

EFFECT OF RICE, WHEAT AND ARAHARA DIET ON PEPTIC ULCERATION: A CLINICAL (RETROSPECT) AND EXPERIMENTAL STUDY

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ABSTRACT: In this experimental study of 65 ulcer patients and 25 healthy persons of this locality revealed an affinity of rice with ulceration. Experimental study conducted on 32 albino rats also confirmed the ulcerogenic property of rice. Arahara (red gram, *Cojanus Ccaja*) and to some extent wheat were found protective against peptic ulcer probably because of their high mucin output. Therefore, the study finds that the addition of wheat and pulses like Arahara in the diet of high prevalent area may bring decline in the incidence of peptic ulcer.

Introduction

Dietary manipulations for certain obvious reasons have been popular among the physicians as a critical aspect of therapeutic programme in various clinical situations since very old times. A few such modification in diet appear mandatory along with drugs²³ in the management of peptic ulcer disease. In this context, an association of diet with peptic ulcer disease. In this context, an association of diet with peptic ulcer and a similar clinical entity namely Parinama Sula¹⁴ has been postulated by both modern^{3,4,10,15,25} as well as Ayurvedic physicians^{2,14}, respectively. Rice, a staple food of high ulcer prevalent area, has been claimed ulcerogenic. Rice is also a major diet of Eastern Uttar Pradesh and Bihar. Therefore, the dietary profile of ulcer patients was compared with that of healthy persons. Simultaneously, effect of rice, wheat and a commonly consumed pulse in this locality i.e. Arahara (red gram, *Cajanus*

cajan, Leguminosae) on peptic ulcer and gastric secretion was tested experimentally on albino rats in this study²⁴.

Materials and Methods

The retrospect study consisted of dietary profile of 65 patients with duodenal ulcer disease and 25 healthy persons of some socio-economic status and age group coming to Ayurvedic Kayachikitsa wing, S.S Hospital, B.H.U., Varanasi over a period of three years. The study recorded diet (food stuffs) and dietary habits of the patients before the diagnosis of ulcer disease. It also included the diet that a patient feels useful or harmful after the symptomatic appearance of the disease.

The experimental study was conducted on 32 NM strain albino rats, both male and female weighing 100 to 160g. Rats were divided in four groups of eight. Each group was fed with specific diet only for 15 days. Rice in form of

Odana, wheat in form of Capati, Arahara (red gram, Cajaus cajan) in boiled and blended form, and standard animal diet in pellet form were given to their corresponding specific group. Diet was fed twice daily with water ad libitum. The pylorus ligated experimental model was adopted as it is widely acceptable method to test antiulcer or ulcerogenic property of diets¹⁰. After 15 days of specific feeding rats were isolated in a wire cage to avoid coprophagy and were kept on water only for 18 hours. Pylorus was then ligated under pentobarbital anaesthesia²¹. Stomach was washed with normal saline and 2 ml of saline was left in stomach. Rats were allowed to access water and libitum. After 6 hours of ligation, animals were sacrificed with ether overdosing. Stomach was dissected out and opened through greater curvature. Gastric juice was collected and centrifuged which was then tested for acidity, peptic activity^{1,5} much activity in terms of hexosamine 1 and total hexoses²⁸ and protein content¹³. Simultaneously, gastric mucosa was examined for ulcer count and severity. Ulcer index was calculated adopting the recent methods^{19,22}.

Results and Observations

Although ulcer patients (64%) were more mixed eaters and more healthy persons (56%) were vegetarians but frequency of non-vegetarian meals (weekly or more than weekly) was found more among healthy persons (32%) than the ulcer patients (20%). Perhaps, ulceration has no relation with vegetarian or non-vegetarian meal. High number of the ulcer patients (84%) were rice eaters whereas majority of normal persons (84%) were wheat eaters. Arahara was observed the pulse of first choice in both the groups. More than 90% ulcer patients as well as healthy persons were in the habit of eating

