

Development of cognitive learning scale to measure the knowledge level of meat consumers on meat hygiene

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Abstract

Globally, food safety is a major concern for consumers, food service institutions and regulatory authorities. Food safety knowledge, awareness and practices are crucial in the prevention of foodborne disease outbreaks. The present study, therefore, sought to develop a cognitive learning scale on meat hygiene. A total number of 175 items were initially selected and were subjected to 60 citizens of Kolkata, and the reliability test was done among the 30 citizens of another batch from Kolkata using the split half method and test-retest method. The correlation coefficient was found to be significant with a value of 0.82 and 0.84, respectively, which was significant at 1% level of significance. A total of 42 statements were finally selected. This can be used universally to access the knowledge level of the public on meat hygiene.

Key words: Food, Hygiene, Knowledge scale, Non-vegetarian

Highlights

- Difficulty index and discrimination index of each item were analysed.
- Reliability test and the correlation coefficient revealed the significant value of 0.82 and 0.84, respectively at a 1% level of significance.
- A total of 42 items (statements) were finally selected for the meat hygiene scale.

INTRODUCTION

Meat hygiene refers to the expert supervision of all meat and meat products with the object of providing wholesome meat for human consumption and preventing danger to public health (Thornton, 1966). Hygienic practice in the meat market is very poorly handled and managed in majority of market place of India. The World Health Organization (WHO, 2015) estimates revealed that worldwide about 600 million cases of illness and 420,000 deaths annually are directly linked to foodborne diseases. WHO (2015) also estimated that consuming unsafe food has resulted to 33 million years of healthy lives lost (YLL) annually. Unhygienic handling by meat handlers gives room for contamination and

cross contamination of meat and endangers not only consumers but the meat handlers themselves (Miner *et al.*, 2020). Therefore, the concept of meat hygiene needs to be understood in order to prevent ruckus among the health of the consumers. In order to disseminate the knowledge on meat hygiene, we must access the knowledge level of the public on meat hygiene and bridge the gap. Thus, the study is aimed at preparing a tool for preparing a cognitive learning scale that can help in predicting the knowledge level of the public in a relevant manner.

MATERIALS AND METHODS

The different steps followed in order to prepare the knowledge level on meat hygiene

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are explained below:

Collection of items: Items refer to the questions that were selected to ask the respondents in order to prepare the desired scale (Goswami *et al.*, 2012; Morgado *et al.*, 2017; Powell *et al.*, 2017). This forms the content of the test. Items were collected from the literature, subject matter specialists and from the researchers' own experience.

The Initial selection of items: The items were selected keeping in view that they should not be mugged up information and they should require some analytical abilities (Goswami *et al.*, 2012; Biswas *et al.*, 2017). The questions were designed on a dichotomous scale. The procedure followed was in line with the learning scale developed by Nanda *et al.* (2022) on the knowledge level of veterinary students on ICT. An earlier study reported by Goswami *et al.* (2011) revealed the development of a similar scale on the knowledge level of duck farmers on duck farming. Further, a similar study was conducted by Dhargupta *et al.* (2008) on the development of a cognitive learning scale to measure the knowledge level about health status.

RESULTS

Preliminary administration of test: A total number of 60 respondents were chosen from the city of Kolkata during the month of July and August 2022. Each respondent was given a score 1 or 0 for each correct and wrong answer, respectively. The total number of correct answers that can be given by a respondent was the score of a total of 175. After calculating the scores obtained from all the respondents, the scores were arranged in descending order. The 60 respondents were divided into 6 groups ($G_1 \dots G_6$) with 10 members each. The extreme four groups with high and low scores were selected for the computation of the item difficulty index and item discrimination index.

Item analysis: Item analysis yields two types

of information, i.e., item difficulty index and item discrimination index.

