POPULAR ATTITUDES TOWARD CONSUMPTION OF IRRADIATED FOODS

by
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We were recently engaged in an investigation of market development of gamma-irradiated papaya. The process of gamma irradiation was to be substituted for the present methods employed in fruit fly disinfestation and shelf-life prolongation of the product.

However, Food and Drug Administration requirements made it impossible to have irradiated papayas on the market during the life of the project and within the foreseeable future.

To estimate what might be the effect of gamma irradiation on the demand and general market behavior of papayas, a somewhat roundabout method had to be employed. It is this method and consequent findings with which this paper will be concerned.

The most workable approach, it seemed to us, was to address ourselves directly to a population sample and to ask whether irradiation would or would not create a consumption barrier and to what extent it would do so. It should be noted that reference is made here to irradiated food rather than irradiated papaya. Obviously, the aim is to eliminate as far as possible any bias connected with consumption of papaya per se. The basic plan was as follows: A representative sample of the population in our two test cities was to be polled on (1) its attitude toward food irradiation, (2) its knowledge of and about food irradiation and (3) wherever applicable, reasons for negative attitudes toward

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food irradiation. This information was then to be related to certain societal and demographic factors such as income, age, education, sex, etc., to determine the extent to which they influence attitudes towards food irradiation. The results of this survey were then to form the basis for educational and promotional activities required to elicit a more informed response toward food irradiation per se. In addition, knowledge of the factors involved can point toward expected demand responses relative to irradiated papaya. Thus if it is found for example that the predominant number of those who consume papayas are in the $10,000 to $15,000 bracket and if it is known that say 60 percent of those in the particular income bracket would refuse consumption of any irradiated foods, it could then be concluded that the demand for irradiated papaya would be reduced by 60 percent. And even on a more general plane, findings of this nature would also give insight into the direction in which educational and promotional activity would need to move.

There was still another reason for conducting this part of the survey. It is quite evident that once food irradiation becomes widely employed for food preservation and shelf-life prolongation, the various irradiated products will need to be labelled as such. Since the wording and formulation of these labels may directly affect the demand for irradiated foods, a set of labels was introduced into this survey so that the degree of its acceptability (or non-acceptability) to respondents may be tested.

Methodology:

Limitation of funds and time required that this attitudinal survey be conducted through telephone rather than on a personal basis. A schedule was therefore designed to elicit the required information through a telephone survey. Prior to submission of the schedule to our enumerators in Sacramento

and Redlands, California, it was tested by means of conferences with two panels of housewives in Kailua. Panel 1 consisted of nine members and Panel 2 had four. The purpose of the pre-test through these panels was: (a) to determine whether the structure of the schedule would meet the required criteria in terms of time and effectiveness, (b) to discuss various methods of approach to prospective respondents (e.g., best time of day to make a call, introductory remarks by the interviewer, etc.), and (c) to obtain a first inkling of general attitudes toward the concept of food irradiation. Moreover, being aware of the requirement on the part of the Food and Drug Administration that irradiated foods will need to be labelled as such, a number of labels were devised which also were submitted to the panels for later introduction into the main questionnaire.

While the two panels were equal in terms of ethnic and religious distribution, there were differences in terms of per family income, education, and occupational environment. More specifically, Panel 1 consisted of a large proportion of college graduates, their per family incomes averaged between $10,000 and $15,000 and their own as well as their husband's occupation were mainly within professional and managerial categories. The second panel consisted of somewhat younger women none of whom had attended college. Their average per family income was less than $5,000 and their husbands were either in the military service or associated with the military in a civilian capacity.

The two panels met at different times and care was taken that members of one panel did not know the members of the other. At the beginning of each session, panel members were first asked to complete a brief general information sheet about themselves and their family so that some of the demographic and family background may be established. They were then introduced to the purposes of the tests and the set of actual questions were

placed before them. The first of these questions concerned itself with the members' preparedness to consume or purchase gamma irradiated foods provided that the Food and Drug Administration and the United States Department of Agriculture were to approve of this process. While all members of Panel 2 said they would purchase irradiated foods and consume them, only three members of Panel 1 indicated that they would do so. The remainder said that they would refuse on the grounds that (a) they did not know exactly what irradiation of food meant and (b) that they were concerned over possible health hazards that might derive from this process. None of the members of Panel 2 knew what gamma irradiation of food meant but were prepared to purchase and consume irradiated foods. Here, evidently Food and Drug Administration and USDA approval appeared to be sufficient guarantee which would alleviate any questions of health or other hazards generally associated with the concept of irradiation.

