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THE LEVEL OF KNOWLEDGE AMONGST SMALL AND MEDIUM ENTERPRISES OF THE QUALITY AND SAFETY ISSUES IMPACTING ON THE RE-USE OF COOKING OIL

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ABSTRACT

Objective: This study was designed to examine the level of knowledge, amongst small and medium enterprises, of the quality and safety issues impacting on the re-use cooking oil.

Method: Interviews were conducted within 20 catering establishments in the Crayford and Dartford areas of London. The questionnaire was used to collect data from respondents via face-to-face interviews and comprised 21 questions. In order to evaluate the level of knowledge of food operators regarding the topic, each question was prepared based on the outcomes from the literature review.

Result: The findings of the research showed that the majority of respondents have lack of knowledge regarding the safety and quality issues related to the re-use cooking of oil. The level of knowledge of the food businesses surveyed regarding the safety and quality of cooking oil needs to be improved, in key areas such as; selection criteria of cooking oil for their purpose, safe frying temperatures, segregation of different product before and during frying, frying of wet foods and assessing the quality and safety cooking oil during frying operations. However in other key areas such as storage of cooking oil knowledge and practice was good.

Conclusion: Most respondents interviewed lack adequate knowledge regarding the safety and quality of re-used cooking oil.

Keywords: safety and quality issues, interviews, cooking oil, food businesses

INTRODUCTION

The consumption of vegetable cooking oil has been raising rapidly in the catering industry in the past decade within the UK small and medium catering businesses (Bou *et al.*, 2012; McSavage and Trevisan 2001). Vegetable cooking oil is used by caterers for frying processes, frying operations are fast, convenient and an essential method of food preparation typically producing products with a specific flavour, colour, taste, and crispy surface, that is acceptable to many consumers (Tabee *et al.*, 2008). During the frying process new compounds are formed resulting in a change in fried oil both physically and chemically; for example prolonged heat and high temperatures lead to some chemical

reactions such as polymerization, oxidation, and viscosity (Wai 2007). These chemical reactions affect oil quality and safety (colour becomes darker, smells like smoke, and has an acidic taste), and these changes finally result in deterioration of the oil affecting the quality and safety of fried products (Lioumbas *et al.*, 2013). The frying process is also open to atmospheric oxygen and high temperature and, during frying operations the amount of oil absorbed by the fried foods can affect consumer safety (Kochhar 1998). For these reasons, measures should be taken during the frying process to ensure that the quality and safety of reused oil is maintained (McSavage and Trevisan 2001). Due to the environmental impact

of waste oil importance of oil, governments at all levels have regulations guiding the management and reuse of oil but little which examines the food safety issues (Dobarganes and Marquez-Ruz 1998).

This study is aimed at determining the level of understanding of caterers on the food safety and quality issues of the use and re-use of cooking oil, within Dartford and Crayford, United Kingdom.

MATERIALS AND METHODS

Study design

The study was conducted to gather data appropriate information from small and medium sized catering businesses in respect of their knowledge level relating to the quality and safety issues associated with the use and re-use of cooking oil. Respondents were asked about the use of reused oil, the temperature used in frying their product, their understanding of the factors which effects quality and safety of reused oil, types of oil they use for frying operation and, how long they use reused oil, as well as different products they fry in the reused cooking oil, how often they clean the fryer and their source of information regarding the handling of reused oil.

Design of questionnaire

Questions were developed to understand the level of knowledge amongst small and medium enterprises. The questionnaire comprised 21

questions. In order to evaluate the level of knowledge of food operators regarding the topic, each question was prepared based on the outcomes from the literature review.

Location and sample size

This study was conducted through interviewing 20 small catering businesses that use cooking oil in their respective establishments in Crayford and Dartford) in London, United Kingdom. The questionnaire was used to collect information from respondents in face-to-face interviews. Respondents gave verbal informed consent that they were willing to take part in the survey. Although, some food operators initially expressed concerns assurances were provided that the information collected from them would be treated with absolute confidentiality.

Analysis of survey data

The results of the survey were analyzed using the statistical package of Microsoft Office Excel 2010. Descriptive analysis was also conducted to evaluate food operators' understanding of the safety and quality of reused cooking oil used for frying operations. Also, tables and charts were prepared to present results.

