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EFFECT OF IRRADIATION ON SHELF LIFE OF HEALTH MIX

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ABSTRACT

An experiment was conducted to study the effect of irradiation on Shelf life of health mix. Initially the health mixes were formulated by using ragi, foxtail and green gram in the different ratios. Among them, Health mix of ragi, foxtail and green gram in the ratio of 40:40:20 (T3) was selected because of its superiority over other formulations. Irradiation treatment up to 0.5 kGy was taken to increase the shelf life of selected formulation (T3), then mix was evaluated for the microbial analysis like total bacterial count (TBC), total mould count (TMC) and sensory analysis like mouth feel, taste, texture, aroma, appearance and overall acceptability etc was carried out of both irradiated as well as non-irradiated sample on 0th day, 30th day, and 60th day respectively. The results shows that TBC of irradiated formulation at 0th , 30th and 60th day was recorded less count($3x10^{-3}$,$5x10^{-3}$, $8x\ 10^{-3}$ cfu) over non-irradiated formulation ($0\cdot 1x\ 10^{-2}$, $2x\ 10^{-2}$ cfu). TMC of non-irradiated sample shows 0, $2x\ 10^{-1}$, $3x\ 10^{-1}$ cfu where as irradiated formulation shows zero TMC at 0th, 30th and 60th days.

INTRODUCTION

The use of ionizing radiation to preserve food was the subject of patent applications over 90 years ago and since then it has become one of the most extensively studied and controversial methods of food processing. Radiation processing is a non-thermal or cold process as during radiation processing elevation in temperature of food product is negligible (Marathe *et al.*, 2002). Food irradiation technology is widely adopted because of its effectiveness in both technically and economically. Health mix prepared from millets is considered as a healthy food and compositionally it has high protein, low fat and high fiber. Food mixes are developed with the purpose to provide nutritionally high biological value protein and also to use as concentrated sources of energy, iron, folic acid and other specific nutrients particularly the micronutrients. Low dose radiation process is now widely recognized as an effective method for extending the shelf life of cereals and legumes. Radiation treatment does not affect the acceptability of legumes in terms of sensory attributes, such as taste, aroma, texture and cooking quality and no insect infestation in irradiated millet flour. Food irradiation is one such modern processing technology described as a versatile and safe process.

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So, an attempt was made to increase the shelf life of product by irradiation technology. In this context, better health mix was selected for the current study to know the effect of radiation processing of the health mix on shelf life.

MATERIALS AND METHODS

Selection and formulation of health mix

Ragi, foxtail, and green gram were procured from local market, and then were cleaned in order to remove the dirt, dust, sand etc. After cleaning, the grains were subjected to processing such as soaking, germination, drying, and devegetation, dehusking, kilning and grinding for preparation of health mix. The experimental formulations were based on germinated Ragi, green gram and dehulled foxtail was developed and standardized. Then 50g sample pouches were subjected to irradiation treatment at dose of 0.5 kGy at (Mauron, 1982) gamma irradiation unit ANGRAU, Rajendranagar, Hyderabad. After irradiation treatment health mix was subjected to shelf life studies like microbial (TBC, TMC) and sensory analysis (mouth feel, taste, texture, aroma, appearance and overall acceptability) at 0th, 30th and 60th day respectively. Dilution plate method was followed for estimating the microbial load. Nutrient agar and Potato dextrose used as medium for bacterial growth and \fungal population.

Table1. Formulations of health mix

Treatments	Ragi (%)	Foxtail (%)	Green gram (%)
T1	80	-	20
T2	60	20	20
T3	40	40	20
T4	40	20	40

Table 2. Effect of irradiation on microbial population in cfu

	Non - irradiated		Irradiated	
	TBC	TMC	TBC	TMC
0^{th} day	$3x10^{-3}$	0	0	0
30^{th} day	$5x10^{-3}$	$2x\ 10^{-1}$	$1x\ 10^{-2}$	0
60^{th} day	$8x\ 10^{-3}$	$3x\ 10^{-1}$	$2x\ 10^{-2}$	0

found to be better in comparison to treatment (T1). Similar results were found in sterilized apple juice at 0.5 kGy (Bregvadze, 1963). Lu *et al*. (1986) also found that similar results reported that doses of gamma irradiation up to 2000 Gy showed no effect on colour of sweet potato. Whereas aroma and texture of health mix showed equal results (4.500±0.527) (4.600±0.516) in T1 and T2. Results revealed that at the time of germination and kilning of ragi and green gram there is development of aromatic flavours. There is no significant difference in aroma and texture of irradiate and non-irradiate formulation. (Carolina, 2006) showed there is no difference in bread made by irradiated wheat at 1.0 kGy and non-irradiated wheat. There was no difference in sensory attributes showing