The next step then was to present the panels with a set of labels which are to be used for identification of irradiated foods. Three labels "Radiation Processed", "Radiation Sterilized", and "Radiation Pasteurized" were submitted to these panels for evaluation on an hedonic scale ranging from one through five (one being unfavorable, five being favorable). In addition, panel members were invited to suggest alternative labels which they might consider acceptable to their taste. Members of Panel 1 suggested the inclusion of the label "Radiation Preserved" as an acceptable alternative to those already presented. The response by the panels was as follows (Table 1).

Next various approach statements to be made by interviewers in the two test cities as well as the best time during which calls should be made were discussed. There was generally considerable apprehension about the telephone method of survey but as was stated previously, lack of funds and time did not

TABLE 1

	Panel I					Panel II				
	Rating: 1	2	3	4	5	Rating: 1	2	3	4	5
	No. of Persons Responding					No. of Persons Responding				
Radiation Pasteurized	2	1	6	0	0	0	0	4	0	0
Radiation Sterilized	2	4	3	0	0	0	0	3	0	1
Radiation Processed	2	2	3	1	1	0	1	3	0	0

permit personal interviews (which would have been preferred by a majority of panel members). Also, the use of mail -- questionnaires was considered but was later on rejected on the grounds that normally only a small percentage of such questionnaires were completed and returned to the investigators.

From these discussions and deliberations, a schedule consisting of two parts was evolved. The first part contained the interviewer's introduction and a short explanation of the purposes of the survey followed by three questions, namely, (1) preparedness to purchase and consume irradiated foods, (2) knowledge of the concept of irradiation and (3) reasons for non-acceptance of irradiated foods. The first part also included the presentation of the four labels discussed above plus one "Processed By Ionizing Radiation" which was added later on. The second part contained questions dealing with general information including age, marital status, education, occupation of the interviewee and spouse, income, race, religious preference, etc.

In the performance of the surveys in the two test cities, the following provisions were made:

1. 1,000 responses were to be obtained in each of the test cities.
2. Interviewees were to be randomly selected from the telephone book. Random selection was to occur through selecting the third name in columns 1 and 3 of each page in the local telephone book. In the event that no answer was obtained because the party called was not at home, the interviewer was instructed to call the next name in that column. If the party called answered but refused to participate, the reason for refusal was noted, and the next name was selected in the previously described random fashion.
3. Upon completion of an interview, the name and address of the respondent were recorded on the schedule.

In Sacramento, 1,552 individuals were contacted of which 402 refused to participate because they felt they had insufficient knowledge about the subject to even talk about it, 38 had language problems, and 8 did not answer because they do not wish to answer any telephone surveys on principle. Of the 1,004 responses which were received, 7 had to be discarded because of errors in completion so that a total of 997 responses remained for analytical purposes.

In Redlands, 1,005 individuals were contacted of which 163 refused to answer on the grounds that they felt that they did not know enough about the subject to discuss any part of it, 11 had language problems, and 1 refused to answer any survey on principle. Of the 825 responses received, 18 had to be discarded due to sampling errors. Therefore, 807 completed responses from Redlands and 997 from Sacramento for a total 1,804 responses for both test cities became available for analytical purposes.

An attempt was made to compare the population profiles of the two test cities with the population profile obtained from part two of the schedule in our sample in order to establish the representativeness of the sample with respect to the test cities under consideration.

