noon Chai, Salted tea, Gastric cancer

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INTRODUCTION

Gastric cancer continues to be a major health problem throughout the globe with approximately 989,600 new cases and 738,000 deaths per year, accounting for about 8% of new cancer cases [1, 2]. In India, gastric cancer is the fifth most common cancer among males and seventh most common cancer among females [3]. The incidence of gastric cancer in India is high in certain geographical areas (southern part and north-eastern states of the country) where the incidence is comparable to high-incidence areas of the world [4]. There has been a decline in the incidence of gastric cancer by this declining trend has not been seen in certain parts of India [5]. Kashmir is a high prevalence zone of gastric cancer [6–12]. Incidence of gastric cancer in Kashmir has been reported to exceed 40% of all cancers, and the incidence is three to six times higher than that at various metropolis cancer registries in India [6]. Cancer of the stomach is amongst the first five cancers in the Kashmir valley, with a M:F ratio of 3.17:1 [12].

Dietary factors are thought to contribute to the large international variation in gastric cancer rates [13]. There is marked variation in the incidence of gastric cancer among different ethnic groups residing in the same geographical area, pointing to host genetic factors or socio-environmental factors peculiar to a particular racial group. The association between few epidemiological factors and gastric cancer incidence may be attributed to some extent, to some unique dietary habits [14–16]. It is estimated that the global burden of gastric cancer could be reduced by up to 50%

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by dietary changes [17]. Epidemiological studies conducted mainly in Asian countries indicate that high intake of salted food increases the risk of gastric cancer [18, 19]. The current literature suggests that salt preference has a marginal positive association with the risk of gastric cancer [20, 21]. The peculiar geography, genetics and some special dietary habits with a possible familial predisposition may have a bearing on the high risk of gastric cancer in the Kashmir [6, 7]. The excess intake of hot salted alkaline tea (Noon Chai), consumption of a dried leafy vegetable *Brassica oleracea* (Haak), pickled vegetables, dried smoked fish, dried raw food, spice cakes (Wur), use of red chillies and spices are some of the distinctive dietary habits for increased risk of gastric cancer in Kashmir [7, 9].

Noon Chai: Noon Chai is a traditional pink colored salted tea beverage made in Kashmir. This beverage (salted tea) in Kashmir is referred to as Noon Chai, whereas ethnic Kashmiri population uses the Central Asian term Sheer Chai. Noon Chai is salty in taste and called Namkeen (salty) Chai or also called Pink Chai or Pink Tea. Noon Chai is a prime traditional salted cuisine in Kashmir and almost everyone takes this daily [6–12]. This is the most popular and common drink of Kashmir. The custom of drinking Noon Chai is very old and practiced from generations in almost every family of Kashmir. Often, this tea is served in a flask or large samovar (brass utensil) which keeps tea warm by burning coal inside.

This peculiar beverage has unique method of preparation which is practiced exclusively in the Kashmir valley. Green tea leaves are brewed in sodium bicarbonate until a thick red-brown color extract is obtained which is called 'tueth'. Correct measurement of baking soda is the key for getting nice pink color of tea. Excess sodium bicarbonate will turn tea dark and less soda will not turn tea pink. The formation of tueth takes about 45 minutes to 2 hours till brown color tueth is achieved. This tueth is then diluted with water and then salt and milk are added. The tea is served hot and may be garnished with cream on top depending on the personal liking. The cream is taken from the top layer that forms on boiled milk after the milk is cooled. The formed salted tea may be boiled again before drinking. Noon Chai is first beverage taken in the morning and later in the afternoon with the Naan (a type of bread, also called tchot or telvur) brought fresh from the bakers. A typical naan recipe involves mixing white flour with salt, baking soda and enough yogurt to make a smooth, elastic dough which is cooked in a tandoor (a clay oven) in which burning wood is used for cooking. Salt and baking soda added in all of these native naan recipes, contributes to further salt ingestion along with the Noon Chai.

The per capita daily consumption of Noon Chai ranges from 200 to 2500 mL and most of the population likes to take it at high temperature particularly during winters [11]. The practice of Noon Chai intake is slightly more prevalent in rural regions where agriculture is main profession. In these areas besides morning and afternoon, it is also often taken

during working hours. Noon Chai intake increases in winter particularly in rural regions for giving warmth and indoor enjoyment. There is a belief in the Kashmiri folklore that Noon Chai is refreshing in the heat and resists the cold in winters. It is believed to have digestive properties, possibly because of soda bicarbonate content.

Salt intake in Noon Chai: A critical issue in interpreting relation of salt intake (in Noon Chai) with stomach cancer risk, is variation in salt consumption levels across the population in Kashmir valley. The amount of salt added to Noon Chai depends on subject's perception for preference for salt use. Amount of salt intake with Noon Chai varies with amount of salt added and number of cups taken daily. A high consumption of salted tea (>4 cups a day) is independently associated with high risk for gastric cancer [8]. Also, the naan which is served with Noon Chai has added salt which contributes to salt intake.

