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FOOD SAMPLING FOR QUALITY ANALYSIS IN LIBYA - A REVIEW

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ABSTRACT

Industry and public health agencies sample and test food products for various purposes related to food safety and quality. Methods of sample selection and sample size determination are important in designing an optimal sampling plan. The appropriate sample size of a sampling plan depends on the objective. It is assumed that the quality of the selected portion is typical of the whole lot. Analysing samples instead of the whole population can give an estimate of the quality more quickly, with less expense and personnel time. Also as most of the analytical methods are destructive, sampling is advantageous. Analysing samples instead of the whole population can give an estimate of the quality more quickly, with less expense and personnel time. At the same time, only adequate sampling technique helps to ensure that the measured sample quality is an accurate and precise estimate of the population.

***KEYWORDS*:** Food safety sampling, Sample size, Quality analysis, Libya.

1. INTRODUCTION

To control food quality and acceptance within satisfactory limits, it is important to monitor the vital characteristics of raw materials, ingredients and processed foods. This could be done by evaluating all foods or ingredients from a particular lot, which is feasible if the analytical technique is rapid and non-destructive. However, it is usually more practical to select a portion of the total product volume and assume the quality of the selected portion is typical of the whole lot. Obtaining a portion or sample, that is representative of the whole is referred to as sampling, and the total quantity from which a sample is obtained is called the population. Adequate sampling technique helps to ensure that sample quality measurements are an

accurate and precise estimate of the quantity of the population.[1] By sampling only a fraction of the population, a quality estimate can be obtained more quickly and with less expense and personnel time than if the total population were measured. The sample is only an estimate of the value of the population, but with proper sampling technique, it can be a very accurate estimate.

2. Importance of food sampling

Sample collection is very important to ensure that analytical data is reliable and to draw a representative sample. Three activities in analysis are Collection of representative sample, Sample preparation and Analysis using proper methods & instruments. Potential sources of variation for above activities to be identified and minimized or avoided.[2] Proper sample size, suitable containers for sampling or use of appropriate preservatives to prevent spoilage/damage before analysis.

3. Precautions during sampling

The condition of the sample received for examination is of primary importance. A representative sample is essential when pathogens or toxins are sparsely distributed within the food. The number of units that comprise a representative sample from a designated lot of a food product must be statistically significant. The proper statistical sampling procedure, according to whether the food is solid, semisolid, viscous or liquid, must be determined at the time of sampling. Clean, dry, leak-proof, wide-mouthed and sterile containers of a size suitable for sample of the product must be used. Sample must be submitted in original and in sealed condition.[3] Dry or canned foods that are not perishable and are collected at ambient temperatures need not be refrigerated. Collect frozen samples in pre-chilled containers and follow storage norms.

4. Sampling plan

The criteria should be considering in formulating a sampling plan:

- Type of food product
- The size of food articles to be sampled
- The degree of hazard to human health
- The potential for fraud
- Acceptance and rejection sampling plan criteria:

✓ Adulteration,

✓ Tolerance limits,

- ✓ Compositional standards,
- ✓ Net contents

5. Sample collection

It is important to clearly define the population that is to be sampled. The population may vary in size from a production lot, a day's production, to the contents of a warehouse. Extrapolating information obtained from a sample of a production lot to the population of the lot can be done accurately, but conclusions cannot be drawn from data describing larger populations, such as the whole warehouse. Populations may be finite, such as the size of a lot, or infinite, such as in the number of temperature observations made of a lot over time.[4] For finite populations, sampling provides an estimate of lot quality. Regardless of the population type, that is, finite or infinite, the data obtained from sampling are compared to a range of acceptable values to ensure the population sampled is within specifications.

5.1 Homogeneous versus heterogeneous populations

The ideal population would be uniform throughout and identical at all locations. Such a population would be homogeneous. Sampling from such a population is simple, as a sample can be taken from any location and the analytical data obtained will be representative of the whole. However, this occurs rarely, as even in an apparently uniform product, such as sugar syrup, suspended particles and sediments in a few places may render the population heterogeneous.[5] In fact, most populations that are sampled are heterogeneous. Therefore, the location within a population where a sample is taken will affect the subsequent data obtained. However, sampling plans and sample preparation can make the sample representative of the population or take heterogeneity into account in some other way.