To make this comparison, data that appeared in a publication "The Sacramento 19 County Market and Metropolitan Area" prepared by the Research Department of the McClatchy Newspapers for the Sacramento Bee were used. Data compared pertain to income, age, and racial distribution in metropolitan Sacramento. (Table 2) As can be seen from that Table, the population profile in those categories which are considered here fits very well to the random sample taken in Sacramento. Since the other statistical representations in the publication are not comparable to various categories in our sample, they were deleted from

TABLE 2

	Sacramento	
	Sample	Metropolitan*
	(percent)	(percent)
a) Per Family Income		
Less than $5,000	15.5	23.0
$5,000 to less than $10,000	47.1	50.0
$10,000 to less than $15,000	30.0	20.0
$15,000 and over	7.4	7.0
b) Age Distribution (Women)*		
Less than 25 years	8.2	11.0
25 to 34	29.9	26.0
35 to 50	36.8	36.0
51 to 64	18.1	15.0
65 and over	7.0	12.0
c) Race of Population		
White	92.7	96.0
Negro	4.6	2.0
Oriental	2.2	2.0
Other	0.5	0.0
d) Education		
Less than high school	10.0	31.0
High school graduates	44.3	31.0
Second year college	20.5	19.0
College graduate	20.0	19.0
Other	5.2	0.0

* Source: McClatchy Newspapers, Sacramento, California (1966)

comparisons. It was, however, felt that those statistics that were compared are ample evidence that the sample taken is fairly representative of the total population profile of Sacramento. It was, therefore, concluded that findings in the telephone survey would not significantly differ from the actual population behavior in Sacramento. Unfortunately, no similar comparison was possible in the Redlands area since no recent publication of a population profile exists there.

Findings:

The procedure that will be used in this section will be to examine the first part of the schedule, question by question, and to analyze the results obtained for Sacramento, Redlands and the total sample (both areas combined).

Question 1 stated: Would you purchase or consume food that has been treated by X-ray irradiation provided that the U. S. Food and Drug Administration (FDA) and the U. S. Department of Agriculture (USDA) approved of this method? Three fourths of all those who answered this question appeared prepared to consume irradiated foods. A little over 21% answered in the negative while 3.7% appeared indifferent. It may be worthy of note that attitudinal differences between respondents of Redlands and Sacramento are not large--less than 4% of the positive, 2% of the negative responses (Table 3).

Question 2 concerned itself with the respondent's knowledge of irradiation and it was posed as: Do you know what X-ray irradiation of food means?

As Table 4 reveals 2/3 of all respondents did not know the meaning of food irradiation. And yet 75% of all respondents indicated that they would consume irradiated foods. One can only conclude that the phrase "provided that the U. S. Food and Drug Administration and the U. S. Department of Agriculture approved of this method" directly affected the response to the first question. More specifically, it may be concluded that there is sufficient popular trust

TABLE 3

Response to Question 1

Response	Redlands	Sacramento	Total Sample
	(Percent)	(Percent)	(Percent)
Yes	72.6	76.9	75.0
No	22.4	20.4	21.3
Indifferent	5.0	2.7	3.7

TABLE 4

Response to Question 2

Response	Redlands	Sacramento	Total Sample
	(Percent)	(Percent)	(Percent)
Yes	26.0	30.7	28.6
No	64.6	68.9	67.0
No Answer	9.4	0.4	4.4

in these two agencies that their approval is sufficient to make any given food treatment acceptable even to those who do not understand its meaning. While it would have been interesting to find out what the response to question 1 would have been had the phrase been deleted, concern with the size of the schedule and awareness that deletion would have only led to an academic debate, prompted its maintenance in question 1.

Question 3 was solely directed to respondents who gave a negative answer to question no. 1. It was stated as follows: "You have indicated that you would not consume irradiated foods. Would you state some of the reasons for your stand?" The responses were then categorized as follows: (see Table 5)

1) Dangerous to Health

2) Religious Reasons

3) Negative Connotation

   a) Bomb
   b) Nuclear Fallout
   c) Cancer
   d) Burns
   e) Other
   f) No answer

Over three-fourths of the respondents failed to answer this question. The most important concern expressed by respondents was with the "health hazard" of food irradiation. Of the 3.7 percent categorized as "Other" the greater majority (86 percent) was largely concerned with inexperience in the state of the arts. Comments such as: "We (meaning mankind in general) don't know enough about irradiation", or "Until we know more about it, we shouldn't fool around with irradiation". The remaining 14 percent were concerned with possible genetic repercussions ascribed to irradiation in general. Another small group would not touch irradiated foods because "our government has been wrong in so many things--how do we know that it wouldn't be wrong in this field?"