RESULTS

Table1: Type of establishment

Respondent	Number	Percentage (%)
Pizzeria	2	10
Fish and chip shop	4	20
Steak House	4	20
Bar and Grill	1	5
Café	3	15

Indian restaurant	2	10
Chinese restaurant	4	20
Others	0	0

Table 2: Role in the business

Respondent	Number	Percentage (%)
Food business operator	0	0
Supervisor	0	0
Manager	8	40
Chef	12	60
Other	0	0

Table 3: Types of oil used by the catering business

Respondent	Number	Percentage (%)
Vegetable oil	16	80
Rapeseed oil	4	20
Olive oil	0	0
Palm-kernel oil	0	0
Sunflower oil	0	0
Soya-bean oil	0	0
Others	0	0

Table 4: Amount of oil

Respondent	Frequency	Percentage (%)
10-20L	0	0
20-40L	0	0
40-80L	3	15
Above 100L	17	85

Table 5: Criteria for choosing cooking oil

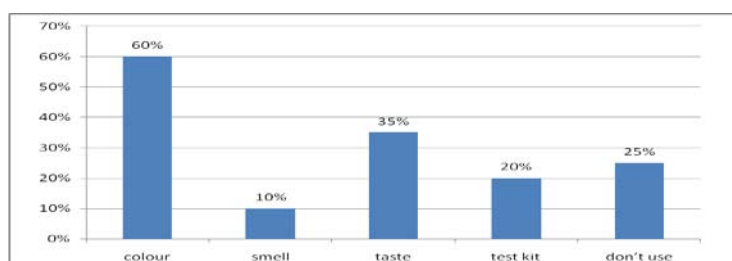
Respondent	Number	Percentage (%)
Number of times it can be used	2	10
Flavour of the fried product	4	20
Price	2	10
Availability	2	10
Healthily eating attributes	8	40
Other(company have chosen)	2	10

Table 6: Re-use frequency of oil

Respondent	Number	Percentage (%)
Single use per batch	3	15
Use for three days	4	20
More than three days	11	55
Use until the colour becomes dark	1	5
Until the flavour of the product is unacceptable	1	5
Until there is too much food matter in the oil	0	0

Table 7: Re-use oil practice

Respondent	Number	Percentage (%)
Top up existing used oil with fresh unused oil	3	15
After frying dispose of used oil and refill with completely fresh oil after every batch	7	35
Filter used oil and top up with fresh unused oil	8	40
Other	2	10

**Figure 1: Assessing the quality of used frying oil****Table 8: Food safety issue in relation to cooking oil**

Respondent	Number	Percentage (%)
Change in colour of oil	3	15
Food particles in oil	0	0
Bubbling and foaming of oil during cooking	2	10
Smoking of oil	2	10
All of the above	13	65

Table 9: Food quality issues in relation to cooking oil

Respondent	Number	Percentage (%)
Change in colour of oil	3	15
Food particles in oil	1	5
Bubbling and foaming of oil during cooking	0	0
Smoking of oil	0	0
All of the above	16	80

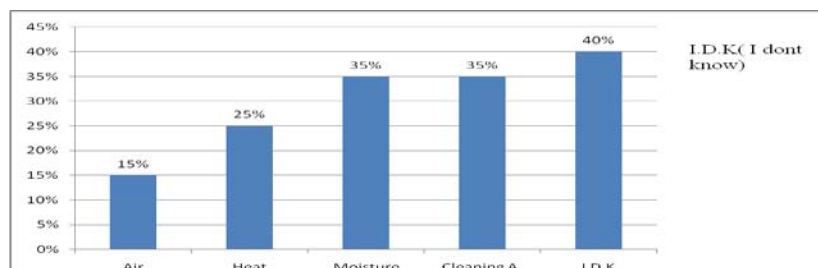


Figure 2: Quality deterioration of oil

Table 10: Frying different product in cooking oil

Respondent	Number	Percentage (%)
All products are fried separately	9	45
All products are fried in same fryer/ pan	4	20
Meat and fish are cooked in separate fryer/ pan from vegetable products and chips	7	35
Others	0	0

Table 11: Storage of re-used oil

Respondent	Number	Percentage (%)
In the same container as fresh unused oil	0	0
In a container specifically for used oil	20	100
Used oil is not stored and is disposed of immediately	0	0
Others	0	0

