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Determination of Some Chemical Contaminants Might Exist in Some Raw Food Materials Used in Some Egyptian Hotels

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Abstract: In hospitality industry, guests expect more from food and beverage operations to meet specific dietary requirements. Hotels, resorts, restaurants and airline catering operators face one common challenge, which is keeping up the increasingly fussy demands of guests. As a result, food and drink has become more important and have a higher priority amongst certain social groupings. The aim of this study is to assess some chemical contaminations of some raw food material samples taken from the three sources in terms of heavy metals and pesticides residues. Tests validate that there is no contamination with pesticides residues also this test is used to find out if there is a significant difference between food raw materials in terms of heavy metals detection. On the other hand obtained data showed that cadmium (Cd) was available in a maximum level (0.05ppm) in some tomato samples, whereas there was a high level in nickel (Ni) element higher than the maximum level (1-10 ppm) in all of tested samples.

Key words: Heavy metals detection · Pesticide residues analysis · Raw food materials

INTRODUCTION

In hospitality industry, guests expect more from food and beverage operations to meet specific dietary requirements. Hotels, resorts, restaurants and airline catering operators face one common challenge, which is keeping up the increasingly fussy demands of guests. Moreover, people want their demand to be fulfilled within no time. Food has a strategic importance in the national economy of each country. Simultaneously, it also has a great specific preponderance in the establishment of a quantitatively and qualitatively satisfactory tourism industry and it seemingly has and will continue to have, an indubitably great importance for the development of our century's tourism industry in the future. Today, the consumer is better educated, wealthy, travelled more extensively, lives longer and is concerned about his health and the environment. As a result, food and drink has become more important and have a higher priority amongst certain social groupings. To this extent, food has become the new culture capital of a destination, as if culture has moved out of the museum to become a living experience of consumption. One thing has become clear; food must be a quality product, whether it is slow food or fast food [1]. Hcareers [2] stated that the hotel industry is already at the forefront of the greening of the hospitality industry, with a long list of efforts to reduce its carbon footprint. Now restaurants are painting the town green with their initiatives. In general, we can confirm that there is an increase on the demand for free contamination food at the level of the hospitality industry because of the increasing public awareness of the consumers to the hospitality industry. Meanwhile, that understanding how food moves through the operation is important. The knowledge will help a caterer effectively coordinate many numerous operational tasks that must be performed to create a finished product. It is important for anyone to understand the flow of food through a food-service system in order to determine the system that will best meet his needs and to develop an effective production system [3]. The flow of food in a food service establishment is the path that food follows from receiving

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through service or sale to the consumer. Several activities or stages make up the flow of food and are called operational steps. Food flows through ten possible processes the food flow in hospitality industry [4].

Colchamiro [5] mentioned that Marriott, JW Marriott and Renaissance Hotels and Resorts will introduce a series of meeting products that are eco-friendly and will help guests and meeting planners reduce their environmental impact. Marriott is building on an aggressive environmental strategy by adding new elements to green its meetings. Products and services include free pesticides products too such as food and beverages and flower options.

Heavy Metals Detection: The rapidly expanding field of food safety includes many new developments in the understanding of the entire range of toxic compounds found in foods whether naturally occurring or having been introduced by industry or food processing methods. The term heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. Examples of heavy metals include mercury (Hg), cadmium (Cd), arsenic (As), chromium (Cr), thallium (Tl) and lead (Pb). Heavy metals are natural components of the Earth's crust. They cannot be degraded or destroyed. To a small extent they enter our bodies via food, drinking water and air. As trace elements, some heavy metals (e.g. copper, selenium, zinc) are essential to maintain the metabolism of the human body. However, at higher concentrations they can lead to poisoning. Heavy metal poisoning could result, for instance, from drinking-water contamination (e.g. lead pipes), high ambient air concentrations near emission sources, or intake via the food chain [6]. Heavy metals detection analysis was used to find out if there is a significant difference between food raw materials in terms of heavy metals detection (e.g. cadmium (Cd), zinc (Zn), lead (Pb), iron (Fe), manganese (Mn), copper (Cu), nickel (Ni) and cobalt (Co).Pesticide Residues Analysis: A pesticide is any substance or a mixture of substances formulated to destroy or control any organism that competes with humans for food, destroys property, or spreads disease. “Pests” include weeds, insects and rodents. Currently, more than 800 active substances, belonging to different chemical groups, are formulated in pesticide products (500 registered pesticide products). The main classes of pesticides include: (1) herbicides (for weed control, e.g. triazine (e.g. atrazine)); (2) insecticides (e.g. organochloride (OC) (e.g. dichlorodiphenyl trichloroethane, DDT); Organophosphates (OP) (e.g. malathion, dimethoate, omethoate) and methylcarbamates (e.g. aldicarb)); and (3) fungicides (e.g. ohthalimide (e.g. Captan). Other types of pesticides may include acaricides, molluscicides, nematicides, pheromones, plant growth regulators, repellents and rodenticides. A glossary of pesticide chemicals is published by FDA [7]. It must be noted that a test has been applied to laboratory samples of vegetables, fruits and only in samples of tomatoes and plum, due to many reasons, including time, cost and difficulty of taking samples from the sources of the sample. The main objective of the pesticide residues analysis is to detect the presence or absence of residual pesticide contamination of food samples tested to be registered in the study and to identify the differences between hotel food samples. Testing Laboratory-complies with the criteria of EN ISO/IEC 17025:2005 with accreditation certificate No.UKAS-1983, EGAC [8].