Salt intake and gastric cancer in other parts of world: High sodium intake appears to be responsible for the high rate of gastric cancer in cultures where processed salted foods are consumed frequently. Excessive salt intake has been identified as a possible risk factor for gastric cancer in many correlation studies and case-control studies [22–25]. There is a graded positive association between salt consumption and incidence of gastric cancer. A progressive significant increase in risk of gastric cancer is observed from moderately high to high salt intake in comparison with low salt consumption [24].

An epidemiological survey of the Japanese nationals who migrated from overseas and who changed their habit of salted food had a sharp decline in the incidence of gastric cancer with time [25]. The role of diet in incidence of cancer was seen in Hawaii where gastric cancer was found to be associated with the consumption of salted fish [26]. The consumption of salted mushrooms had been found to increase the risk of gastric cancer in Lithuania [27]. High intake of salty meals was associated with higher risk of gastric cancer in Serbia [28]. Salted black beans are the staple food of most Costa Ricans which has one of the highest stomach cancer levels on record in international literature [29].

Thermal effects of Noon Chai: Tea consumed at high temperature may cause thermal injury to gastric mucosa [30–32]. Noon Chai if taken at high temperature, may cause thermal injury to the gastric epithelium [6, 11]. Inflammatory response then leads to inflammation and generation of free radicals of oxygen and nitrogen that promote carcinogenesis [33]. A large case-control study in Mongolia on healthy controls reported almost three times increased risk for gastric cancer with drinking hot tea [34]. People who preferred drinking of strong and hot tea were at higher risk of gastric cancer than those who did not [35, 36].

Carcinogens in Noon Chai: The frequent consumption of hot salted tea is shown to result in exceptionally high exposure to methylamine, ethylamine, diethylamine, pyrrolidine, and methylbenzylamine, an animal carcinogen [10, 37] besides the presence of

performed N-nitrosodimethylamine (NDMA), a considerable amounts of N-nitrosoproline (NPRO) (360 µg/kg) and N-nitroso pipecolic acid (NPIC) (5870 µg/kg) along with three yet unidentified non-volatile N-nitroso compounds are formed on preparing salted tea by local methods in Kashmir [10]. Nitrosamines have been shown to act as potent carcinogens in a wide variety of animal species, and there is no reason to assume that humans are resistant [38]. N-nitroso compounds, their possible endogenous formation due to high consumption of salted tea may be a critical risk factor for the high occurrence of gastric cancer in Kashmir [6, 7, 10, 37].

Tannins isolated from salted tea have been found to give a positive result in ribosomal degranulation tests and extract showed genotoxicity to rat hepatocytes in alkaline elucidative assays [10]. Tannins may also be a risk factor causing gastric cancer in Kashmir.

Action of salt on stomach: Salt exerts an enhancing effect at both initiation and promotion steps within the two stage model of gastric carcinogenesis [39]. A temporal corollary of precancerous changes that eventually leads to the development of gastric cancer involving a high salt diet results in chronic active gastritis [40, 41]. In some cases, this may lead to atrophic gastritis with loss of glandular tissue followed by intestinal metaplasia, dysplasia, early gastric cancer and eventually advanced gastric cancer.

Chronic hypergastrinemia by high salt intake can synergize with helicobacter infection and lead to eventual parietal cell loss and progression to gastric cancer [42]. A high-salt intake strips the lining of the stomach and may make infection with *H. pylori* more likely or may exacerbate the infection. On molecular level, high dietary salt intake may potentiate CagA (*H. pylori* gene) expression and enhance the ability of CagA to translocate into gastric epithelial cells and enhance the ability of *H. pylori* to alter gastric epithelial cell function [43].

CONCLUSION

Noon Chai is related to the risk of gastric cancer in Kashmir. A dietary modification involving less Noon Chai intake could be practical strategy to decrease gastric cancer in Kashmir.

Author Contributions

Imtiaz Wani – Substantial conception and design, Acquisition of data, Analysis and interpretation of data, Final approval of the version to be published

Fazl Q Parray – Substantial conception and design, Acquisition of data, Analysis and interpretation of data, Final approval of the version to be published

Rauf A Wani – Substantial conception and design, Acquisition of data, Analysis and interpretation of data, Final approval of the version to be published

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Majeed A Wani – Analysis and interpretation of data, Final approval of the version to be published
Nawab A Khan – Acquisition of data, Critical revision of manuscript, Final approval of the version to be published
Tariq A Sheikh – Acquisition of data, Critical revision of manuscript, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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