5.2 Manual versus continuous sampling

To obtain a manual sample the person taking the sample must attempt to take a "random sample" to avoid human bias in the sampling method. Thus, the sample must be taken from a number of locations within the population to ensure it is representative of the whole population. For liquids in small containers, this can be done by shaking prior to sampling. When sampling from a large volume of liquid, such as that stored in silos, aeration ensures a homogeneous unit. Liquids may be sampled by pipetting, pumping or dipping. However, when sampling grain from a rail car, mixing is impossible and samples are obtained by probing from several points at random within the rail car.[6] Such manual sampling of granular or powdered material is usually achieved with triers or probes that are inserted into

the population at several locations. Errors may occur in sampling, as rounded particles may flow into the sampling compartments more easily than angular ones. Similarly, hygroscopic materials flow more readily into the sampling devices than does non hygroscopic material. Horizontal core samples have been found to contain a larger proportion of smaller-sized particles than vertical ones. Continuous sampling is performed mechanically.

5.3 Importance of sample collection

The reliability of analytical data thus obtained depends on several factors, sampling being the major factor. Current analytical methods require only few grams of food sample to analyze. Thus, it is necessary that a sample be as representative of the population as possible. There are three basic activities involved in analysis of food products:

- Collection of representative sample.
- Sample preparation.
- Analysis using appropriate methods and instruments.

These activities, although independent in nature, yet can have decisive influence on each other. Furthermore, each of these activities have their own potential sources of variations that contribute to the uncertainty level associated with any analytical result. Thus, care must be taken to identify the sources of variation and minimize or avoid them while accomplishing any activity.[7] On the part of the laboratories, it is therefore necessary to develop a plan for the proper performance of each activity, and then establish quality standards and written procedures in compliance with the standards. Many times, the activity of sampling falls outside the purview of a laboratory's mandate or control. This is especially true in commercial testing laboratories where the "first contact" is the arrival of samples. To improve the overall quality of the analytical process, a laboratory must do all it can to receive appropriate, applicable, defensible samples.[8] The development of appropriate plans will depend upon an understanding of the problems involved in each activity, and then the application of reasonable judgements in seeking solutions.

6. Methods of sampling

6.1 Random sampling

Random samples are collected in such a way as to ensure that every item in the population of the food being sampled has an equal chance of being collected and incorporated into the sample to be analysed. This is difficult to achieve in practice because it is difficult to visualize the entire population of say, all the cabbages in a country let alone ensure that each

one has an equal chance of being selected. It is more usual to set up a stratification of the food population.[9]

6.2 Stratified sampling

In this method the population of food is classified into strata, taking into account the most important causes of variation. Stratification by geographical area may be useful even where there are no known significant regional variations. Stratification according to the distribution of the consuming population, among rural and urban sources or by type of retail outlet, are other useful examples. The sampling of branded foods can be stratified according to manufacturing plant. Where different brands of the same food are not expected to show significant variation, the sample can be weighted according to market share. Where this information is not available, extrapolating from similar foods or an intuitive assessment will be required.[10]

6.3 Selective sampling

Selective sampling is widely used in experimental studies of plant and animal husbandry and in home economics. The resultant data are valuable guides for the design of sampling protocols but since they are not generally representative of the foods available, they require careful documentation when included in the database.

7. Sampling Tools and Containers

Samples collected from bulk packages or unpackaged foods soldat retail must be placed in suitable containers for storage and handling to be presented for laboratory analysis.

7.1 Sampling tools

- The tools available to FSO/ Authorized Officer range from common tools for general purposes to special tools to be used in specific situations and for specific examinations of particular food products.
- Common tools such as pliers, spoon, screwdriver and knife are useful for opening containers, cutting bags of food products.

7.2 Sample containers

In general, for liquids the FSO/ Authorized Officer should use clean, dry containers of appropriate waterproof and leak proof material, including glass, stainless metal, and suitable plastic material which can be sterilized by heat if necessary.