Table 3. Effect of irradiation on sensory parameters of health mix

Attribute	Appearance	Colour	Taste	Aroma	Texture	Mouth feel	Overall acceptability
T1: Non-Irradiated	4.300±0.675	4.300±0.675	4.600±0.56	4.500±0.527	4.600±0.516	4.300±0.823	4.500 ±0.527
T2: Irradiated	4.800±0.422	4.500±0.527	4.500±0.57	4.500±0.527	4.600±0.516	4.400±0.516	4.200 ±0.632
S.Ed	0.26874	0.20000	0.17951***	0.21082	0.21082	0.29059**	0.25784
C.D (0.05)	0.60793	0.45243	0.40607	0.47690	0.47690	0.59625	0.52904

The data obtained were subjected to statistical analysis as per procedure outlined by Snedecor and Cochran, 1983. Analysis of Variance (ANOVA) technique was used.

RESULTS AND DISCUSSION

Microbial analysis

Health mix was evaluated for the microbial analysis like total bacterial count (TBC), total mould count (TMC) and sensory analysis like mouth feel, taste, texture, aroma, appearance and overall acceptability etc was carried out of both irradiated as well as non-irradiated sample on 0^{th} day, 30^{th} day, and 60th day respectively as shown in table 2. The results shows that TBC of irradiated formulation at 0^{th}, 30^{th} and 60^{th} day was recorded less count ($3x10^{-3}$, $5x10^{-3}$, $8x\ 10^{-3}$ cfu) over non-irradiated formulation (0, $1x\ 10^{-2}$, $2x\ 10^{-2}$ cfu). Result concludes that irradiation treatment (0.5kGy upto 3kGy) of health mix reduced the bacterial count and increased the shelf life. All the bacterial counts of test pathogens into the samples were reduced to below the limit of detection by 3 kGy irradiation. (Lee *et al*. 2005) TMC of non-irradiated sample shows (0, $2x\ 10^{-1}$, $3x\ 10^{-1}$ cfu) where as irradiated formulation shows zero TMC at 0^{th}, 30^{th} and 60^{th} day. Results are in line with finding of Singh *et al*., 2006, Mallesi *et al*., 1996. Results found that there is no mould growth in irradiated formulation at the dosage of 0.5kGy. Results are in accordance with finding of Boonchoo *et al.* (2005) it is proved that gamma irradiation of 6 kGy reduced more than 80% of fungal loads on inoculated brown rice which was kept under vaccum and sealed packages.

Consumer evaluation

The results showed that irradiated (T2) sample was rated higher (4.800± 0.422), (4.500±0.527), (4.400±0.516) in terms of appearance, colour and mouth feel when compared to the non- irradiated (T1) (4.300±0.675), (4.300±0.675) and (4.300±0.823) sample as per the table 3. Results found that during the time of kilning improves the mouth feel, colour and appearance. But in storage the non-irradiated sample changes these attributes slightly. Scores for irradiation dose (T2) was that there were no general significant differences between irradiated and non-irradiated bread. As in case of taste T1 (4.600±0.56), T2 (4.500±0.57) and overall acceptability T1 (4.500 ±0.527), T2(4.200 ±0.632) non irradiated sample was superior over irradiated sample as shown in the table 3. Present Results are in accordance with the findings of kalyani *et al.,* 2011 on soy mix.

Conclusion

The results of the present study on the effect of irradiation on Shelf life of health mix revealed that the irradiated health mix was safe for consumption up to 60 days on proper storage. It may be concluded that by the radiation processing the self life of the health mix was extended, by without any microbial and mould infestation spoilage. It is thus evident that the irradiated health mix was microbiologically and organoleptically satisfactory on storage.

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