MATERIALS AND METHODS

In this study, random samples of food raw materials such as Tomato, Plum and Chicken from three different Egyptian hotels in Cairo, Sharm El Sheikh and Hurghada were taken. In this study, two different tests were carried out to verify that the chemical contaminations. These tests were as follows: (1) Heavy metals detection and (2) Pesticides residues detection.

Heavy Metals: were determined in samples as sulphate using the wet ashing method with acid mixture (nitric: phosphoric: sulphuric acids) at the ratio of (8:1:1) according to Galvao *et al.* [9], using atomic absorption spectrophotometer FMD_3 Zesis. Selenium was determined according to the method of Diaz-Alarcon *et al.* [10] in Faculty of Agriculture, Ain Shams University, Egypt.

Pesticides Residues Detection: Samples containing 15 (± 0.1) grams of tomato and plum were weighed into centrifuge tubes. The samples were spiked with appropriate amount of spiking solutions to yield the samples with quantitative concentrations relative to the 3:1 split ratio of 150, 300 and 750 ng/ml levels for GC/MS-SIM determination and 50, 100 and 250 ng/ml by flame photometric detection. Each sample received a 15-ml aliquot of acetonitrile (ACN). Two ceramic bars (Agilent p/n 5982-9313) were added to each sample to aid in sample extraction. The samples were vortexed for 1 minute. An original Agilent Bond Elut QuEChERS extraction salt packet (Agilent p/n 5982-5555) containing 6 grams of $MgSO_4$ and 1.5 grams sodium chloride was added to each centrifuge tube. The capped tubes were shaken on a Geno/Grinder x 1500 rpm for 1 minute. The samples were centrifuged at 4000 rpm for 5 min. An 8 ml aliquot of the upper layer was transferred to an Agilent Bond Elut QuEChERS General Fruits and Vegetables dispersive SPE 15 ml tube (Agilent p/n 5982-5058). The dSPE tube was vortexed for 1 minute and then centrifuged at 4000 rpm for 3 minutes to complete the sample extraction. The extract from the dSPE tube was transferred to a GC vial and analyzed by SIM GC/MS and GC/FPD using the chromato-graphic conditions as flow:

GC/MSD: Agilent 7890 GC/Agilent 5975C Series GC/MSD Agilent 7683B automatic liquid sampler, 5.0µl syringe (Agilent p/n 5181-1273).

Sampler: 1.2 m × 0.15 mm id deactivated fused silica tubing 1.4 m x 0.15 mm id deactivated fused silica tubing. Column: Agilent J and W DB-35ms UI 20 m x 0.18 mm x 0.18 µm (Agilent p/n121-3822UI). [11]. Extractions of water and acetonitrile aliquots were prepared in the same manner as the samples and served as reagent blanks. Because of all results were calculated on dry bases, so the moisture content of all tested samples was determined as described by AOAC [12].

RESULTS AND DISCUSSION

Laboratory tests are used in the present study to verify that tested raw food materials in different hotels and to highlight the advantages and importance of raw food materials. Two different tests are used which are: Heavy metals detection and Pesticides detection. All the previous tests are used to investigate three hotels food raw materials: tomato, plum and chicken.

Heavy Metals Detection: Data presented in Table 1 shows a significant difference between food raw materials in terms of heavy metals detection (e.g. Cadmium (Cd), Zinc (Zn), Lead (Pb), Iron (Fe), Manganese (Mn), Copper (Cu), Nickel (Ni) and Cobalt (Co)).