- The containers must have a secure closure of rubber or plastic stoppers, or a screw-cap of metal or plastic, coated with an insoluble, non-absorbent.
- For solids or semi-solids, clean, dry, wide-mouth, cylindrical receptacles of suitable waterproof, material should be used. For butter, suitable wide-mouth jars should be used.
- The butter must not be allowed to come into contact with paper or any water or fat-absorbing surface.[11]

8. Sampling size

Normally different types of food materials are collected for food sampling, according to the food material certain quantity amount are taken from it for sample, now we can see crop type and sampling procedure with examples and minimum quantity.

Crop type	Sampling procedure	Example	Minimum quantity
Root, tuber and bulb vegetables	Take samples from all areas of the crop. Remove as much adhering soil as possible from samples but do not wash.	Beet (red, sugar, fodder), onions, parsnips, potatoes, sweet potatoes, turnips	5 kg (and not less than 5 items)
	In some cases, where leaf parts are used as stock feed, they may need to be sampled separately	Carrots, radish, spring onions.	2 kg
	Take the sample from all areas of the crop. Sample parts of the crop exposed to the spray and also those apparently protected by foliage.	Brassica (cabbage, cauliflower, broccoli, kohlrabi, curly kale).	5 kg (and not less than 5 items)
Leafy, stem, fruiting and legume vegetables	Remove as much soil as possible from crops such as celery, but do not wash.	Asparagus, brussel sprouts, celery, chicory, lettuce, spinach, turnip tops	2 kg
		Cucumber, melon, squashes, eggplant	5 kg (and not less than 5 items)
		Peppers, tomatoes, gherkins	2 kg
		Beans, peas, etc. (with pods)	2 kg

All tree and bush fruit, including vines, small fruits and berries	Select fruit from all parts of the tree/bush, high and low, and from both sides of the row and select fruits according to abundance whether in each segment or the whole tree/bush. More fruit should therefore be selected from the more densely laden parts of the crop	Apples, citrus, peaches, pears	5 Kg
	Sample parts of the crop exposed to the spray and also those apparently protected by foliage.	Cherries, nuts, olives, plums.	2 Kg
	Take large and small fruits, perfect or slightly blemished, but not so small or blemished that they would not normally be saleable.	Bush fruit (all types), grapes, strawberries	2 Kg
Cereal Grains	Cut not less than ten small areas (approximately 0.1 m^2) chosen randomly from all areas of the crop. Cut stalks about 10 cm above the ground. Remove grain from the straw.	Maize (grain and cobs)	2 Kg
Oil Seeds.	Collect the heads when they have reached the stage of maturity at which they are normally harvested and if convenient thresh to remove the seeds.	Sesame, canola, soybeans, sunflower	1 kg of seeds

9. Sample collection techniques

The FSO/ Authorized Officer must obtain the following information:

- Name of the food
- Lot number
- Container size or sizes
- Product code numbers
- Labelling information
- Condition of the lot, i.e., broken packages, evidence of rodent or insect infestation, debris, etc.[12]

10. Sampled unit (Lot)

Every effort should be made to restore the lot from which the sample is collected to its original condition. Whenever possible, samples should be collected from previously unopened boxes or crates, unopened retail packages, and unopened bulk containers such as sealed big containers. Often samples may have to be collected from bulk containers which have been inadequately covered.[13] When this happens, the existing condition should be described in detail, keeping in mind the effect that opening could have had on the composition of the product.

11. Sample integrity

The Authorized Officer must always be aware of the perishability of the sample and that, for analytical significance, the sample must reach the laboratory in a condition similar to that at the time of sampling. In taking official samples, many food control authorities prescribe the use of special tamper-proof containers or sealing with wax and a seal with the Authorized Officer's designated identification number. It is usually a good precaution to have the owner of the goods sign for the owner's portion of the sample. The Authorized Officer is responsible for collecting, holding, sealing, storing and delivering the sample.[14] Whoever receives the sample at the laboratory has the same responsibility from that time on. It is very important that the Authorized Officer be able to document sample integrity from time of collection to delivery to the analyst, particularly when enforcement action is being considered.

