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Research Article

Knowledge regarding food safety and hygiene issues among street food vendors in Lucknow city

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ABSTRACT

Street food is an inexpensive and deserving source of dietary intake; it's highly noticeable consumption in developed and developing countries. The aim of this study was to rate the proximate analysis of the nutritional status of street food consumers in Lucknow, it's an urban town. The study given a questionnaire to 100 individuals constituted by randomly selected in Chatori Gali near 1090 women helplines (street food lane) in Luck now. Nutritional Status was based on the number of food groups consumed in the previous 24 hrs. To 3 months in the participants, 40% were male and 45% were female, (the majority of them were between 19 and 22 years of age. 6% Children (Age group-1 year to 12 years), 4% old age (50+ to +70). It was found that 41.1% of the young people ate street food 2-3 times per week, whereas 24.3% were found to eat it every day from 100 street food consumers in street food in Lucknow city. The nutritional status of the respondents was assessed with the physiological issues and the use of Body Mass Index (BMI) which was classified as underweight (<18.5 kg/m^2), normal (18.5-24.9 kg/m^2), overweight (25.0-29.9 kg/m^2) and obese (≥ 30.0 kg/m^2). Dietary Diversity Score (DDS) ranging from 0 to 9 was constructed from a 9-food group model. The mean age of the respondents was 38.5 ± 12 years, majority (85%) was male and 61.7% were self-employed. About 42% spent half of their income on food while 15% spent more than four-quarters on food. More than 65% consumed street food daily, 854.1% indicated street meal as the most preferred street food snacks and beverages were preferred by only 15%. Majority (75.0%) consumed street foods in the afternoon and about 20% in the morning. Five out of 10 respondents had low DDS, about one had medium DDS and 10% had high DDS. The nutritional status indicated 28.2% to be overweight while 5.1% and 8.2% were found to be underweight and obese, respectively. A notable association was found between the dietary diversity and nutritional status of the respondents. This study discloses that street food consumers in the urban town of Lucknow, N were either overweight or obese, mal nourished and their nutritional status was very low.

Keywords: Street food, Consumers, Nutritional status, Food safety, Hygiene

INTRODUCTION

Street foods are ready to eat foods and beverages prepared and sold by vendors and hawkers on the street from stalls, shops, four permanent walls or through the online apps [1]. It includes traditional and commercially produced snacks that are sell by street food vendors, as well as street food items made by vendors on-site (on the same locations where they're selling out) or in nearby kitchens [2].

Street foods have become an essential component of food dissemination systems and mainly contribute to the daily nutritional intake of urban consumers in the developing world.

Today's society is known for its rapid urbanization and civilization where people have less time to select, cook and eat food than before [3].

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Street foods, however, are now considered to be more appealing because they provide quick, reasonable price and readily available alternatives to home cooking. Street food vending have become common and important features of urban towns in many of these countries including India. In Lucknow, street foods are popular and on an ever highly demanded. Most of the street foods are prepared daily from a variety of ingredients to suit local taste and demand. Their intake, however, is usually influenced by characteristic taste, distinguished flavors as well as cultural acceptability and demand [4].

Street food is a ready-made meal and drinks provided by hawkers specifically in streets and open places (food and agricultural organization). According to food and agricultural organization street food is a significant contributor to the diet of most people in developing countries. The transformation in community lifestyle has an impact on the current development of consumerism. In other words, socio-cultural change in society influenced changes street food consumption patterns [5]. Therefore, in order to make all states in Malaysia maintained its presence as a tourist destination; each state could brand its cities and promote its street food to raise the reputation of the state. As destination branding is the cornerstone of survival in today's competitive tourism industry, the benchmark of a city reputation depends on its strong branding which distinguished itself from its competitor. In this case, food has the potential to become one of the tourist attractions in the destination. While, food is gaining momentum in planning a travel itinerary which soon became commonly known as food destinations; food tourism has become one of the fastest growing segments in the tourism industry (world tourism organization) [6]. Previous studies had showed that food played an important role in touristic experience and as a means to fascinate traveler destinations. The street food sector offers numerous business opportunities for budding entrepreneurs. Street food have great influence in the tourism industry the local foods served in certain destinations yields benefits in two folds-it boosts up the local tourism sector and gain loyalty from potential retuning customer.

Street foods symbolize the roots and identity of a community and it was perceived as a fundamental aspect for tourist to gain great experiences which proofs to be an imperative platform for economic reason. Despite street food sales being one of the significant contributors in developing economy, however the rise in foodborne diseases in evolving countries had associated street food as a risk. There are many studies conducted on street food hygiene issues in developing countries. Street food is accountable for 691 food poisoning cases and 49 deaths from 1983 to 1992 in Malaysia. Thus, this study was conducted to examine the linkages between street foods and hygiene issues in George town, Penang, Malaysia. The objectives of the study include exploring hawkers' attitudes toward cleanliness of street food and consumers' perceptions regarding street food hygiene issues [7].