Item difficulty index: The difficulty index was defined as the proportions of citizens of Kolkata giving correct answers to that item. This was calculated using the formula:

$$p_i = \frac{n_i}{N_i} \times 100$$

Where, P_i = Difficulty index in the percentage of the i^{th} item

n_i = Number of citizens of Kolkata giving the correct answer to the i^{th} item

N_i = Total number of citizens of Kolkata to whom the i^{th} item was administered (60 numbers in this research)

Item discrimination index: The discrimination index may be defined as the measure of the capability of the item to differentiate the well-informed respondents and the less informed respondents. The following formula was used for the calculation of this index.

$$E^{1/3} = \frac{(S_1 + S_2) - (S_5 + S_6)}{N/3}$$

Where, S_1, S_2, S_5 and S_6 were the frequencies of correct answers in G_1, G_2, G_5 and G_6 groups, respectively and N = Total number of citizens of Kolkata in the sample of the item analysis

Selection of items for the test: The final format of the knowledge test was prepared after considering the values of item difficulty and item discrimination indices. In the present study, the items with an item difficulty index ranging from 30 to 80 and a discrimination index ranging from 0.30-0.55 were selected to be included in the final list of knowledge tests. The items following both the criteria mentioned above were taken into consideration. The number of total selected items was 42, and the items with the item difficulty index and item discriminatory index are shown in Table 1.

Table 1. Item difficulty index and item discrimination index of the finally selected items

Sl. No.	Items	Difficulty Index	Discrimination index	Correct	Incorrect
1	Major issues in meat hygiene include chemical contamination	76.66	0.3	1	0
2	Contamination may occur due to carcass suspension touching too low to the floor	78.33	0.4	1	0
3	Careless evisceration spreads intestinal content onto meat surface	68.33	0.55	1	0
4	Microbial pathogens may be transferred onto raw meat and ready-to-eat product from worker's hands	71.66	0.55	1	0
5	Microbial pathogens may be transferred onto raw meat and ready-to-eat product from tools	65	0.5	1	0
6	Microbial pathogens may grow during the storage of meat	65	0.55	1	0
7	Drug residues in meat can be reduced by the application of drugs at prescribed level	71.66	0.45	1	0
8	Drug residues in meat can be reduced by application of drugs for prescribed period	75	0.5	1	0
9	Drug residues in meat can be reduced by following recommended withdrawal period after application of drugs	75	0.4	1	0
10	Contamination of meat in slaughterhouse/place may also occur from mislabelling	48.33	0.55	1	0
11	Edible meat should be free from off-odour	50	0.35	1	0
12	Edible meat should be free from the blemishes	43.33	0.4	1	0
13	Packaging material should be clean	73.33	0.5	1	0
14	Packaging material should be recyclable	63.33	0.5	1	0
15	Packaging material can be polypropylene (PP)	70	0.55	1	0
16	Do you know Vacuum packaging method?	78.33	0.35	1	0

Table 1., Cont. ...

Cont. Table 1.

Sl. No.	Items	Difficulty Index	Discrimination index	Correct	Incorrect
17	Do you know about Modified atmosphere packaging (MAP)?	61.66	0.4	1	0
18	Do you know about Mother bag concept in MAP	43.33	0.55	1	0
19	<i>Salmonella</i> is present in raw poultry	71.66	0.4	1	0
20	<i>Campylobacter</i> is present in raw poultry	56.66	0.5	1	0
21	<i>E. coli</i> is present in raw beef	73.33	0.35	1	0
22	Prions associated with beef cause BSE (mad cow disease) or CJD	70	0.45	1	0
23	<i>Staphylococcus aureus</i> is present in raw lamb and mutton	71.66	0.35	1	0
24	<i>E. coli</i> is present in raw lamb and mutton	51.66	0.55	1	0
25	<i>Trichinella spiralis</i> is present in raw pork and ham	73.33	0.3	1	0
26	Bloody diarrhoea is transmitted from undercooked poultry meat to human body	66.66	0.35	1	0
27	Fever is transmitted from undercooked poultry meat to human body	51.66	0.45	1	0
28	Specific hygienic and sanitary practices must be present across entire meat food chain i.e., from farm to fork	76.66	0.45	1	0
29	Tenderness of meat depends on animal's age, sex, or muscle location	80	0.35	1	0
30	Fat of beef is yellow, whereas fat of cara-beef, mutton and chevon is white	78.33	0.35	1	0
31	Will you prefer to buy packaged meat?	43.33	0.5	1	0
32	Will you prefer to buy chilled/frozen meat?	45	0.35	1	0
33	Jhatka is a type of slaughtering method of meat animal	55	0.55	1	0
34	Kosher is a type of slaughtering method of meat animal	46.66	0.5	1	0

Table 7., Cont. ...

