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## Consumer awareness and acceptance survey with regard to biospeckle laser screened foods

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### Abstract

Bio speckle laser technology is a non-invasive, non-destructive technology used for detecting internal bruises in fruits and vegetables. The survey was conducted among 100 consumers selected randomly from Thiruvananthapuram district. Majority of the consumers (48%) preferred conventional foods over convenient foods. Over (57%) of the consumers strongly agreed for development of novel technologies in food industry. Consumer awareness about bio speckle laser technology (BLT) was very low (10%). Majority of the consumers were uncertain about the effect of BLT on health (46%) and only (13%) of the consumers felt BLT screened foods are safe. Preference to buy BLT screened foods increased (48%) by the trusted companies.

**Keywords:** Biospeckle laser technology, consumer awareness and awareness

### 1. Introduction

Food safety, health, aesthetics, and other market qualities are always being improved due to the socioeconomic necessity of ensuring quality food. Fruit and vegetable harvesting and post-harvesting procedures, as well as developing innovative ways to extend the shelf life of the goods, rely on having the newest information regarding enhanced mechanical characteristics and maturity stages. Laser equipment, with its capacity to do non-destructive and automated assessments, is one area where machine-based testing is gaining popularity (Ansari *et al.*, 2012)<sup>[2]</sup>.

The bio speckle method allows for early detection of interior bruising in potatoes (Costa *et al.*, 2018)<sup>[7]</sup>. Bio speckle method was used to assess fruits during shelf-life storage (Ansari *et al.*, 2014)<sup>[3]</sup>. The bio speckle method was used to detect fungus in beans (Braga Jr, *et al.*, 2005)<sup>[5]</sup>. The bio speckle approach was used to assess the biological activity of the kefir grains (Guedes *et al.*, 2014)<sup>[8]</sup>.

Using a bio speckle laser and a frequency technique, researchers were able to identify changes in respiration rate and water activity in fresh-cut carrots (Alves *et al.*, 2013)<sup>[1]</sup>. Fruit bruises are assessed using a bio speckle method (Pajuelo *et al.*, 2003)<sup>[11]</sup>. Fruit ripening is assessed with a laser bio speckle (Retheesh *et al.*, 2016)<sup>[12]</sup>.

Because we are literally what we eat, new food technologies have a profound impact on our lives. Uncertainty, as well as insufficient or wrong information about the perceived hazards and benefits of such technologies, contribute to the public's reluctance to accept new technology (Castell-Perez & Moreira, 2021)<sup>[6]</sup>. Consumers' awareness about bio speckle laser technology is inadequate. When consumers are given science based information including safety and product benefits of irradiated food products (Bruhn, 1998)<sup>[4]</sup>. In addition, scientific knowledge and educational activities can improve the image of irradiated foods (Oliveria & Sabato, 2004)<sup>[9]</sup>.

### 2. Methods

#### 2.1 Questionnaire preparation

A questionnaire of 15 questions was prepared to elicit consumer awareness and acceptance of bio speckle laser technology. In the beginning of questionnaire general information like gender, education, occupation, income, area of residence were asked. After these demographic characteristics, preference in selection of food was asked. Next, they were asked about the frequency of reading the information provided on the label.

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They were asked about the awareness of emerging technologies in food industry followed by their opinion on need for development of novel technologies. Frequency of convenient foods was asked. Then they were asked about bio speckle laser technology followed by their preference for buying laser screened foods, concern about safety and health effects of laser on food products, skepticism on radioactivity of laser screened foods. Finally the consumers were asked their preference in buying products labelled as BLT screened, need for commercial industrial practice, preference of trusted companies in the market and requirement of safety certification marks on food label.

## 2.2 Questionnaire distribution

Questionnaires were distributed to 100 consumers randomly selected from both urban and rural areas of Thiruvananthapuram district, Kerala. The data was collected through an online survey. Respondents' identification information was not recorded.

## 2.3 Evaluation of questionnaire

Data from the completely filled 100 questionnaires were coded and then entered into Microsoft excel worksheet and desired categories were filtered. For all the questions percentage frequencies were obtained. Respondents' attitude towards awareness and acceptance of bio speckle laser technology was evaluated by co-relating their responses with demographic characteristics.

## 3. Results and Discussion

### 3.1 Demographic characteristics

In the current study the 54 per cent of respondents were male and 46 per cent of them were female. Equal distribution of gender was observed as there is no gender bias regarding the consumers of mangoes. Among the respondents 50 per cent of them were graduated and 47 per cent of them were having post-graduation as the highest degree of education. Only two per cent of the respondents were having plus two as their educational qualification and one per cent of the respondents were educated till high school level. The study revealed that 53 per cent of the respondents were employed, amongst them 30 per cent were private employees, twelve per cent of them were self-employed and only 11 per cent of them were government employees. Forty seven per cent among the respondents were unemployed as their educational status showed they were pursuing master's degree.