MATERIALS AND METHODS

Target participant

The sample group of this study were outlined as follow-200 consumers (100 local peoples of Lucknow citizens) 2.20 hawkers and the researcher get the consumers to answer the questionnaires and conducted in depth interviews with few street food vendors.

The MCQs designed study was distributed in Gomti Nagar to calculating the daily ratio and side effects of eating street food by the different group of people. Gomti Nagar is a crowded urban area for street food which is located in Lucknow city, Uttar Pradesh [8]. We are randomly selected for the study of the street food by MCQs questionnaire and one to one connection and asked orally about side effects of street food. A semi-structured interviewer administered questionnaire was used to obtain information on socioeconomic characteristics, physiological characteristics, physical characteristics and consumption of street food from 100 consumers of street food. The respondents were randomly selected from 2 major street food outlets in the selected area of Lucknow city. The anthropometric indices (height and weight) were measured and asked by our questionnaire and then used to obtain the Body Mass Index (BMI=weight (kg)/height (m^2)) of the respondents. Body Mass Index was classified as-
Underweight (<18.5 kg/m^2); normal (18.5-24.9 kg/m^2) overweight (25.0-29.9 kg/m^2) and OBESE-(≥30 kg/m^2)

The dietary intake of the attester was obtained from the Dietary Diversity Score (DDS) which is defined as the number of different types of food groups consumed in the 24 hours antecedent the interview. The information collected from the 24 h dietary recall was used to calculate for the DDS of each. In this study, 9 food-groups accumulation was created from the list of food groups created from the 24 hr recall. The assemblage of 9 food groups (starchy, dark green leafy vegetables, leafy vegetables and Vitamin A rich fruits and vegetables, fruits and vegetables, meat, fish, eggs, legumes, seeds and nuts, milk and milk products) was then used to create the diversity scores with each group carrying a score. Attester with a score less than 3 was regarded as low dietary diversity; those with scores of 5 and 6 had medium dietary diversity while those with a score of 6 and above had high dietary diversity. This scoring categorization has been used in previous studies [9].

Analysis data

This study was using mixed methods (combination of quantitative and qualitative methods). According to my survey of 2022-2023 data collection through this mixed-method has long been used but incorporating it into a research design is a new approach. According to survey further stated that mixed-method approach is a study which involved collecting and analyzing data through both quantitative and qualitative methods in one study.

The qualitative data collected through questionnaires and in-depth interviews were analyzed using content analysis to explore hawker's attitude street food in Lucknow city.

Samosa and pani puri powder preparation

Take 100g, of samosa and panipuri and kept in dehydrator for 48 hr between temperatures 75°C to 90°C. Then weight of the product again, when dehydrates properly made fine powder of both sample products and ready to move analysis (Figures 1 and 2).

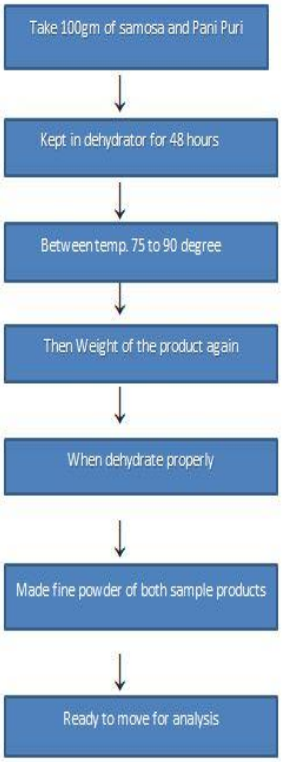

Figure 1. Flow chart of sample preparation.

Figure 2. Diagram shows samosa and mixture.

Nutritional analysis of sample

Determination of moisture content: Moisture content of sample (samosa and pani puri) was determined by using dehydrator according to Rangana method. 10 g of sample was taken in clear and dried dish. The dish was placed in the hot dehydrator at 75°C -90°C for 20 hours then, the dish was placed to desiccator for allow to cool. The dish containing dried sample was weighed by using electronic weighing balance.

The loss of weight=Initial weight-Final weight × 100 Weight of the sample

Determination of fat: Fat content was determined by using Soxhlet apparatus. Soxhlet method is a traditional method used for extracting lipids in different food. 3 gm of sample was taken in thimble and placed in thimble holder; 250 ml of petroleum ether was added.