Cont. Table 1.

Sl. No.	Items	Difficulty Index	Discrimination index	Correct	Incorrect
35	Penetrating captive bolt can be used for stunning of animals	66.66	0.51	1	0
36	Electrical stunning is a type of stunning method for animals	55	0.55	1	0
37	Gas stunning/killing is a type of stunning method for animals	60	0.45	1	0
38	Anesthetization is a type of stunning method for animals	46.66	0.55	1	0
39	Do you buy live birds/animal from local market?	68.33	0.45	1	0
40	Do you buy live birds/animal from private company?	45	0.35	1	0
41	Do you buy live birds/animal from Govt. farms?	48.33	0.35	1	0
42	Do you buy live birds/animal from college farms?	35	0.3	1	0

Scoring method: The summing up of scores for correct replies over all the items of a particular respondent indicates his/her knowledge about meat hygiene. The range of scores was from 0 to 42.

Reliability by Split half method: All 42 items were arranged randomly and divided into two equal halves of 21 items each. The two sets were administered to 30 citizens of Kolkata, but the respondents were different from the above respondents used for the construction of the scale. The coefficient of correlation (r) between the two sets of scores was found to be 0.82, which was significant at 1% level of significance. The reliability coefficient, thus obtained, indicated the “internal consistency” of the knowledge test developed for this study was high.

Reliability by Test-Retest method: This method was also employed for calculation of reliability of the prepared knowledge scale. The prepared 42 items were subjected to the 30 respondents other than the respondents used for

preparation of the scale. The same questions were again subjected to the same respondents after 15 days. The coefficient of correlation (r) was calculated between the two sets of results and it was found to be 0.84, which was significant at 1% level of significance.

Content validity of the knowledge test: Proper care was taken to include items from the entire universe relevant to the knowledge of meat hygiene for the public. The items were collected from different relevant literature, specialists, and various other sources. Thus, it was assumed that the measurement was done as intended.

DISCUSSION

The study was directed to assess the knowledge level of the resident of Kolkata on meat hygiene in order to develop a scale. Item analysis provided us with the item difficulty index which indicates the difficulty level of an item, and the item discrimination index which indicates how well the item discriminates in agreement with the test of the scale (Guliford, 1954; Biswas *et al.*, 2017). The result revealed

that only 42 out of 145 items were significant in terms of difficulty index and discrimination index, and these items were further found valid and reliable for the development of the knowledge scale on meat hygiene. This indicates that these 42 selected items are considered less difficult to comprehend and answer and have the ability to differentiate the well-informed respondents and less-informed respondents.

The demand for meat and its value-added products is remarkably surpassing all other food sectors among non-vegetarians in India. With the growing demand for meat, the safety and hygiene of meat also emanate to the most priority of concern. Therefore, knowledge of meat hygiene is the foremost important point for healthy production and consumption of meat. Most of the meat handlers and consumers are well aware of the safety and hygiene of meat and meat products; however proper scientific management is not practiced. This could be due to their educational level, mass media exposure and communication gap. With this context, construction of a knowledge test scale was carried out in order to assess the knowledge level of meat hygiene of the respondents. Similarly, a study was conducted by Biswas *et al.*, 2017 on development of a scale to test the knowledge level of dairy farmers.

This knowledge test scale including all the

statements will help the researcher and concerned department in the identification of less-informed respondents' areas, implementation of the awareness programme on healthy meat production and consumption and the socio-economic development of the meat consumers.

The knowledge test which has been prepared can be used worldwide to identify the knowledge level of the local public on meat hygiene. However, this scale can be modified as per the localities under the test to obtain appropriate results.

Conflict of interest: Authors have no conflict of interest in this study.

Author's contribution: AG: Conception and design and supervision; MA: Performed acquisition of primary data; KJ: Performed acquisition and statistical analysis of primary data; SMN: Performed drafting of the manuscript; SB, CD: Performed interpretation of the results.

ACKNOWLEDGMENT

The authors acknowledge all the respondents for their selfless participation in the research work. The authors also acknowledge the department of VAHEE, WBUAFS, Kolkata for their valuable suggestions during the experiment and manuscript writing.

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