TABLE 5

Response to Question 3

Response	Redlands	Sacramento	Total Sample
	(Percent)	(Percent)	(Percent)
1. Dangerous to Health	16.6	15.5	16.0
2. Religious Reasons	0.1	--	0.1
3. Negative Connot.			
a. Bomb	0.1	--	0.1
b. Nuclear Fallout	0.4	0.1	0.2
c. Cancer	1.7	1.3	1.5
d. Burns	--	0.1	0.1
e. Other	4.0	3.9	3.7
f. No Answer	77.1	79.1	78.3

The third general question concerned itself with labelling of irradiated foods. At this point the enumerator explained what was meant by irradiation and presented the five labels to the respondent who then was asked to state on each whether he liked or disliked the label or found it acceptable or non-acceptable. The explanatory statement given to the interviewee was as follows: "We understand irradiation of food to mean the following: exposing food to X-ray or gamma rays for a short period of time for the purpose of disinfestation and shelf-life extension of food without injuring or changing taste, texture, aroma, or color of the product". It can be seen in Table 6 that the label "Radiation Processed" is the most liked one. The most disliked label is "Processed by Ionizing" and the most non-acceptable was "Radiation Preserved". It would be very difficult to explain the last result.

Although there are definite quantitative differences between Redlands and Sacramento, the two samples, however, are in agreement on the label which is most liked and the most disliked. There is, however, some variation in the non-acceptability of labels which cannot be explained on the basis of information presently available.

In order to establish the significance or non-significance of population characteristics which would influence the willingness to consume or not to consume irradiated foods, a program was written for the IBM 360 which rendered percentage breakdowns of various population characteristics (e.g., income, education, occupation) related to those respondents who indicated that they would or would not consume irradiated foods. Table 7 for example shows that of all those respondents who would consume irradiated foods, 30 percent knew the meaning of the term 'irradiation', while 69 percent did not. Of those who would NOT consume irradiated food 33.4% knew and 66.4% did not know the meaning of this term.

Conversely of those who knew the meaning of food-irradiation 78.7 would consume irradiated foods, 17.4% would not and 3.9 percent would be indifferent.

TABLE 6

Labelling Preference

Label	Like			Dislike			Acceptable			Not Acceptable		
	R	S	T	R	S	T	R	S	T	R	S	T
	(Percent)			(Percent)			(Percent)			(Percent)		
Radiation Pasteurization	13.5	16.4	15.1	9.5	12.0	10.9	58.2	53.8	55.9	15.0	17.7	16.6
Radiation Sterilized	19.3	25.7	22.8	11.3	16.9	14.4	48.8	29.4	38.1	16.7	28.0	22.9
Radiation Processed	25.9	32.5	29.5	2.9	5.8	4.5	54.4	50.1	52.0	13.1	11.5	12.3
Radiation Preserved	20.4	12.1	15.9	4.6	11.4	8.4	58.4	43.2	50.0	13.1	33.1	24.2
Processed by Ionizing	10.9	13.7	12.9	24.4	52.8	40.1	41.6	18.2	28.7	19.2	15.2	17.3

R = Redlands
S = Sacramento
T = Total Sample (Redlands and Sacramento)

Among those who did not know the meaning of irradiated foods 77.4% would consume irradiated foods, 19.2% would not and 3.4% would be indifferent. Since the difference in response to this question was not significant between these two groups, it can be concluded that knowledge of the term "irradiated" has no significant effect on an individual's preparedness to consume or not to consume irradiated foods.

Looking at the age distribution of both groups (Table 7) it can again be demonstrated that there are no significant differences between the two groups (those who would or would not consume irradiated foods) and the percentage breakdown conforms in both groups closely to the age distribution of the total sample. It can, therefore, be concluded that the age of individuals does not significantly effect the preparedness to consume irradiated foods.

A chi-square test on this statistic proved non-significant substantiating the evidence presented in the "age" section of Table 7. In fact, all other variables of the population profile of the whole sample related similarly to questions of consumption of irradiated foods. Chi-square tests were performed on the relationship of education, income, race, religious preference and sex, to preparedness to consume or not to consume irradiated foods. All tests showed that any deviations due to these variables are non-significant and therefore have apparently no impact on the acceptability or non-acceptability of irradiated foods. The only exception was sex. Had all 1,804 respondents been males results would have shown that 82 percent would consume irradiated foods while 15 percent would not (with 3 percent indifferent). Conversely had all respondents been females, 73 percent would have answered in the affirmative, 22 percent in the negative and the remaining 5 percent would have been indifferent.