12. Quantity of food samples to be collected for analysis

Under the provision of Rule No. 13 (FSSA) the quantity of sample of food to be sent to the Food Analyst / Director for analysis shall be as specified in the table below. Article of food Approximate quantity to be supplied

1. Milk 500 ml.
2. Sterilized Milk/UHT Milk 250 ml.
3. Malai/Dahi/Curd 200 gms.
4. Yoghurt/Sweetened Dahi 300 gms.
5. Chhana/Paneer/Khoya/Shrikhand 250 gms.
6. Cheese/Cheese spread 200 gms.
7. Evaporated Milk/Condensed Milk 200 gms.
8. Ice-Cream/Softy/Kulfi/Ice Candy/Ice lolly 300 gms.

9. Milk Powder/Skimmed Milk Powder 250 gms.
10. Infant Food/Weaning Food 500 gms.
11. Malt Food/Malted Milk Food 300 gms.
12. Butter/Butter Oil/Ghee/Margarine/Cream/ 200 gms. Bakery Shortening
13. Vanaspati, Edible Oils/Fats 250 gms.
14. Carbonated Water 600 ml.
15. Baking Powder 100 gms
16. Arrowroot/Sago 250 gms
17. Corn flakes/Macaroni Products/ Corn Flour/ Custard 200 gms. Powder
18. Spices, Condiments and Mixed Masala(Whole) 200 gms.
19. Spices, Condiments and Mixed Masala (Powder) 250 gms.
20. Nutmeg/Mace 150 gms.
21. Asafoetida 100 gms.
22. Compounded Asafoetida 150 gms.
23. Saffron 20 gm.
24. Gur/jaggery, Icing Sugar, Honey, Synthetic Syrup, Bura 250 gms.
25. Cane Sugar/Cube sugar/Refined Sugar/Dextrose, Misri/ 200 gms Dried Glucose Syrup.,
26. Artificial Sweetener 100 gms.
27. Fruit Juice/Fruit Drink/Fruit Squash 400 ml
28. Tomato Sauce/Ketchup/Tomato Paste, Jam/ Jelly/ 300 gms. Marmalade/ Tomato Puree/Vegetable Sauce
29. Non Fruit Jellies 200 gms
30. Pickles and Chutneys 250 gms.
31. Oilseeds/Nuts/Dry Fruits 250 gms.
32. Tea/Roasted Coffee/Roasted Chicory 200 gms.
33. Instant Tea/Instant Coffee/Instant Coffee Chichory Mixture 100 gms[15]

13. Dispatch of sample

All samples packaged for dispatch must be secured with shockabsorbing materials to protect them from damage en route. Samples of frozen foods to be sent overnight may be packed in insulated cartons containing dry ice that will last for that length of time. If special precautions in handling or storing samples are needed, the Authorized Officer should ensure that persons who will be handling the samples are informed.[16]

14. CONCLUSION

Although many of the types of foods described above have different handling and shipping considerations, one important element common to all is the coordination of product arrival at the processing facility. The manner in which samples are to be composited was the primary consideration when sampling from multiple sites. If individual perishable samples arriving from multiple locations are to be combined and analyzed together as one aliquot, all foods going into the composite have to arrive at the processing facility within one to two days of one another.[17,18] In addition, the facility has to be able to complete all composites within the first several days of receipt. In most cases, highly perishable foods cannot be held over a weekend without significant deterioration of the product.[19] There is more flexibility built into the receipt and processing of foods which may be held under appropriate conditions and processed at a later date, such as shelf-stable and frozen foods.[20]

Multiple factors must be taken into account in the design and implementation of a successful sample pick-up. The need to balance the type of foods purchased at one time and to stagger pickups from multiple locations so that the volume of product arriving at the final destination is manageable emerged as key factors in reducing problems associated with a pick-up.[21] Scheduling also needs to avoid major holidays and other events. Therefore, the strategies for the good quality analysis and result, we need enough sampling must be taken in the proper way.

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