

Do methods used in Food microbiology satisfy actual needs for Food safety implementation ?

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During the past decades, something like a tornado could be observed in the sky of Food Safety . Happily, while that topic became more and more important for the consumers as well as for public authorities and industrials , a lot of efforts to find new microbiological methods adapted to the new needs were developed.

However , due to the important demands in Food Safety ,one is allowed to ask itself the following question: do methods used in Food microbiology satisfy actual needs for Food Safety implementation ?

In order to answer that question, at least partly, I would like to share with you a few data concerning at first the analysis methods used in Food microbiology for products analysis and their evolution during the past decades ; then , we shall examine briefly the needs for Food safety implementation . Finally , we'll try to answer the question Do methods used in Food microbiology satisfy actual needs for Food safety implementation ? and draw a few conclusions .

I- METHODS USED IN FOOD MICROBIOLOGY

I-1- GENERAL ASPECTS

Classically, methods used in Food microbiology are divided into two groups :

- Qualitative methods, based on the isolation, identification and characterization of presumed pathogenic microorganisms .
- Quantitative methods based on the enumeration of microorganisms on agar or in liquid medium, using the most probable number technique .

During a long period , methods used in Food microbiology were based exclusively on the use of culture media . However , from a few decades , following their development in medical microbiology , alternative methods have been initiated in the field of Food microbiology and, as you probably know, the "father" of those new, rapid methods is Dr Fung who, as you know, is the keynote speaker and Major lecturer of this workshop .

At the moment , one is able to find a lot of microbiological kits on the market to identify, characterize or enumerate microorganisms and it is somewhat hard to choose and decide the best method for a given purpose or according to the type of laboratory .

As you probably know, during a long time, some legal requirements limited the use of alternative methods . However, we shall see that the situation has somewhat changed by now and we can classify methods used in Food microbiology into the following ones :

- *Reference methods* , which are complete expertise methods ; they are used especially in the case of discordance in the results obtained by two laboratories ; their main advantage is their international recognition (ISO, CEN) ;till recently they were based exclusively on classical principles .
- *Routine methods* (in France at least) , which are reference simplified methods ; in a first step , those methods are experimental and published for two years ; the comments of users during that period are used for their revision and homologation .
- *Alternative validated methods* you will study during the present workshop : they allow to analyse and estimate for one category of product the same value as that given by the reference method ; moreover, they have to answer one or more of the following criteria : rapidity, facility to perform, analytical characteristics .
- *Internal methods* which are used in some laboratories ; that is the reason why a standard concerning specifically intralaboratory validation of internal methods has been developed .

- *Sectorial methods* , whose opportunity is examined in different groups of ISO , for example concerning canned products .

I-2- THE METHODS USED MAY BE DIFFERENT ACCORDING TO THE MISSIONS OF LABORATORIES .

Public and (in some cases) private laboratories

In France and in most countries , microbiological food controls have to answer to different purposes :

- Official controls which are realized using standard reference methods
- Auto-controls : they are performed using reference or alternative methods
- Expertises in case of disagreement between laboratories which are performed using reference methods
- Analyses performed in case of foodborne outbreaks : in that case, internal methods are used systematically but, simultaneously, reference or validated methods are undertaken in order to obtain a confirmation .

Private laboratories of Food industries

In those laboratories, the analyses depend mostly of the applications for which they are requested .: quality control, production lines, end-products, environment, cleaning, HACCP or quality assurance . In that context, different types of methods may be used ; the choice may vary according to the objective .

For a long time, only the results obtained when using standard methods were officially recognized but it is obvious that standard methods do not always answer industrial needs , but we have also to mention that the diversity of alternative methods is such that it is very difficult to decide which method must be used and that is true, even for industrials involved in standardization works .

Happily, validation of alternative methods has been considered quite early in different countries but the situation can be considered as clear only from the publication of the EC regulation 2073/ 15 December 2005 concerning microbiological criteria " Test results are dependent on the analytical method used and, therefore, a given reference method should be associated with each microbiological criterion . However, Food business operators should have the possibility to use analytical methods other than the reference methods in particular more rapid methods as long as the use of these alternative methods provide equivalent results. "

Moreover, the use of new principles can now be introduced in standard methods , as it was decided 4 years ago during a joined meeting of ISO /TC34/ SC9 and CEN/TC275/WG6 :

- " 1- Each time a standard method is being revised, the possibility of using new technologies , including PCR, must be examined by comparing results with those obtained when using the official conventional method .
- 2- For a given microorganism, in order to complete the existing method, , the development of standardized methods based on new technologies can be proposed when the purpose to be obtained (for example pathogenicity level) makes it necessary .
- 3- When new technologies , including PCR, are used as alternative methods, they must be validated against the reference method. "

So, after a long period , we have now to recognize that innovation has found its place in Food microbiology.