Similar statistic appeared also in those occupational categories which were predominantly held by males or those predominantly held by females. Thus, had all respondents been members of the Armed Forces, 82 percent would have

TABLE 7 Positive and Negative Attitude Toward Acceptance of Irradiated Foods--Related to Various Demographic Characteristics

Of those who would consume irradiated foods (Percent)		Of those who would not consume irradiated foods (Percent)	Total sample (Percent)
30.0	Knew the meaning of irradiation	23.4	28.6
69.1	Did not know the meaning of irradiation	60.4	67.0
0.9	Did not answer question	16.2	4.4
	Age		
10.6	Less than 25	7.8	9.9
27.1	25 to 35	26.6	27.7
23.6	36 to 45	25.3	23.8
15.2	46 to 55	19.5	15.9
11.1	56 to 65	9.6	10.6
11.9	Over 65	10.4	12.1
	Marital Status		
81.1	Married	82.6	81.3
5.6	Single	6.0	5.5
2.7	Divorced	1.8	2.5
0.4	Separated	0.8	0.4
7.7	Widowed	5.7	7.3
3.6	No Answer	3.1	2.9
	Education		
0.6	Grade 1 to 6	1.0	0.7
9.0	Grade 7 to 9	9.6	9.3
43.7	Grade 10 to 12 (high school graduates)	46.7	44.3
21.3	College 1 to 2	18.8	20.5
21.1	College 3 to 4 (college graduates)	20.1	20.9
2.4	M. A. or M. S.	1.8	2.2
0.4	Ph.D.	0.0	0.4
1.3	No Answer	1.8	1.6

TABLE 7 (continued)

Of those who would consume irradiated foods (Percent)			Of those who would not consume irradiated foods (Percent)		Total sample (Percent)	
Husband	Wife	Occupation	Husband	Wife	Husband	Wife
--	66.7	Housewives	--	65.1	--	66.2
8.6	--	Engineers, Technical	6.2	--	7.8	0.1
1.3	2.5	Medical, Other Health	3.1	2.6	1.8	2.7
5.5	5.4	Teachers--Grade, High School	4.4	5.7	5.2	5.5
10.3	1.8	Other Professors (Accountants, Colleges)	9.6	1.3	8.9	1.6
1.0	--	Farmers and Farm Managers	1.3	--	1.1	--
10.2	1.1	Managers, Proprietors, Officials	7.6	1.6	8.8	1.2
0.1	3.6	Secretaries, Typists	--	2.9	0.1	3.3
4.7	5.8	Clerical	4.9	6.5	3.3	5.0
6.7	1.6	Sales Workers	7.0	2.4	6.8	1.8
5.5	--	Construction	5.5	--	5.5	--
3.5	--	Mechanics Repair	4.2	--	3.3	--
1.3	--	Metal Workers	1.8	--	1.4	--
1.8	0.4	Other Craftsmen	2.1	--	1.8	0.3
2.4	0.1	Drivers, Delivery Men	2.1	--	2.2	0.1
2.4	1.0	Other Operatives	2.6	0.5	2.3	0.9
--	0.3	Private Household	--	0.8	--	0.4
1.9	0.1	Protect Services	1.6	0.3	1.8	0.1
0.1	0.6	Waiters and Cooks	0.3	0.3	0.2	0.5
2.6	1.3	Other Service Workers	1.6	2.1	1.9	1.3
--	--	Unpaid Farm Lab	--	--	--	--
--	--	Paid Farm Lab	--	--	--	--
0.9	0.1	Laborer	3.4	0.3	1.3	0.2
3.8	--	Military	2.9	--	0.2	--
3.2	1.1	Others	5.5	1.8	3.3	1.1
19.6	6.4	Retired	20.1	5.2	20.1	6.1
		Income				
19.3		Less than $5,000	20.6		19.8	
43.2		$5,000 but less than $10,000	43.5		43.1	
26.7		$10,000 but less than $15,000	24.7		26.1	
8.8		$15,000 and Over	7.6		8.4	
2.1		No Answer	3.6		2.6	

TABLE 7 (continued)