After 4 hours extraction, the heater and water tap were turned off. The weight of the beaker and the fat it contains was weighed [12].

FAT (%)=W_1-W_2 × 100

Determination of Ash: Determination of ash content gets by using Muffle Furnace. Oven dried crucible was taken then, taken 5 g of sample into the crucible. The ignition is completed by keeping it in muffle furnace at 55°C until grey ash is formed. The dish is cooled in the desiccator and weighed. The ash content is estimated by using formula;

Ash (%) (Dry basis)=M_2-M × 100/M_1–M

Determination of protein: Percentage of protein in sample was determined by the Kjeld Hal method. (It does not directly measure the percentage of protein). The percentage of protein was calculated from the nitrogen content in the sample [13].

Determination of carbohydrates: Percentage of the carbohydrates as a Nitrogen Free Extract (NFE) was calculated by using formula- NFE=100–(protein%+fat%+ash%+moisture %)

Morphological analysis (SEM+EDX): For forensic investigation in the food industry, Scanning Electron Microscopy (SEM) in conjunction with Energy Dispersive X-ray Spectrometry (EDS) is a powerful, often non-destructive, instrumental analysis tool to provide information about: The identification of materials by SEM/EDS is accomplished through a combination of morphology by SEM imaging and the elemental composition of the material by EDS. Typically, the EDS analysis provides a qualitative spectrum showing the elements present in the sample. Further analysis can be done to quantify the detected elements in order to further refine the material identification [14].

Metal alloys can often be differentiated even within the same family such as 300 series stainless steels. Glass types can be identified by the elemental composition where the detected elements are quantified as the oxides of each element.

In this way, for example, common window glass is distinguishable from insulation glass used in many ovens. Wear particles or fragments from breakage can find their way into food products. SEM/EDS analysis of the materials is an important resource to utilize when trying to determine the original source. Suspected source materials can then be sampled for comparative analysis. EDS X-ray mapping is another tool that is available to provide information about the distribution of materials within a matrix. For example, the distribution of inorganic ingredients in a dried food helps to provide information about the grind and blend of the materials.
In scanning electron microscopy, a highly energetic and focused electron beam scans the sample and normally provides an extremely enlarged image of the morphology of the sample, as well as information on its chemical composition using an Energy Dispersive Spectrometer (EDS) detector.

SEM-EDS are mainly used for characterization of materials, but lately its application has been extended to study organic-based specimens, such as biological samples and polymers. Micro plastics are hazardous materials produced not only directly by anthropogenic activities but also as a resulting product of macro plastics degradation.

Pollution due to release of micro nano plastics into the environment and their ecological consequences are nowadays subject of extended scientific research. Consequently, the demand of dedicated techniques for the assessment of morphology and chemical nature of such polymer-based materials is of utmost importance. This chapter highlights the recent application of SEM and EDS for the characterization of microplastics as emergent pollutants [15].

SEM and EDS is an advanced imaging and analytical technique that effortlessly copes with the urgent need for the characterization of such waste products as well as the other toxic substances that may be adsorbed by micro plastics. The prominence of electron microscopy coupled with analytical detectors, particularly SEM and EDS, in the identification and determination of morphology of micro nano plastics can doubtless and be established.

Intro of morphological analysis (SEM+ EDX)

Fast, easy to interpret microstructural and elemental analysis with scanning electron microscopy and energy dispersive X-ray spectroscopy.

As the complexity of industrial processes increases so does the need for more rigorous, higher quality analysis to ensure that products are meeting all standards of quality and reliability. Scanning Electron Microscopy (SEM) has become a common tool in modern research and development as well as failure analysis and troubleshooting laboratories, as it provides detailed (nanometer scale) information about the surface structure of samples. An SEM is often used in conjunction with Energy Dispersive X-ray Spectroscopy (EDS), which adds elemental information to the surface-imaging data generally associated with SEM. Combining EDS and SEM typically involves complex workflows that use multiple pieces of software to produce the required data. This complicated user experience slows down lab productivity, creates potentially inconsistent instrument behavior, and makes training more difficult, keeping SEM-EDS as a specialized technique in most labs. In this document we will provide a brief introduction to SEM and ED's analysis and how their joint application supports in-depth material characterization for industrial applications. We will also

show examples of how unique thermo Scientific ChemiSEM technology integrates these two techniques into a single, fast, easy-to-use package, accessible and valuable to novices and experts alike (Figures 3and 4).

Instruments used for morphological analysis

Figure 3. Thermo Fisher Scientific Scios.

