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Samples from Proficiency Tests for Food Microbiology are Interchangeable

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Introduction

For the past half century, proficiency testing (PT), also known as interlaboratory comparisons, has been used to guide laboratories, evaluate their performance, and harmonize analytical procedures. The best way to guarantee that a sample analyzed by multiple laboratories will produce consistent and accurate analytical results, regardless of which laboratory performed the analyses, is through these external quality controls. Under ISO 17025 certification, regular participation in PTs is now required for laboratories. Numerous PT schemes are organized in the field of food microbiology to evaluate the analytical performances of laboratories under routine conditions. The ISO 22117 standard for the organization of food microbiology PT says that the nature of the PT samples is important because the analyses have to find a single target microorganism in the presence of important background flora and biological substances that interfere. The presence of bacteriostatic components, the natural flora of the sample, or the interaction between fats, fibers, and resident microorganisms are examples of "matrix-related effects" that are likely to influence the results of real food product analysis. Therefore, it is essential for PT organizers to provide samples that are analogous to actual samples in order to effectively evaluate the analytical methods' applicability to routine analyses [1].

Description

The majority of microbiology PT providers continue to only distribute sterile matrices (such as irradiated meat or skim milk powder) or reference materials (such as pellets or powders) that have been artificially inoculated with lyophilized microbial strains: These samples are simple to make, relatively stable, and offer a precise value that has been assigned to them. However, the question of their "fitness for purpose" or "commutability" has been raised because some of these artificial PT items are far removed from the food samples that are routinely analyzed. Commutability is defined as "a property of a PT sample whereby the sample has the same numeric relationship between measurement procedures as is observed for a panel of representative clinical patient samples," and it was first used in the clinical field in 1973.By evaluating the equivalence of the results obtained on a sample when employing various analytical methods, it thus refers to the adequacy of a PT item in comparison to a "real" analytical sample. To put it another way, regardless of the analytical approach taken, the samples suggested by a PT scheme ought to behave in the same manner as actual samples during the analysis. Sample commutability is regarded as "one of the most important concepts affecting the design and interpretation of PT schemes" in clinical physical therapy. By utilizing commutable PT samples, erroneous conclusions are avoided, thereby penalizing some analytical techniques that would have produced accurate results on actual patient samples [2].

Clinical PT organizers are increasingly concerned about commutability: According to a number of studies, approximately 50% of the artificial samples used for clinical PTs cannot be compared to clinical patient samples. Food microbiology has completely ignored the concept of commutability, which has been extensively researched in the biochemical and clinical fields. In this field, however, where a large number of analytical methods with varying properties (such as selectivity and sensitivity) are validated for the measurement of certain parameters, the commutability of the PT samples ought to be evaluated. For instance, numerous validated methods based on colony-count, MPN (most probable number), PetrifilmTM, or even oxygen consumption can be used to carry out a fundamental analysis like counting the total aerobic flora present in foods. Some PT samples may become noncommutable when various measurement techniques are used, making them unsuitable for performance evaluation [3].

When participants employ a variety of analytical techniques, a noncommutable PT sample will produce inconsistent results: The PT results will show differences that wouldn't show up on real samples. The observed anomaly is referred to as a "matrix effect" or "matrix-related bias." The analytical results that are obtained with some measurement procedures are influenced by an intrinsic property of the artificial sample. The interpretation of the results will be complicated if PT samples exhibit a bias related to the matrix: It will be difficult to determine whether an incorrect PT result is caused solely by an incompatibility between the measurement procedure and the artificial test sample or by a measurement malfunction. In the second scenario, the method's applicability to actual food samples is still unknown. In the case of noncommutable PT samples, the agreement observed on real-world samples will not be reflected in the results obtained by the participants using various measurement methods. As a result, only groups of participants using the same method—or a group of methods that are supposed to exhibit similar matrix-related bias can analyze the results. The only option is to analyze all of the results together and incorporate the (previously quantified) matrix-related bias into the uncertainty on the assigned value if the analysis in clusters is impossible, for example because there are too few results in some groups. The PT organizer is required to first quantify the matrix-related bias under this method. Due to the lack of agreement between results, the grouped analysis's main flaw can result in extremely large tolerance intervals: Then, outliers might be wrongly deemed satisfactory [4,5].

Conclusion

Proposing only genuine, naturally contaminated food matrices that are close to the real-world laboratory conditions is the most effective method for ensuring that the food microbiology PT samples are commutable. However, since the natural contamination of foodstuffs is typically heterogeneous, unstable, and highly variable, including real food samples into a PT scheme necessitates special precautions and presents technical difficulties. Because

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of these specialized requirements, most food microbial science PT suppliers settled on the decision to propose just clean spiked frameworks or reference materials as test tests, without knowing exactly on the off chance that these examples act as standard examples or on the other hand on the off chance that they show a lattice related inclination for some estimation strategies. These matrix effects can be caused by the sample's composition and structure (such as fats, enzymes, fibers, salts, or preservatives), the presence of a microbiological flora, or the process of preparation in food microbiology. Clinical chemistry has shown that the processing of a sample, such as lyophilization, freezing, sterilization, or the addition of stabilizing components, can significantly alter the matrix properties and make clinical samples less commutable. When genuine PT samples are utilized, an artificial inoculation—also known as "spiking" of the samples is frequently required to attain sufficient analyses concentrations. It is generally accepted that adding small amounts of purified analytes to a sample will not affect the composition of the matrix or affect the commutability of the sample. Clinical serum samples supplemented with creatinine, for instance, successfully demonstrated this assumption.

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