Table 12: Temperature ranges for frying operation

Respondent	Number	Percentage (%)
80°C – 100°C	0	0
100°C - 120°C	1	5
120°C-140°C	0	0
140°C- 180°C	0	0
180°C- 200°C	3	15
Above 200°C	16	80

Table 13: Handling wet and frozen foods prior to the frying operation

Respondent	Number	Percentage (%)
Ensure wet foods are dried prior to frying	6	30
Put wet/ defrosted foods directly in to the frying oil without drying	9	45
Put frozen foods directly into the frying oil without defrosting	5	25

Table 14: Sources of information about current frying practices

Respondent	Number	Percentage (%)
Codex standards	0	0
Advice provided by the local authority enforcement officers	2	10
Food Standard Agency recommendations	7	35
Information gained on a training course	8	40
No any standards used	3	15

Table 15: Cleaning of fryer

Respondent	Number	Percentage (%)
Hot water and soap	5	25
Degreaser and detergent	0	0
Using spray cleaner then wipe with a dry cloth	1	5
Empty the oil, clean with hot water and detergents and then dry	14	70
Do not clean	0	0
Other	1	5

Respondents were asked about what they think could be quality and safety issues associated with oil used for frying. Twenty five percent of the respondents made mentioned of contamination that from food sources in the oil to constitute a food safety and quality issue, 10% suggested cleaning of frying equipment would be quality and safety issue associated with oil, 15% stated that they believed that design and maintenance of equipment and cleaning of frying equipment could be quality and safety issue associated with oil, 30% responded to suggest that all of these constituted quality and safety issue in respect of frying oil, as opposite 20% stated that they believed that none of these would be a food quality or food safety issue.

Respondents were asked on the source they might obtain further information regarding the safe use and reuse of frying oil. Seventy of respondents would obtain information from the Local Authority EHO, while 15% would not obtain any information. Ten percent got information from a consultant, and 5% of respondents obtained information from trade publications. Additionally, the result indicated that respondents use Food

Hygiene Training, Health and Safety and HACCP training.

All respondents have Health and Safety training. Ninety percent had Food Hygiene training in addition. Interestingly only 25% had undergone HACCP training.

DISCUSSION

The study aimed at obtaining information on the quality and safety issues associated with the use and re-use of cooking oil, together with levels of knowledge of appropriateness of use, and management, and health aspects of specific oils.

The results of the study indicated the types of work undertaken regularly by interviewees in relation to the use and re-use of cooking oil. The purpose of this was to identify those responsible for the purchase, storage, handling, management of oil usage. From this information it was possible to identify those interviewees who could reasonably be expected to have higher levels of knowledge of the use of cooking oil. The initial survey targeted Food Business Operators, Supervisors, Managers and Chefs, but the results indicated that (in the case of small and medium

sized businesses) in the many cases the owner or manager was also the chef.

The results of the survey in respect of which types of oil were being used were somewhat unexpected. The vast majority (80%) of businesses stated that they used vegetable oil for all frying operations. A minority of study participants (20%) used rapeseed oil, which may be as a result of its higher suitability and common association with particular types of cuisine (i.e. Chinese) it was, however, surprising to find that there were no businesses using other types of oil such as olive, Palm- kernel, sunflower, soya- bean.

One further finding, of interest, from the survey was that a high proportion of the respondents cited health attributes as being an important factor in their choice of oil. They stated that they were of the opinion that vegetable oil was healthier than the other alternatives available to them. This indicates a lack of knowledge amongst participants as to the actual properties of varieties. The outcome of a volume of other research (McSavage and Trevisan 2001; GSFS 2008; CAC 2011; GEA Food solutions 2013) shows that there are many types of oil which are actually healthier than vegetable oil. Olive oil, for example is unique frying oil having low saturated fatty acids and many nutritional benefits.

The results from the survey indicated a juxtaposition between what respondents reported the drivers behind choice of oil type were i.e. healthy attributes of the oil being the main driver and their evident lack of knowledge about the healthy attributes of vegetable oil. For a minority of respondents, due to specific culinary requirements, the prime selection criteria were cooking characteristics. There was a lamentably low level of knowledge of the actual health aspect of the use of various oils.

The results of the study show that, of the businesses surveyed only 15% use appropriate frequency for re-use of oil and the remainder of them need to improve their knowledge on re-use frequency of oil.