Morphological analysis (SEM+EDS) of street food

SEM+EDS analysis of samosa

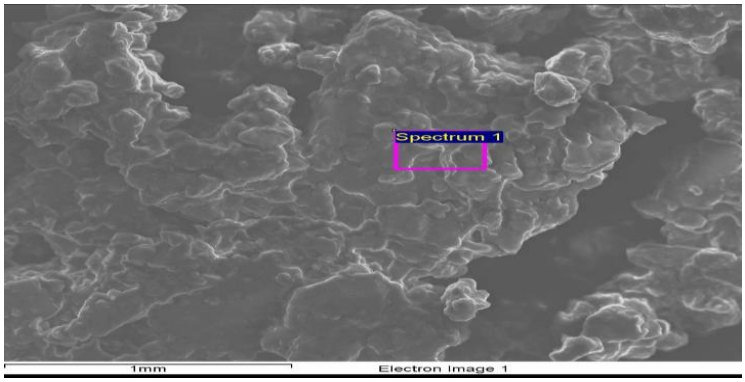

Figure 4. Electron image of samosa.

SEM, EDX is used which is a micro analytical technique used to determine local elements in a sample. SEM-EDX analysis was used to determine mineral distribution in samosa powder. The aim of EDX in present study was to identify minerals in the prepared samples and to compare the mineral composition of apple pulp. The result showed that sample contains eight elements *i.e.* C, 0, Nacl, K, Pt (Tables 1 and 2).

The element present in highest percentage is carbon *i.e.* 63.26% and the least amount is K *i.e.*0.17% (Figures 5 and 6).

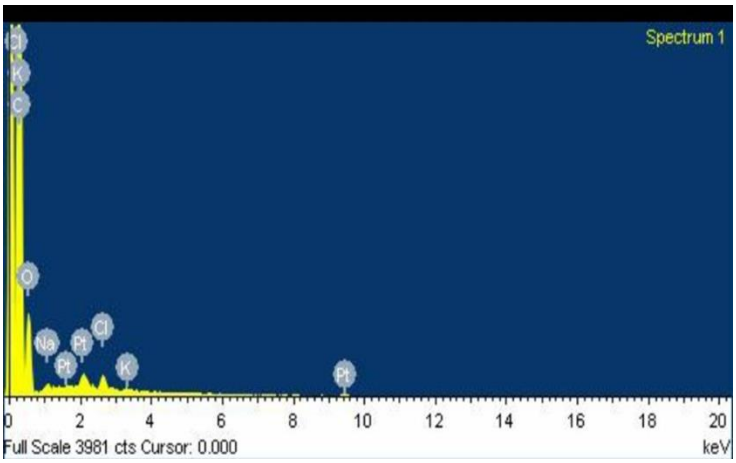

Figure 5. EDS of samosa.

Element	Weight	Atomic
C K	63.26	70.83
O K	33.83	28.47
Na K	0.39	0.23
Cl K	0.81	0.31
K K	0.17	0.06
Pt M	0.14	0.1
Totals	100.00	

Table 1. SEM+EDS analysis samosa.

Proximate compositions

Proximate compositions	
Fat	11
Protein	6.1
Carbs	29
Moisture	72
Ash	1.7

Table 2. Nutrients count of samosa.

SEM+ED's analysis of pani puri

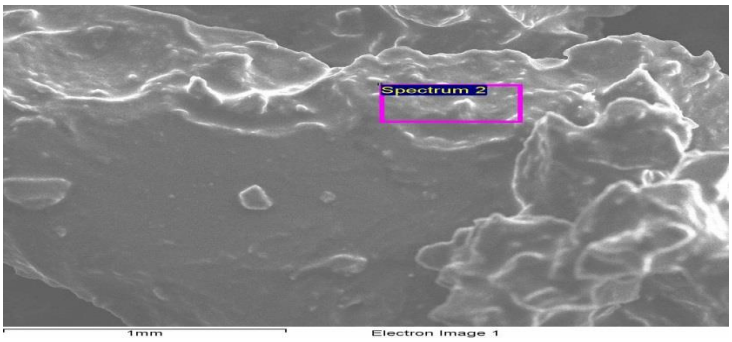

Figure 6. Electron image of pani puri.

SEM, EDX is used which is a micro analytical technique used to determine local elements in a sample. SEM-EDX analysis was used to determine mineral distribution in samosa powder. The aim of EDX in present study was to identify minerals in the prepared samples and to compare the mineral composition of Apple pulp.

The result showed that sample contains eight elements *i.e.* C, 0, Nacl, K, Pt.

The element present in highest percentage is O *i.e.* 83.64% and the least amount is S *i.e.*1.71% (Figure 7).