Thirty three per cent of the consumers were having an annual income between Rs. 2,73,098 – 8,45,955 and 26 per cent of them were having Rs. 70,000 – 2,73,098. Twenty three per cent among the respondents were reported have an annual income of Rs. 8,45,955 and above where as only 18 per cent of them had low income level of below Rs. 70,000. Among the respondents 48 per cent of them were residing in urban areas and 23 per cent belonged to rural area. Fifteen per cent of the respondents resided in metropolitan area where as 8 per cent of them belonged to semi urban and only 6 per cent resided in municipality areas.

### 3.2 Preference and usage of convenient foods

**Table 1:** Preference in selection of food

Preferences	Frequency	Percentage (%)
Conventional foods	48	48%
Minimal processed foods	34	34%
Processed foods	10	10%

Foods developed using new innovative food technologies

From the results of table 1 it was evident that 48 per cent of the consumers preferred conventional foods and 34 per cent preferred minimally processed foods. Only 10 percent among the respondents' preferred processed foods and 8 per cent preferred foods developed using new innovative food technologies. This could be due to skepticism of consumers regarding hygiene and safety of the processed food products.

**Table 2:** Usage of convenient foods

Preferences	Frequency	Percentage (%)
Extremely frequent	6	6%
Often	21	21%
Occasionally	35	35%
Rare	29	29%
Never used	9	9%

Thirty five per cent of the consumers showed occasional usage of foods developed with novel technologies like canning, pasteurization etc., Twenty one per cent used them often and 6 per cent used them extremely frequent. This might be due increased urbanization and income levels which in turn may increase expenditure on processed foods (table 2).

### 3.3 Awareness of biospeckle laser technology

**Table 3:** Attitude on development of novel technologies

Preferences	Frequency	Percentage (%)
Strongly agree	57	57%
Agree	32	32%
Neither agree nor disagree	10	10%
Disagree	1	1%
Strongly disagree	0	0%

From the study (table 3), it is depicted that 57 per cent of the consumers strongly agreed and 32 per cent agreed for the need for development of novel technologies for bringing more safety and quality of food. The acceptance can be improved by providing accurate and simplified information about the technology.

**Table 4:** Awareness on emerging technologies in food industry

Preferences	Frequency	Percentage (%)
Very much aware	10	10%
Partially aware	57	57%
Uncertain	16	16%
Not much aware	14	14%
Not aware	3	3%

Around fifty seven percent of the consumers were partially aware and 10 per cent were very much aware of the emerging technologies in food industry. This might be due to higher educational status of the respondents (table 4).

**Table 5:** Awareness about bio speckle laser technology

Preferences	Frequency	Percentage (%)
Aware about bio speckle laser screening	13	13%
Familiar with the term but not aware of bio speckle laser screening	12	12%
Familiar with the term and partially aware of bio speckle laser screening	15	15%
Not aware about bio speckle laser screening	60	60%

Among the consumers 60 per cent of them were not aware about bio speckle laser screening. This could be due to lack of knowledge and availability of information regarding the

technology. Only 15 per cent were familiar with the term and partially aware of this technology (table 5).

**Table 6:** Attitude toward the commercial practice of bio speckle technology

Preferences	Frequency	Percentage (%)
Strongly agree	10	10%
Agree	31	31%
Neither agree nor disagree	55	55%
Disagree	4	4%
Strongly disagree	0	0%

From the results (table 6), it is revealed that 55 per cent of the respondents neither agreed nor disagreed about the need for commercial practice of bio speckle screening. Among the consumers 31 per cent of them agreed and 10 per cent strongly agreed that bio speckle screening should be practiced commercially. This might be due to uncertainty about this novel technology.

**Table 7:** Awareness about information on label

Preferences	Frequency	Percentage (%)
Always	27	27%
Often	40	40%
May or may not	16	16%
Rare	15	15%
Seldom	2	2%

The most important criteria was sell- by date followed by price and then brand. Quite a large per cent of respondents (37%) showed their attention was more on sell by date, price and brand of food product before they purchased (Gunes 2007). Around 40 per cent of the consumers go through the information on label often and 27 per cent of them read the labeled information always. Sixteen per cent may or may not go through the information and 15 per cent rarely read the label and 2 per cent seldom read the labeled information (table 7).