Arahara daily (Fig 1) Pulse of second choice was Masura (lentil) in ulcer patients (26%) and Munga (green gram) in healthy persons (32%). Excessive intake of condiments and spices was observed in majority of ulcer patients (63%) in contrast to average intake in most of the normals (80%). No difference was observed in salt intake of additional items like lemon, ginger, garlic and onion and their incidence during meals were observed almost in equal number of cases of both the groups. Similarly, milk consumption was found equal in the two groups. However, the mean quantity of curd intake (g/day) was found significantly less among ulcer patients (30.76 ± 10.17) than the healthy persons (102.00 ± 27.52). 65% ulcer cases and 72% healthy persons used to take tea daily. Mean number of cups per day was 3.08 ± 0.36 and 2.64 ± 0.54 in patients with duodenal ulcer and normals respectively, the difference being insignificant. However, tea and coffee as pain accentuating factors were observed in 15% ulcer patients. Mustard oil was found to be used for vegetable cooking and other purposes equally in both the groups. Extra fat intake (Ghee) during meals was observed in only 15% ulcer patients in comparison to 32% healthy persons.

Among dietary habits (Fig. 2), no significant difference was observed in frequency of major meals or tiffins between the ulcer and healthy groups. Irregularity in meals was found slightly more in ulcer patients (46%) than the normals (36%). More number of ulcer patients (42%) had the habit of eating harshly in comparison to healthy persons (28%). Consequently, gulping pattern of eating was recorded comparatively more in ulcer patients (54%) whereas chewing pattern more in healthy individual (72%). There was not observed any difference in the habit that a person eats lonely or in group or family

between the two groups. Recently cooked food was preferred by most of the persons of ulcer (71%) and healthy group (88%). Similarly, majority of both the ulcer patients (97%) as well as normals (92%) were in the habit of taking the meals prepared at home. Although the habit of frequent change in dish was observed more in healthy persons (64%) than the patients (38%), but adjustment to unfavourable dish was found identical in both the groups. Majority of the two groups also could not specify their favourite dish. Sweets were liked by equal number (20%) of them. Likewise, non-vegetarian meal was favourite to about equal number (8%) of individuals of both the groups. However, spicy fried foods were liked more by ulcer patients. As much as 73% patients specified the pain accentuating diets, rice being the pain accentuating diets, rice being the most common among them, observed in 43% cases. Next were spicy fried foods and red chillis, recorded in 28% and 11% patients respectively. Majority of cases (80%) were known to their pain relieving diet. Milk was the most frequent diet that relieved the pain in 60% patients. Other-pain relieving diets included any food, cereals like barley or wheat, Sayttu of Bengal gram, and even water in 22% 14%,9% and 8% patients respectively.

All the rats remained alive during the experimental study. No rat refused to eat specific diet. Every animal gained body weight. Increase in body weight was 15%,23%, 26% and 21 % in rice, wheat, Arahara and animal diet preferred group respectively. More weight gain by arahara feeding may be due to its high protein content. Maximum peptic ulceration was observed in rice group. Ulcer index that included mean ulcer incidence, mean ulcer count and mean ulcer severity was as much as 32 in comparison to 14 of Arahara

group. Rice and wheat both caused less gastric juice secretion i.e 2.33 and 1.62 ml per six hour per 100 g body weight respectively in contrast to 7.68 and 4.76 ml in Arahara and animal diet group respectively. Different variables of gastric juice have been depicted in Table-I. Protein content (ug/ml) of gastric juice in rice, wheat, Arahara and animal diet group was 323±22, 167 ±12, 189 ±12 and 430 ± 14 respectively.