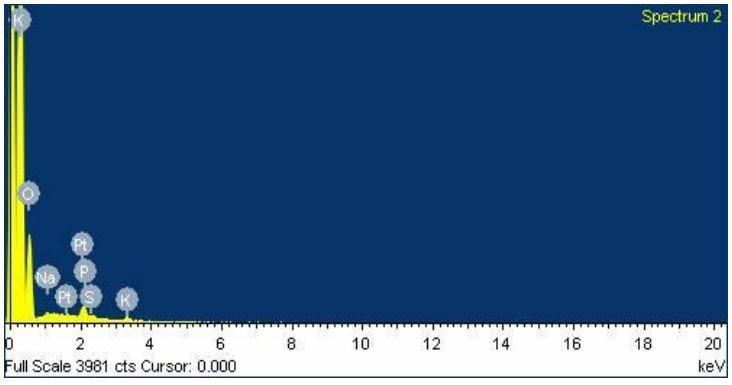

Figure 7. EDS of pani puri.

RESULTS AND DISCUSSION

How SEM+EDS works

Energy Dispersive X-ray Spectroscopy (EDS-EDX) quantifies elemental composition at every pixel within a scanned area of a micrograph. To make this measurement, EDS analyzes the characteristic x-rays emitted as the primary electron beam excites atoms in the outermost 10 nm to 100 nm of the sample.

These characteristic x-rays are correlated to elements from B-U on the periodic table, and the intensity of each X-ray signal is used to compute the corresponding element's atomic concentration before EDS is performed; an SEM image is captured to calibrate the position and domain of the EDS measurement. Experts can either conduct a point-scan on a single pixel of the image, or run EDS analysis across a line or 2D area to evaluate how elemental composition varies across boundaries and regions of interest. Once the target area is set, ED's spectra are collected at every pixel, enabling 0D, 1D and 2D mapping of elemental distribution.

EDS can also be combined with FIB-SEM tomography to generate 3D reconstructed volumes of elemental information (Tables 3 and 4).

Element	Weight	Atomic
O K	83.64	94.08
Na K	2.36	1.85
P K	2.48	1.44
S K	1.71	0.96
K K	2.08	0.96
Pt M	7.73	0.71
Totals	100.00	

Table 3. SEM+ED's analysis of pani puri.

Proximate compositions

Proximate compositions	
Fat	5.3
Protein	5.3
Carbs	29.6
Moisture	7
Ash	1.1

Table 4. Nutrients count of pani puri.

CONCLUSION

Street foods are convenient, cheap, easily accessible and a source of income for many poor people, who would not find employment. In addition, street foods contribute to the diet of many people worldwide. However, the difficulty of sanitary quality control and the low nutritional quality of street foods can be a threat to consumer's health in terms of nutritional security. Street foods could be associated with the emergence of foodborne diseases, due to the ease of contamination by several agents, including pathogenic microorganisms. In addition, street foods could also be associated with the development of chronic and non-communicable diseases, since street foods usually have high quantities of carbohydrates and fats. These issues indicate that pertinent health authorities should regulate the marketing of street foods and initiate appropriate training programs for school based street food vendors, for example in foodborne diseases, food safety, and food security.

Simultaneously, incorporation of food safety and food security messages into textbooks and school curriculum would provide opportunities for increasing awareness of people regarding food security and nutrition.

Combined EDS and SEM analysis is increasingly becoming a standard tool in failure analysis as well as research and development settings, providing both microstructural and compositional insight for materials. As the need for this valuable food data increases, so does the burden on the laboratories running this analysis. New technology in these fields shouldn't just focus on generating higher quality results; it should also consider the logistics of acquiring and processing the resulting

data. Speed, reliability and ease of use are critical for new tools in a successful industrial lab setting. That is why ChemiSEM technology provides a combination of high-quality data, speed and system integration, giving you increased throughput for quick inspection tasks along with quantitative data for more advanced work. Chemi SEM echnology offers an accurate picture of spatial elemental data within seconds. The overall combination of improved user experience and time to data enables you to own an approachable solution that incorporates advanced technology within an easy to use platform. Regardless of the use case, Chemi SEM technology makes compositional microscopy routine, even for novice users.

Findings

Consumers' perception on street food hygiene issues in Lucknow city. Street food can be exposed to the dangers of different pollutants (microbes, parasites, physical and chemical) that sometimes make the food harmful to consumers (2022-2023). The quality of food hygiene depends on identifying and control potential hazards. Its strict and systematic nature requires an appropriate method of analysis for hygiene issues, the perception of consumers when they first arrived at street food stalls while shows consumers' perception on street food before and after arriving at street food stalls [11].

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