Data Table 1 also shows that there was no existent of Cd element in the tomato sample in hotel No. 3, whereas Cd was available in a maximum level (0.05ppm) in both rest samples tomato from hotel No. 2 (2.8 ppm) and hotel No. 1 (1.9 ppm). Meanwhile, there was a high level in Ni element higher than the maximum level (1-10 ppm) in all of tested samples; while, tomato from hotel No. 2 had the highest level (42.5 ppm) followed by tomato hotel 3 (34 ppm); then tomato from hotel 1 was (26.5 ppm).Moreover, the data shows that there was a high level of Co element higher than the maximum level (0.02-0.5 ppm); while, tomato from hotel 1 recorded the highest level (13.6 ppm) followed by tomato from hotel 3 (7.6 ppm); whereas, Co shows no existence in tomato from hotel 2 sample. All the rest elements (Zn, Pb, Mn and Cu) were matched with the maximum levels.

Data in Table 2 illustrates that there was a high level of Cd element in the three tested samples higher than the maximum level (0.05 ppm); whereas, the plum from hotel No. 2 had the highest level (3.4 ppm); followed by plum sample from hotel No. 3 (1.3 ppm) then plum from hotel No. 3: had the low level of Cd element (0.03 ppm). On the other hand, the Ni element recorded the highest level in plum from hotel No. 2 sample (41.8 ppm) higher than the maximum level (1-10 ppm); this is followed by plum from hotel No. 3 sample (35.5 ppm). Meanwhile, the plum from hotel No. 1 came at the last level (34.6 ppm). Also there was a high level of Co element in the three tested samples than the maximum level (0.02-0.5 ppm); while, the sample of plum from hotel No. 1 recorded 12 ppm; while, plum from hotel No. 3 recorded 7.7 ppm and plum from hotel No. 2 recorded 4.7 ppm. However, the rest tested elements were in the average of maximum levels.

Table 1: Detection of metals (mg\kg dry base) in tomato samples from three sources

Detection Metals (mg/kg dry base)	*Maximum levels (mg/kg wet weight) or Part per million (ppm)	Tomato samples		
		Hotel 1	Hotel 2	Hotel 3
Cd	0.05	1.9	2.8	**nd
Zn	5-100	8.9	14.2	21.2
Pb	6-9	** nd	**nd	**nd
Fe	***NA	85.6	106.7	52.8
Mn	10-20	14	12.6	13.2
Cu	2-20	10.4	15.8	19
Ni	1-10	26.5	42.5	34
Co	0.02-0.5	13.6	** nd	7.6

* Maximum levels according to WHO guidelines [13].

** Not Detected *** Not Available

Table 2: Detection of metals (mg\kg dry base) in plum samples from three sources

Detection Metals (mg/kg dry base)	*Maximum levels (mg/kg wet weight) or Part per million (ppm)	Plum samples		
		Hotel 1	Hotel 2	Hotel 3
Cd	0.05	0.3	3.4	1.3
Zn	5-100	12.9	20.5	13.5
Pb	6-9	** nd	**nd	**nd
Fe	***NA	34.6	95.3	44.6
Mn	10-20	14.3	14.3	17.3
Cu	2-20	14.1	12.8	12.7
Ni	1-10	34.6	41.8	35.5
Co	0.02-0.5	12	4.7	7.7

* Maximum levels according to WHO guidelines [13]. ** Not Detected *** Not Available

Table 3: Detection of metals (mg\kg dry base) in chicken samples from three sources.

Detection Metals (mg/kg dry base)	*Maximum levels (mg/kg wet weight) or Part per million (ppm)	Chicken samples		
		Hotel 1	Hotel 2	Hotel 3
Cd	0.05	**nd	0.6	**nd
Zn	5-100	19.6	20.1	24.5
Pb	6-9	** nd	**nd	**nd
Fe	***NA	345	357	79.1
Mn	10-20	5.3	5.0	2.7
Cu	2-20	11.2	10.9	8.0
Ni	1-10	9.8	10.1	3
Co	0.02-0.5	** nd	**nd	** nd

* Maximum levels according to WHO guidelines [13]. ** Not Detected *** Not Available

