Microbiological, Chemical and Organoliptical Evaluation for Irradiated white Shrimp

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Introduction

The present study was carried out to evaluate the microbiological, chemical and organoliptical aspects of irradiated white shrimp to extend its shelf-life. In this investigation, the shrimps were irradiated at five doses (1.5,3.0,4.5,6.0 and 9.0) , used for preservation, to study the effect of these doses on the microbiological aspects, fatty acids ,amino acids and organoliptical properties of shrimp post-irradiation or after 20 days of storage in comparison with the commercial ones .

Table (4): Organoleptical evaluation of irradiated and non-irradiated white shrimp samples within storage periods.

Parameters	Control		1.5 kGy		3.0 kGy		4.5 kGy		6.0 kGy		9.0 kGy	
	*	**	*	**	*	**	*	**	*	**	*	**
Appearance	10	-	10	9.5	10	9.5	10	9.0	10	8.0	10	8.0
Odour	8.2	-	8.3	8.0	8.4	8.4	8.4	8.35	8.3	8.2	8.3	8.1
Texture	9.5	-	9.4	9.1	9.4	9.3	9.4	9.3	9.2	9.0	9.2	9.0
Taste	10	-	10	8.9	10	9.2	10	9.2	10	9.0	10	9.0
Colour	10	-	10	8.2	10	9.5	10	9.5	10	8.8	10	8.9

* : Beginning of storage period ** : End of storage period (20 days).

Table (3): Relative percentage of amino acids of irradiated whit shrimp and control samples within storage periods.

Amino acids	Control		1.5 kGy		3.0 kGy		4.5 kGy		6.0 kGy		9.0 kGy	
Essential amino acids	*	**	*	**	*	**	*	**	*	**	*	**
Valine	7.740	-	6.55	5.98	7.69	7.24	7.58	7.27	6.59	6.04	6.65	6.12
Methionine	4.980	-	3.63	3.23	4.93	4.35	4.88	4.40	3.64	3.36	3.79	3.49
Isoleucine	5.520	-	4.18	3.69	5.44	4.84	5.39	4.92	4.28	3.78	4.39	3.86
Leucine	10.26	-	8.96	8.57	10.21	9.54	10.15	9.59	9.00	8.63	9.07	3.69
Tyrosine	6.170	-	4.89	4.65	6.13	5.39	6.09	5.42	4.94	4.75	4.98	4.77
Phenylalanine	7.380	-	6.31	5.83	7.31	6.76	7.27	6.81	6.36	5.92	6.42	6.04
Lysine	5.020	-	4.00	3.70	4.96	4.40	4.90	4.46	4.08	3.75	4.12	3.85
Arginine	6.510	-	5.58	5.17	6.47	6.00	6.41	6.09	5.64	5.19	5.72	5.26
Histadine	6.920	-	5.95	5.74	6.86	6.30	6.81	6.31	5.99	5.78	6.07	5.84
Total essential amino acids	**60.5**	-	**50.46**	**46.55**	**60.00**	**54.82**	**59.48**	**55.27**	**50.98**	**47.20**	**51.72**	**47.92**
Non-essential amino acids												
Aspartic acid	11.18	-	10.04	9.68	11.14	10.57	11.09	10.61	10.08	9.70	10.11	9.75
Threonine	6.02	-	5.02	4.77	5.96	5.46	5.91	5.50	5.08	4.81	5.12	4.84
Serine	5.54	-	4.93	4.59	5.49	5.10	5.44	5.15	4.97	4.74	5.02	4.80
Glutamin acid	14.69	-	13.89	3.23	14.62	14.20	14.57	14.24	13.96	13.27	14.0	13.29
Glycine	6.48	-	5.85	5.48	6.42	6.04	6.37	6.08	5.91	5.51	5.94	5.72
Alanine	5.36	-	4.39	4.05	5.31	4.79	5.26	4.84	4.43	4.07	4.48	4.09
Total non-essential amino acids	**49.27**	-	**44.12**	**11.80**	**48.94**	**46.16**	**48.64**	**36.40**	**44.43**	**42.10**	**44.67**	**42.49**
Total amino acids	**109.8**	-	**94.58**	**88.35**	**108.94**	**100.98**	**108.12**	**101.67**	**95.41**	**89.30**	**96.39**	**90.41**

* : Beginning of storage period ** : End of storage period (20 days).

Table (2): Relative percentage of fatty acids of irradiated white shrimp and control samples within storage periods.