Respondents also showed a lack of knowledge of recommended oil re-use practices. The food operators in this survey were asked to state how they handle the used oil after frying operations and how the oil was prepared for the next frying process. The majority of respondents (65%) stated that they filtered used oil and topped up with fresh unused oil or they didn't filter the oil. Many scientific findings CAC 2011; GEA Food Solutions (2013) have recommended that on completion of the frying process, the oil should be filtered in order to remove food particles and bread crumbs completely, because they accelerate oil deterioration. The survey results indicated that 65% of the respondents top up used oil with fresh unused oil, but 35% of respondents follows good practices. A comparison between responses to the question in respect of good practice in respect of re-use of oil and those in respect of the length of time the oil was used for delivered conflicting data, in that respondents appeared to indicate that they followed good practice in one area but not in another.

Survey results gave an insight into respondent's levels of concern regarding food quality and safety issues in relation to cooking oil. Interestingly, 80% of respondents agree that all of the factors (change in colour of oil, food particles in oil, bubbling and foaming of oil) can be quality and safety issues. They are correct in this opinion, because food particles in oil increase the polymerization and oxidation and that these, in turn, cause the oil to change colour (colour darkening, with black spots appearing). This entire factor can affect quality of oil and consequently safety of food being fried. In this study the majority of respondents were aware that changes of colour indicated a reduction in quality. Only 25% were aware that excessive heat could be a cause for the change in colour, but large minorities were not aware of the any of the factors which could affect quality of oil. None were aware of any factors which could affect the health of consumers

Respondents were asked how they cooked different products in oil. The majority of them mentioned that they fried different products in separate fryers. This is good practice and prevents cross-contamination of allergens. Twenty percent of respondents stated that they cooked all products in the same fryer. Allergenic contamination may occur when different products are cooked in the same oil and this could be a health issue for people with allergies (FSA 2006).

The participants in this study showed good levels of knowledge regarding storage of re-used oil. This may be a result of a number of new regulations coming into force (Water UK 2013), specifically the Environmental Protection Act 1990 (Duty of Care). These proved that the level of knowledge respondents regarding the segregation product and storage of re-used oil is high. This is result of regular inspection from the local authority and if cateress does not follow regulation requirement they must pay penalty.

In this study the majority of respondents stated that they fried product above 200°C. A group of researchers (McSavage and Trevisan 2001; GSFS 2008; CAC 2011; GEA Food solutions 2013) mentioned that the optimal frying temperature should be around 180-185°C. Another researcher, Fellows (2000) and Wai (2007) reported that deep frying between the temperature range of 170 °C and 200 °C can lead to the formation of acrylamide when frying especially starchy foods such as potatoes, and there is also likelihood that oil will undergo hydrolysis, oxidation and thermal polymerization. A very large majority of the (80%) participants in this study stated they not aware that the temperature of heating affected oil quality and/or safety of the fried product. This results was similar to those obtain in a study by Lioumbas *et al.*, in Malaysia (2012) which showed that the majority of their respondents were not aware that high temperature heating could lead to increased degradation of oil.

A very surprising result was that a majority of respondents named their sole source of

information regarding the matters investigated as been literature originating with the local authority EHO, although a large number of respondents and the employees had attended courses and obtained qualification and certification in food and hygiene training, health and safety and, HACCP training. Despite this, the food safety issues associated with the use and re-use of cooking oil were either not addressed by the training or respondents had not translated the acquired knowledge into good practices. It was apparent that the only

CONCLUSIONS

The findings of the research showed that the majority of respondents have lack of knowledge regarding the safety and quality issues related to the re-use cooking of oil. The level of knowledge of the food businesses in Crayford and Dartford UK regarding the safety and quality of cooking oil needs to be improved through integrated efforts between the relevant central and local government agencies and the catering businesses themselves. Businesses need to be informed and trained to be aware that for example, by segregation methods, they can avoid cross-contamination from allergenic products to non-allergic products. That the correct monitoring of oil quality can avoid the potential for a buildup of chemicals in the oil and that by making simple alterations to oil use and re-use practices they can do much to significantly reduce food safety problems associated with the misuse of oil whilst simultaneously improving the food quality attributes. The basis for recommendations in this study is that knowledge of other areas of oil handling such as storage and disposal showed high levels of knowledge and compliance amongst the survey participants and this was linked to regular enforcement and oversight by the local authority.

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