Discussion

Diet profile of ulcer patients and healthy persons revealed rice as a staple food of ulcer patients (Fig 1) An equal and high percentage (84%) of ulcer patients and normals were rice and wheat eaters respectively. Moreover, a very few ulcer patients (15%) were pure wheat eater whereas almost same number of normals (16%) were pure rice eater. The ratio of rice to wheat eater in ulcer group was very high (2.73) in comparison to healthy group (only 0.44). Furthermore, a small group of ulcer patients (23%) had the satisfaction from the diet without rice in comparison to majority of normal persons (68%). Likewise, quantity of rice in comparison to majority of normal persons (68%). Likewise, quantity of rice consumed daily by ulcer patients was found significantly more (425±14g) than normals. Obviously, ulcer patients like and eat the rice more. Moreover, rice was found pain accentuating diet in maximum number of patients (43%) confirming the previous observation of ancient Ayurvedic clinicians Sastika Vrihi Salinam Odanena Vivardhate¹⁴ i.e. rice aggravates Parinama sula. Rice is usually gulped rather than chewing. Harsh eating with gulping pattern was recorded more in ulcer patients. Harsh eating through its emotional effect may enhance acid secretion and/or may accelerate gastric emptying, thus exposing duodenum to more acid meals,

Gulping pattern had been strongly correlated with more ulceration. Gulping decreases the secretion of saliva, a well known protective factor. Saliva buffers the meals. Less salivation protects the mucosa less from ulceration.^{15,16} These observations suggest an association of rice with genesis/accentuation of duodenal ulcer. However, no significant difference was observed in both the liking and quantity of wheat consumption between the ulcer patients and healthy persons. Similarly, no difference was found in the consumption of Arahara between the two groups. It appears that both the wheat and Arahara probably have no ulcerogenic effect, though they may possess protective role.

The present study also records the deleterious effects, although to a lesser extent, of excessive use of condiments, red chillies and tea in ulcer patients. Frequency of meals/ tiffins, irregularity in time or place of eating and state or source of food appear to have no strong association with ulceration (Fig.2). Although a reduction in gastric acid secretion along with relief, pain and heartburn on a low salt diet and furo-simide treatment has been reported in duodenal ulcer patients^{11, 27} but in the present study, no significant difference was observed in salt intake of ulcer patients and healthy persons.

The experimental study too exhibited ulcerogenic property of rice. This observation is similar to contentions of previous workers.^{10,26} all the rats developed peptic ulcers in rice group and mean ulcer severity of this group was 13.88 in contrast to 2.88 of Arahara group. Similarly, mean ulcer count in rice group was 5.38 while only 1.38 in Arahara group. Wheat also caused less ulcer severity (4.00) and less ulcer count (2.5) than the rice. Obviously, Arahara and

wheat both caused significantly less ulceration than rice in terms of incidence, count and severity. However, standard animal diet was found equally ulcerogenic to rice. Consequently, ulcer indices were^{14, 16, 28} 14 and 32 in Arahara, wheat, anidiet and rice preferred groups respectively (Table –I, Fig.3).

Gastric secretion (ml per six h per 100g body wt) was found significantly high in Arahara group (7.68 ±0.51) than other groups i.e rice (2.33 ±0.29), wheat 1.62 ±0.20) and anidiet (4.76 ± 0.39). Moreover, rice caused significantly less gastric acidity than arahara (t=

TABLE I Effect of rice, wheat and Arahara diet on gastric secretion and peptic ulceration (mean ± SEM)@

Diet group	Acidity ueq/ml)	Peptic activity	Mucin activity (c) (umol/ml)	C:P (ug/ml)	Ulcer index
1 Rice	88.75 ± 4.19	624.79 ±10.38	501.12 ±23.97	1.60 ±0.15	32
2 Wheat	96.87 ±5.81	248.34 ±10.67	758.50* ±13.41	4.52* ±0.40	16
3 Arahara	118.75* ±5.64	467.09 * ±9.94	1120.12* ±40.45	5.85* ±0.53	14
4 Anidiet	137.50* ±3.27	728.50 * ±21.01	767.37* ±49.05	1.79 ±0.10	28

@ n=8 in each group, p<0.001 in relation to rice diet.

4.269, p<0.001) and anidiet (t=9.219, P<0.001). Likewise, peptic activity was also found significantly high in Arahara (t=14.124, P<0.001) and anidiet (t=19.807, P<0.0001) than the rice group. However, no significant difference was found in gastric acidity and peptic activity of rice and wheat groups. Obviously, combined offensive (acid-peptic) activity (u mol/ml) was

observed significantly high in anidiet (865±23) and Arahara (585±13) than the rice (353 ±13) and wheat (350±11) groups. High carbohydrate content of rice and wheat, and high protein content of pulse Arahara may be responsible for this significant difference in acidpeptic activity of gastric juice. Acid output runs parallel to protein content of a foodstuff²⁰. Pulses tend to secrete more acid¹⁸ but also possess high buffering capacity¹² and thus, gastric pH remains raised resulting in less ulceration. However, in the present study protective role of Arahara appears because of high mucin output (Fig.3).