### 3.4 Skepticism on biospeckl laser technology

**Table 8:** Skepticism on health effects by bio speckle treated foods

Preferences	Frequency	Percentage (%)
Highly skeptic	7	7%
Moderately skeptic	33	33%
Uncertain	46	46%
Least skeptic	11	11%
Not skeptic	3	3%

The results from table 8 depicted that only 7 per cent were highly skeptic and 33 per cent were moderately skeptic about effect on health of laser screened foods. Forty six per cent

**Table 12:** Attitude regarding the cost of bio speckle screened foods

Preferences	Frequency	Percentage (%)
Very expensive	11	11%
Expensive	32	32%
Slightly high priced than normal products in the market	44	44%
Same as the normal products in the market	11	11%
Not expensive	2	2%

From the results (table 12), it was evident that 44 per cent of the respondents opinionated that bio speckle screened foods were slightly high priced than normal products in the market. Thirty two per cent of them felt they are expensive and 11 per

were uncertain. This uncertainty could be due to lack of awareness about the technology in detail

**Table 9:** Attitude towards the safety of bio speckle screened foods

Preferences	Frequency	Percentage (%)
Very safe, not a concern	13	13%
Very safe, but minor concern	15	15%
Safe, but some concern	34	34%
Somewhat safe, but moderate concern	20	20%
Not safe, much concern	18	18%

Thirty four per cent of the consumers felt it was safe and showed some concern. Fifteen per cent of them showed minor concern considering it very safe and 13 per cent of them felt it was very safe and had no concern. Whereas 18 per cent of the consumers considered it was not safe and had much concern regarding the safety (table 9).

**Table 10:** Attitude towards the effect of bio speckle laser on nutritional quality of foods

Preferences	Frequency	Percentage (%)
Does not affect	16	57%
Mild affect	19	32%
Unaware	62	10%
certainly affects	3	1%

From the results (table 10) obtained it is evident that major proportion of consumers about 62 per cent was unaware about effect of bio speckle screening on nutritional quality of food. Nineteen per cent of them felt that it may have mild affect and 16 per cent opinionated that it does not affect. This can be co-related with response of the consumers regarding their awareness about this technology. Sixty per cent of them unaware of this technology so as 60 per cent were unaware of its affects on nutritional quality of food safety of foods screened with bio speckle laser. Scientific studies and accurate information could remove this uncertainty.

**Table 11:** Attitude towards radioactivity of biospeckle screened foods

Preferences	Frequency	Percentage (%)
Strongly believe	5	10%
Believe to an extent	21	31%
Uncertain	52	55%
Disbelieve	20	4%
Strongly disbelieve	2	0%

Among the respondents 5 per cent of them strongly believed and 21 per cent believed to an extent that foods screened with laser becomes radioactive. This could be due to fear of the term laser which associates with radiotherapy, carcinogenicity and so on (table 11).

### 3.5 Acceptance of biospeckle laser technology

**Table 13:** Preference to buy bio speckle screened foods

Preferences	Frequency	Percentage (%)
High Preference	10	10%
Moderate Preference	32	32%
Uncertain	40	40%
Least Preference	12	12%
No Preference	6	6%

Majority of the consumers of about 40% were uncertain to buy foods labeled as bio speckle laser screened. Only 10 per cent of respondents showed high preference and 32 per cent showed moderate preference towards bio speckle screened foods. This may be because larger portion of consumers were not well- informed about this technology and thus may not have formed an opinion about these foods (Table 13).

**Table 14:** Acceptance of bio speckle screened foods by trusted companies

Preferences	Frequency	Percentage (%)
High Preference	10	10%
Moderate Preference	48	48%
Uncertain	31	31%
Least Preference	10	10%
No Preference	1	1%

The results of the study from table 14 depicted that 48 per cent of the respondents showed moderate preference to buy bio speckle screened foods if produced by their trusted companies. This could be due to increase in acceptability of goods produced by trusted companies. Ten per cent of them showed high preference and 31 per cent were uncertain.

**Table 15:** Preference of certification marks on label regarding safety of BLT

Preferences	Frequency	Percentage (%)
High Preference	54	54%
Moderate Preference	24	24%
Uncertain	17	17%
Least Preference	4	4%
No Preference	1	1%

The results from table 15 revealed that about 54 per cent of the respondents highly preferred certification marks on the label and 24 per cent showed moderate preference to this. This can be co-related with their response regarding towards their concern regarding safety of bio speckle screened foods.

### 3.6 Influence of demographic characteristics on response of the consumers

The demographic characteristics were co-related with responses of the consumers and statistical analysis was performed. The results depicted that education showed its maximum influence on the acceptance followed by income level. Occupation and area of residence showed very minimal influence and gender had no influence in awareness and acceptance of laser bio speckle technology.

### 4. Conclusion

The results of the survey revealed that majority of the consumers were unaware of this technology and were skeptic about the effect of laser on food products. There is a need of more scientific evidences to remove their skepticism regarding the acceptance of bio speckle laser technology.

Education had its highest influence on awareness and acceptance of bio speckle laser technology.

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