Table 4: Pesticide residues test analysis of tomato samples

Sources	Tomato samples		
	Type of Test	Test Method	Results
Hotel (1)	Pyrethroids by GC/ECD*	ASU L 00.00-34/99	Not Detected
	Organochlorine Pesticides by GC/ECD	ASU L 00.00-34/99	Not Detected
	Organophosphorus Pesticides by GC/FPD/NPD**	ASU L 00.00-34/99	Not Detected
Hotel (2)	Pyrethroids by GC/ECD	ASU L 00.00-34/99	Not Detected
	Organochlorine Pesticides by GC/ECD	ASU L 00.00-34/99	Not Detected
	Organophosphorus Pesticides by GC/FPD/NPD	ASU L 00.00-34/99	Not Detected
Hotel (3)	Pyrethroids by GC/ECD	ASU L 00.00-34/99	Not Detected
	Organochlorine Pesticides by GC/ECD	ASU L 00.00-34/99	Not Detected
	Organophosphorus Pesticides by GC/FPD/NPD	ASU L 00.00-34/99	Not Detected

*Gas Chromatography-Electron Capture Detector

** Gas chromatography with flame ionization and nitrogen-phosphorus detection

Table 5: Pesticide residues test analysis of plum samples

Sources	Plum samples		
	Type of Test	Test Method	Results
Hotel (1)	Pyrethroids by GC/ECD*	ASU L 00.00-34/99	Not Detected
	Organochlorine Pesticides by GC/ECD	ASU L 00.00-34/99	Not Detected
	Organophosphorus Pesticides by GC/FPD/NPD**	ASU L 00.00-34/99	Not Detected
Hotel (2)	Pyrethroids by GC/ECD	ASU L 00.00-34/99	Not Detected
	Organochlorine Pesticides by GC/ECD	ASU L 00.00-34/99	Not Detected
	Organophosphorus Pesticides by GC/FPD/NPD	ASU L 00.00-34/99	Not Detected
Hotel (3)	Pyrethroids by GC/ECD	ASU L 00.00-34/99	Not Detected
	Organochlorine Pesticides by GC/ECD	ASU L 00.00-34/99	Not Detected
	Organophosphorus Pesticides by GC/FPD/NPD	ASU L 00.00-34/99	Not Detected

*Gas Chromatography-Electron Capture Detector

** gas chromatography with flame ionization and nitrogen-phosphorus detection

Notes: for pesticide residues analysis:

- No detectable = belowquantification limit.
- Maximum residue limits according to European Regulation
- (EC) no.396/2005 current version.
- Expanded measurement uncertainty is ±50% at 95%confidence level.
- List of pesticide analyzed can be sent upon client's request.
- Organochlorine Pesticides (GC/ECD) LOQ 0.005-0.01mg/kg.
- Pyrethroids (GC/ECD) LOQ 0.01-0.05 mg/kg.
- Pesticides (LC/MS/MS) LOQ 0.01-0.02 mg/kg.
- Carbamates (LC/MS/MS) LOQ 0.01-0.02 mg/kg
- Benzimidazoles (LC/MS/MS) LOQ0.01 mg/kg
- Organophosphorus Pesticides (GC/FPD-NPD) LOQ 0.01-0.05mg/kg

Testing Laboratory-complies with the criteria of EN ISO/IEC 17025:2005 with accreditation certificate No.UKAS-1983, EGAC 208003A and 20658A

The obtained data presented in Table 3 shows that Cd element in chicken from hotel No. 2 was increased higher than the average of maximum level (0.05 ppm); in contrast there was no showing for this element in the rest of the tested samples. It was clear that the Ni element gave slight increasing than the maximum level (1-10 ppm) in the chicken from hotel No. 2 which was (10.1 ppm); whereas, it was within the maximum level in the rest tested samples. Moreover, the rest tested elements were in the average of maximum levels in all tested samples.

Pesticide Residues Analysis: Tests validate that there is no contamination with pesticides residues. The objective of this laboratory test is to identify the presence or use of pesticide residues in the food samples tested (Tables 4 and 5).

The laboratory test for pesticide residues is tested on a sample of tomato and plum. These samples are selected from three of the investigated hotels. As shown in previous tables there were no detections found in the tested samples of Pyrethroids, Organochlorine and Organophosphorus Pesticides.

CONCOLUISON

Heavy Metals Detection Tests Findings: The results of food samples in heavy metals detection tests show that the Cd, Ni and Co achieved high levels compared to the maximum levels; whereas, the other elements were in the maximum levels. It can be noticed from this that organic food needs more and more procedures and policies to ensure that the organic food served in hotels is really organic.

Pesticide Residues Tests Findings: There is no significant difference between food samples in terms of pesticides residues. The results of pesticides residues test in food samples show that are free from any contamination of pesticides residues, after searching on some difference kinds of pesticide elements.

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