Rice and wheat groups did not differ in offensive (acid-peptic) activity but a significant difference was observed in their protective activity (mucin or carbohydrate content; $2t=9.208$, $P<0.001$). Although rice group secreted slightly more hexosamine (250 ± 12ug/ml) than two-fold secretion of total hexoses (ug/ml) was observed in wheat (612 ±9) than the rice group (251 ± 22). This is why the rice is ulcerogenic whereas wheat not. Therefore, ulcerogenic property of rice as recorded by old Ayurvedic physicians¹⁴, as well as present day scientists^{8,4,10,15,25} is also evidenced by the present experimental study and retrospect dietary study of healthy persons and ulcer patients.

Moreover, Arahara prefeeding which is a common dietary supplement of rice in north east belt of India, induced highly significant secretion of mucin activity in both the terms of hexosamine (281 ± 13) and total hexoses (839 ± 33), than the rice ($t=13.148$, $p<0.001$), wheat ($t=8.497$, $p<0.001$) and anidiet ($t=5.559$, $p<0.001$). It is evident, thus, that although the Arahara stimulates the secretion of aggressive factors (acid + pepsin) but at the same time it also enhances the output of protective factors

(mucin activity) and certainly in higher proportion to acid-pepsin. Ratio of protective to aggressive factors was found high in Arahara group (1.92) than the rice group (1.42). Carbohydrate (mucin activity) protein ratio (C:P), an index of mucosal barrier²², was found, reciprocal to ulcer index in each group (Table – I). Arahara group (Fig.3) had highest CP ratio (5.85) with lowest ulcer index (14).

Geographic incidence of duodenal ulcer in India reveals two distinct areas of unevenness in the distribution of duodenal ulcer i.e. one of high incidence (South, West coast upto Bombay, East coast including Andhra Pradesh and West Bengal, Meghalaya and Assam) and another of low incidence (North, Punjab, adjacent areas of Rajasthan, Haryana, Uttar Pradesh and Himachal Pradesh)²⁵. Moderately, high and low humidity respectively in these areas of high and low incidence, effect on the staple crops which inturn influence the diet and dietary habits of the inhabited population. Principal staple food is rice in high incidence area whereas wheat in low incidence area. There possible hypothesis have been postulated to explain the unevenness of ulcer incidence in India. Refined carbohydrate diets in Cleave's view⁴ are responsible for the high prevalence of ulcer in the rice belt because of their low buffering capacity¹² and early gastric emptying⁸ and thus, exposing the duodenum to high acid and consequently, to ulceration⁷. Wheat appears useful because of its higher intragastric buffer content than the rice⁹. Malhotra^{15,16} gives emphasis on mastication as required more for thick Capati (wheat) of low incidence area which causes excessive salivation of higher buffer capacity that protects the mucosa against the ill-effects of acid-pepsin and bile. However, in Cheney's view³, various foodstuffs of low prevalence area have certain protective

factors themselves. Protective factor, for example isolated from horse-gram, is told to be heat labile, lipid in nature, ether soluble and equally effective when given orally or parenterally¹⁰. In our view, as the etiology of ulcer is unknown and appears to be multifactorial, all these aforementioned factors such as unrefined and protein diets, adequate chewing and protective food factor itself, work together in protecting the mucosa. Experimental study as well as dietary profile reveal the ulcerogenic property of rice. Wheat diet appears protective. Arahara further seems to be more protective. Lack of pulse like Arahara etc. In south Indian diet may be responsible for more ulceration than the Eastren U.P where rice is usually eaten with Arahara. Probably addition of pulses and moderate substitution of rice with wheat may decrease the ulcer incidence in high prevalent areas like south India.

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