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Full Length Research Paper

Bran in Nigerian Local Rice Confers a High Degree of Protection against Indomethacin-Induced Peptic Ulceration in Albino Rats

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ABSTRACT

A factor in the aetiology of peptic ulcer might be the absence of protective substances; either as a result of the refining of the staple carbohydrate food or of a low intake of supplementary foods containing such factors. It has been proven that unmilled or freshly-milled rice and fresh rice bran or rice bran oil confer a degree of protection against peptic ulceration. The study was carried out to investigate the possible protective effects of two different varieties of Nigerian rice, and rice bran supplementation on indomethacin-induced peptic ulcer by indicating mean ulcer counts in male adult albino rats. Mean ulcer score for Tapa rice (2.88 ± 0.91), Ofada rice (6.79 ± 0.45), and polished rice/rice bran mixes of 95:5 (5.17 ± 1.53), 90:10 (1.42 ± 0.53), 75:25 (7.63 ± 2.44) and 50:50 (5.04 ± 1.13) showed a highly significant decrease ($P < 0.0001$) when compared with the control (16.46 ± 2.05). The polished rice only-treated group showed a high increase in mean ulcer score. The results show a tendency for the commonly-consumed polished rice to increase formation of ulcers. The bran, which is usually removed during the milling process, however confers protection against ulceration.

Keywords: Peptic ulcer, Rice bran, Polished rice, Mean ulcer score

INTRODUCTION

The gastric mucosa is continuously exposed to potentially injurious agents such as acid, pepsin, bile acids, food ingredients, bacterial products, and drugs (Peskar and Maricic, 1998). These agents have been implicated in the pathogenesis of peptic ulcer, such as an increase in gastric acid secretion, the suppression of endogenous generation of prostaglandins, a decrease in gastric blood flow, inhibition of mucosal growth and cell proliferation, and alteration of gastric mobility (Konturek *et al*., 1998). A major cause of peptic ulcer is the use of Non-Steroidal Anti-inflammatory Drugs (NSAIDS). The gastric mucosa protects itself from gastric acid with a layer of mucus, the secretion of which is stimulated by certain prostaglandins. NSAIDs block the function of cyclooxygenase 1 (*cox-1*), which is essential for the production of these prostaglandins (Yamaoka, 2008).

It has been suggested that a factor in the aetiology of peptic ulcer might be the presence or absence of protective substances. This might be either as a result of refining the staple carbohydrate diet or as a result of an associated low intake of supplementary foods containing such factors (Tovey and Tunstall, 1975). It has also been suggested and confirmed that the refinement of staple carbohydrate foods may be a major aetiological factor in accounting for the appearance and the rising incidence

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of ulcer, both in Western countries and in developing countries, during the present century (Cleave, 1962). Cleave postulated that this may be due to loss of buffer in the staple carbohydrates as a result of the removal of bran by milling. He obtained convincing evidence of the ulcerogenic effects of a polished rice diet and suggested a protective effect of fresh rice bran supplements in prisoners of war in the Far East during World War II (Cleave, 1962). The protective effect of a pasteurized rice bran diet has also been reported (Tovey, 1972). The ulcerogenic and protective effects of rice and rice fractions in the pylorus-ligated rice model have also been investigated and described in literature (Jayaraj *et al.,* 1987). The following experiment was therefore carried out to examine the ulcerogenic effects of polished rice, as well as the protective effects of two local varieties of Nigerian rice (Tapa and Ofada) and dietary supplementation with rice bran against ulcerogenesis in prefed rat models.

MATERIALS AND METHODS

Male albino rats of the wistar strain weighing between 200-300g were used for this study. They were maintained under standard laboratory conditions and fed with standard rat's pellets (Ladokun feeds) and water ad libitum (so as to acclimatise them) for two weeks prior to the commencement of the actual experiment. The animals were then divided into 6 different groups and pre-fed on the rice diets and rice bran supplementation for 30 days. The groupings were as follows:

Group 1: Standard diet of pelletised feeds (Ladokun feeds)
Group 2: Local, unmilled (Tapa) rice variety.
Group 3: Local, unmilled (Ofada) rice variety
Group 4: Milled, polished rice (Caprice) only
Group 5: 95% milled, polished rice (Caprice) with 5% freshly-milled rice bran
Group 6: 90% milled, polished rice (Caprice) with 10% freshly-milled rice bran
Group 7: 75% milled, polished rice (Caprice) with 25% freshly-milled rice bran
Group 8: 50% milled, polished rice (Caprice) with 50% freshly-milled rice bran

Table 1:
Composition of Standard pelletised rats feeds (Ladokun feeds)

COMPONENT	AMOUNT
Protein	21%
Fat	3.5%
Fibre	6%
Calcium	0.8%
Phosphorus	0.8%

The rice varieties and polished rice/rice bran mixes were ground and then pelletised. The animals were deprived of food 24 hours before the commencement of the laboratory experiments and oral administration of 40mg/kg BW Indomethacin. They were however allowed free access to clean drinking water. They were then left for six hours after administration of Indomethacin before they were sacrificed. The scoring of the experimentally-induced ulceration was done according to the method described by Alphin and Ward (1967).