Of those who would consume irradiated foods (Percent)		Of those who would not consume irradiated foods (Percent)	Total sample (Percent)
	Race		
94.1	White	93.8	94.0
2.7	Negro	3.4	2.8
1.6	Oriental	0.3	1.3
0.9	Other	1.0	0.9
0.8	No Answer	1.6	1.0
	Religion		
69.9	All Christian - Catholic	68.0	69.3
19.7	Catholic	22.4	21.8
0.6	Jews	0.5	0.6
1.5	Other	1.0	2.8
8.3	No Answer	8.1	8.5
	Sex		
78.6	Women	86.2	80.4
21.4	Men	13.8	19.6

answered positively, 16 percent negatively, 2 percent would have been indifferent. Conversely, had all respondents been housewives or secretaries, computation shows that 74 percent would have given a positive answer, 24.3 percent a negative answer while the remaining 1.5 percent would have been indifferent. One additional category differs significantly from the sample distribution of acceptance and non-acceptance of irradiated foods. Reference is made to the category of those respondents who had attended only the first six grades of school. Had the sample been composed only of this group, only 55 percent would have given a positive answer, 30 percent would have responded negatively, while the remaining 15 percent would have been indifferent.

Summary and Conclusion:

Of 1,804 respondents, over three-fourths were prepared to purchase and consume irradiated foods while 21 percent would not. The remainder being indifferent.

Findings demonstrate that the population profile of the sample of 997 individuals in Sacramento conforms very closely to the population profile of the city as a whole. It could, therefore, be inferred that behavioristics demonstrated in the sample can be ascribed to the population structure of Sacramento. Although no such comparison is feasible in Redlands, the relative closeness in response of the samples of the two cities leads to the assumption that behavior characteristics of the Redlands sample may also well be representative of the cities population. In short the behavior patterns established in the city of Sacramento may not be very divergent from those of the city of Redlands.

No perceptible demographic, educational, economic, and other differences could be determined between those individuals who would refuse consumption

of gamma irradiated foods and those who would in fact be willing to consume them. These results in turn do not depend on the degree of knowledge by individuals regarding the concept of food irradiation. Thus it was found that of those who gave an affirmative answer 30 percent knew the meaning of food irradiation, 69 percent did not while among those who gave a negative answer, 33.4 percent knew the meaning of food irradiation while 66.4 percent did not.

Of those who would refuse consumption of irradiated foods, 15 percent did so because of a direct concern with assumed health and genetic hazards associated with the idea of irradiation. The remainder would refuse to consume irradiated foods either because they themselves feel that they do not know enough about the process or that our present state of the arts is insufficiently developed in this area to make irradiated foods an acceptable product.

It would seem, therefore, that in order to alleviate some of these doubts any educational activity to be carried on either by government or some private organizations should particularly concentrate on explaining precisely the state of the arts in food irradiation and then attempt to demonstrate publicly the general safety of this method of food preservation. However, as can be seen from our investigation, the number of individuals expressing doubts and fears of health hazards in food irradiation are relatively few comprising only about 3 to 4 percent of the total sample (approximately 15 percent of all those who gave a negative response to question 1).

On the other hand, about 12 to 14 percent of the total sample would demand more knowledge on the part of the scientific community in this field which indicates, however, that most respondents expressing such concerns are

not aware of the range of knowledge that has in fact been accumulated in this area.

If legal requirements were to make it necessary to label gamma irradiated foods, our findings show that the label "Radiation Processed" was most liked and would bring about a minimum of apprehension and fear on the part of consumers.

It is, of course, not within the scope of this study to determine why any one label should be so universally preferred over others. However, additional research and the development of other labelling alternatives should, of course, be continually carried on.

We can, at this point, see no serious effects that the process of gamma irradiation will have on the demand for papayas on the long run. Since the various societal and demographic parameters are equally distributed among all those who would accept and those who would not accept irradiated foods, it can be simply stated that an initial reduction in the demand for papaya (ceteris paribus) of about 23 percent may be expected if papayas were to be irradiated at this moment. Since larger proportion of those who would refuse consumption of irradiated foods do so solely on the basis of lack of sufficient information and since the number of "hard core" opponents to the process seems to be negligible, the negative effects of irradiation on the demand for the product (and for food in general) would also be negligible.

Moreover, these effects will be offset by benefits of greater handling efficiency, reduction in spoilage and prolongation of shelf-life.