Fatty acids		Control		1.5 kGy		3.0 kGy		4.5 kGy		6.0 kGy		9.0 kGy	
		*	**	*	**	*	**	*	**	*	**	*	**
Saturated fatty acids													
Laurie	C12:0	0.27	-	0.30	0.35	0.22	0.26	19.0	0.24	0.28	0.32	0.25	0.29
Myristic	C14:0	3.02	-	3.04	3.08	2.95	2.99	2.86	2.90	2.95	2.99	2.89	2.94
Palmitic	C16:0	19.28	-	19.35	19.40	19.23	19.29	19.19	19.25	19.31	19.36	19.29	19.34
Margaic	C17:0	15.21	-	15.27	15.33	15.15	15.21	15.09	15.14	15.19	15.23	15.14	15.20
Stearic	C18:0	18.45	-	18.50	18.56	18.39	18.45	18.35	18.41	18.47	18.53	18.42	18.47
Arachidic	C20:0	4.66	-	4.73	4.78	4.61	4.67	4.58	4.64	4.69	4.74	4.61	4.67
Total saturated fatty acids		**60.89**	-	**64.19**	**64.50**	**60.55**	**60.87**	**60.26**	**60.58**	**60.89**	**61.17**	**60.60**	**60.91**
Unsaturated fatty acids													
Palmitic	C16:1	2.65	-	2.42	2.33	2.59	2.51	2.55	2.46	2.39	2.31	2.39	2.35
Oleic	C18:1	28.27	-	27.98	27.87	28.21	28.09	28.16	28.08	27.98	27.90	28.0	27.94
Linoleic	C18:2	5.22	-	4.93	4.81	5.17	5.05	5.13	5.04	4.93	4.84	4.94	4.87
Linolenic	C18:3	2.21	-	1.89	1.77	2.15	2.00	2.09	1.99	1.90	1.82	1.92	1.86
Total unsaturated fatty acids		**38.35**	-	**37.22**	**36.78**	**38.12**	**37.65**	**37.93**	**37.57**	**37.20**	**36.87**	**37.25**	**37.02**
Total fatty acids		**99.24**	-	**101.41**	**101.28**	**98.67**	**98.52**	**98.19**	**98.15**	**98.09**	**98.04**	**97.85**	**97.93**

* : Beginning of storage period ** : End of storage period (20 days).

Table (1): Microbiological quality of irradiated white shrimp and control samples within storage period.

Microbiological quality	Control		1.5 kGy		3.0 kGy		4.5 kGy		6.0 kGy		9.0 kGy	
	*	**	*	**	*	**	*	**	*	**	*	**
Total aerobic bacteria	8.2×10^3	-	7.5×10^3	5.1×10	5.0×10^2	4.0×10^3	3.1×10^2	2.7×10^2	1.9×10^2	1.0×10	1.2×10^2	1.0×10
Total yeasts and molds	1.7×10^3	-	3.3×10^2	2.9×10	<10	<10	<10	<10	<10	<10	<10	<10
Faecal streptococci	3.0×10^3	-	3.2×10^2	2.5×10	<10	<10	<10	<10	<10	<10	<10	<10
Staphylococcus aureus	3.3×10^2	-	<100	<10	<10	<10	<10	<10	<10	<10	<10	<10
Salmonella	1.1×10	-	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG

NG: No growth * : Beginning of storage period ** : End of storage period (20 days).

Materials and Methods

Samples

Fresh white shrimp (Metapenaeus afinisf) , approximately 25 kg , were obtained the Qatif Fish market in eastern province of Saudi Arabia .This market is one of the main sources of fish and white shrimp in the kingdom. The white shrimp was iced and arranged in of fish and white shrimp in the kingdom. The white shrimp was iced and arranged in plastic isolated box (25 kg capacity) and transported directly in air condition to Riyadh .Immediately on receiving , white shrimp were washed and peeled then the peeler samples were washed again . Samples were divded into 6 Groups (every one 3 kg) in plastic bags and all samples were completely surrounded and covered with ice during sampling and transportation to gamma irradiator . Samples were irradiated by Co-60 source (Nutronic) at 1.5 , 3.0 ,4.5 , 6.0 and 9.0 KGy. The samples were stored in chill room (20±2ºC) then microbiological and chemical analyses as well as sensory evaluation were determined . All samples under investigation were stored in cold (0-2ºC) for 20 days and tested from the beginning till the end of the storage period.

Microbial content assay

Total aerobic bacterial counts enumerated on plate count agar as described by [1] while total mold and yeasts were counted on malt extract agar medium [2]

Chemical analysis

Fatty acids and amino acids were determined according to the method described [3]

Organoleptic evaluation:

Organoleptic Test: Fresh white shrimp was submitted to 10 panelists for evaluation. The ranking method was used in combination with scoring based on the hedonic scale with 9 scores ranging from “dislike extremely” to “like extremely”. The results were analyzed using analysis of variance[4]

Discussion

The results of radiation treatment white shrimp led to reduce the microbial count,Staphylococcus aureus, microorganism very much, as microbes destroyed the completely Salmonella. The fatty acids composition of irradiated and non – irradiated shrimps were qualitatively similar, since no new fatty acids or other artefacts due to irradiation were observed .the relative percentage of total unsaturated fatty acids of all shrimp lipids was slightly decreased with increasing the irradiation dose ,which indicated the possibility of \ unsaturation to be oxidized by irradiation . The present results indicated that shrimp, which rich source for a proteins, is adequate to fulifil amajor part of the requirements for human foods. As the results indicated that the shrimp proteins under investigation contained most of the known amino acids particularly the essential amino acid valine, which was found in the amount of 7.74% and other amino acid were found in considerable quantities. Considering the organoleptic evaluation,it could be concluded that the optimum irradiation doses for shrimp should not exceed 3.0 and 4.5 KGy without adverse effect on their chemical and organoleptical properties.

Conclusion

To sum up, Gamma irradiation caused a great reduction in microorganisms and this reduction was proportional with irradiation dose., it could be concluded that the optimum irradiation doses for shrimp should not exceed 3.0 and 4.5 KGy without adverse effect on their chemical and organoleptical properties.
Conclusion Accordingly, the present study recommends utilizing γ-irradiation for preservation of White Shrimp and other Fish.

References

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