Table 2:
Ulcer Scoring (Alphin and Ward, 1967)

ULCER SCORE	CRITERIA
0	Normal Stomach/No ulcer
0.5	Punctuate or pinpoint ulcers
1.0	Two or more small haemorrhagic ulcers
2.0	Ulcers greater than 3mm in diameter

The Ulcer Index (UI) was calculated using the following formula:

$$\text{i.e.} \quad \frac{\text{Mean Ulcer Score x Number of animals in a group}}{100\%}$$

The percentage inhibition was calculated as follows:

$$\% \text{ Inhibition} = \frac{\text{UI of Control group} - \text{UI of Test group}}{\text{Index of Control group}}$$

RESULTS

The results for the experimental studies on the incidence and formation of gastric ulcers in pre-fed animals is shown in Table 3 below. There was a significant decrease ($P<0.05$) in mean ulcer count in the second group fed on Tapa rice in comparison with the control group. There was also a significant decrease when compared with the group fed on polished rice only. Group 3 fed on Ofada rice recorded a mean ulcer score with a highly significant reduction ($P < 0.05$) in score when compared with the control group. It also showed a significant decrease when compared with the group fed on polished rice only. Group 4 fed on polished rice only recorded a mean ulcer score that was however not significant in comparison with the control group ($P > 0.05$). Group 5 fed on 95% Polished rice mixed with 5% Rice bran showed a highly significant reduction ($P < 0.05$) in score when compared with the control group. It also showed a significant decrease when compared with the group fed on polished rice only. Group 6 fed on 90% Polished rice mixed with 10% Rice bran also showed a highly significant reduction ($P < 0.05$) in score when compared with the control group.

Table 3:
Effects of Different Nigerian Rice Varieties and Varying Proportions of Rice Bran on Ulcerogenesis in Albino Rats

GROUPS	TREATMENT (30DAYS)	MEAN ULCER SCORE (MEAN ± SEM)	ULCER INDEX	% INHIBITION
1	Normal rats feeds	16.46 ± 2.05	0.99	-
2	Tapa-fed rats	2.88 ± 0.91 ***	0.173	82.53
3	Ofada-fed rats	6.79 ± 0.45 ***	0.407	58.89
4	Polished rice-fed rats	18.63 ± 3.00	1.118	-12.92
5	Polished rice + Bran (95:5)	5.17 ± 1.53 ***	0.31	68.69
6	Polished rice + Bran (90:10)	1.42 ± 0.53 ***	0.085	91.41
7	Polished rice + Bran (75:25)	7.63 ± 2.44 ***	0.458	53.74
8	Polished rice + Bran (50:50)	5.04 ± 1.13 ***	0.302	69.49

*P < 0.05

It also showed a significant decrease when compared with the group fed on polished rice only. The group showed the lowest mean ulcer count amounting to the highest percentage inhibition of all treatment groups. Groups 7 and 8 fed on 75% Polished rice mixed with 25% Rice bran and 50% Polished rice mixed with 50% Rice bran respectively both showed a highly significant reduction ($P < 0.05$) in score when individually compared with the control group. They also showed a significant decrease when compared with the group fed on polished rice only.

DISCUSSION

The results obtained in this study suggest that the unpolished rice varieties (Tapa and Ofada) have a protective effect on the mucosa of the stomach. The rice bran, which is removed from rice during the milling process, also conferred a high degree of protection against ulceration while the polished rice (rice without bran), is on the other hand, highly ulcerogenic, predisposing the stomach mucosa to an increase in ulcer formation.

When compared with the control group, animals fed on Tapa rice showed a significant decrease in mean ulcer score. The animals fed on Ofada rice also showed a significant decrease in mean ulcer score in comparison with the control. The Tapa rice-prefed group however showed a decrease in score which was more than was noticed in the Ofada group. This therefore means that Tapa rice has a greater protective effect against the formation of ulcers. These results are consistent with the findings of Oluwole *et al*. in 1991. Values of mean ulcer score in the Tapa and Ofada groups also showed a significant decrease when compared individually with the polished rice group; there was also an increase in mean ulcer score when the polished rice-treated group was compared with the control group, although this result was not statistically significant ($P>0.05$). Going by these observations, polished rice appears to have an ulcerogenic effect. This lends support to the earlier suggestion of Cleave (1962), that a polished rice diet had ulcerogenic effects, which was confirmed by Tovey *et al*. (1975) and Oluwole *et al*. (1991). The rice bran supplementation in these animals showed significant decrease in mean ulcer score when compared individually with either the control or the polished rice groups ($P<0.05$). This agrees with the findings of Jayaraj *et al*. (1986). In this work, the addition of rice bran supplementation to the polished rice conferred a protective effect against the ulcerogenic effects of the polished rice. It is of importance to note that the decrease in mean ulcer score was however not dose-dependent and the results obtained show that a peak protective effect was observed with supplementation of 90% polished rice with 10% rice bran. With further increase in rice bran supplementation, mean ulcer score was observed to increase with quantity of the rice bran. This

investigation shows that freshly-milled rice bran collected on a daily basis from the mill confers a degree of protection against experimentally-induced peptic ulceration in rats.

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