However, one additional and important point must not be forgotten: we have to include in the word "method" a lot of parameters including sampling , transport and preparation of the sample, preenrichment, enrichment and measurement uncertainty ..which I did not develop in this first part.

II- THE METHODS USED IN FOOD MICROBIOLOGY MUST ANSWER TO NEW NEEDS .

Of course , as we have seen , official and industrial controls have been existing for a long time and the HACCP method has been introduced in different industries, from many decades now, with the wish of industrials to get a production as safe as possible .

However, there were very important differences in the way the controls were organized and the relationship between Food and the consumer's health was not considered as obvious, except in a few cases of foodborne outbreaks.

For a long time, this relationship has been underestimated; then, the problem of BSE, the recognition of Food as responsible of listeriosis outbreaks..... has led to an overestimation which conducted the authorities to undertake a lot of efforts to protect the consumers (what I above mentioned as a tornado).

When we look at the new world of Food safety, this evolution appears as a consequence of a long period during which a lot of work has been realized in different fields: setting up regulations in different countries, introduction and implementation of the HACCP concept in different industries and, what is also wonderful, all efforts done in the purpose of setting up new techniques, more rapid, cheaper and easy to handle ...It looks somewhat as if somebody had to prepare a piece of work and, if that purpose, a lot of people, belonging to different groups, knew they had to participate to that purpose, each group working without knowing the work being done in different parts of the world.

So, very important changes have appeared at the beginning of the new millennium. From 1998, different national agencies for Food safety were created and, in December 1998, a meeting of all those agencies was held in Paris in order to exchange ideas, concepts and projects in the field of Risk analysis.

On January 12, 2000, David Byrne, acting as EC Commissioner for Health and Consumer protection, presented the "White paper" which gave new orientations and directives to **ensure Food safety protection in all countries of EU**. He proposed to prepare a coherent set of rules in order to modernize the legislation and to reinforce controls from farm to table. Moreover, he recommended the creation of an independent Authority to give independent scientific advices and provide a clear communication on risks.

Following the presentation of the White Paper, on 28 January 2002, the European Parliament and Council adopted the regulation EC 178/2002 laying down general principles and requirements of the Food Law. The objectives were as follows:

- achieve effective control systems;
- prepare international relations with third countries;
- work in relation with the European Food Safety Authority in order to insure a science based risk management.

So, the White paper outlined a radical revision of the EU's food hygiene rules. The hygiene package aims to harmonise and simplify very detailed hygiene requirements scattered over 17 directives. Finally, it includes five regulations which can be considered as the basis of the controls which have to be realized from farm to fork in order to establish the traceability of products and ensure Food safety for the consumers.

Of course, the Food law is only the basis of the regulation; later, subsequent regulations providing additional details have been set up, including microbiological criteria for foodstuffs (Commission Regulation EC N° 2073/2005 updated by Commission Regulation 1441/2007) and also Implementation measures including provision methods for food and chain information.

One key aspect of the new legislation is that all food and feed business operators will have principal responsibility for insuring that food placed on the EU market meets the required food standards.

That may appear as a quite impossible challenge. However, we have to take progress into account and look at what is really done " in the field" .

I think the first perception we may have when looking at the new regulations is to wonder how to implement the requirements in terms of sampling, analyzing, interpreting the results in order to ensure Food safety. Another question is: how to be sure that the controls set up and realized by laboratories are in conformity with the official requirements.

One part of the answer is surely given in the necessity for each group of producers to propose a Guide of good hygiene practices. Those guides whose main purpose is to avoid any problem of Food safety describe the way in which the HACCP concept is implemented and must be submitted by the administration for agreement.

In those guides , the critical points are defined as well as number of samples to be examined, the nature of the samples, the microbiological methods used ...in that context, the sentence included in the regulation concerning the microbiological method above mentioned is very important as it gives the possibility of using alternative methods instead of reference standard methods, when they have been validated by an accepted protocol .That represents really a very important improvement compared to the situation a few years ago .

FINALLY,

III- CAN WE ANSWER THE QUESTION “ DO METHODS USED IN FOOD MICROBIOLOGY SATISFY ACTUAL NEEDS FOR FOOD SAFETY IMPLEMENTATION “ ?

When trying to summarize and draw a few conclusions , we observe a lot of improvements which help to satisfy the needs but, at the same time, we must confess that the situation is not perfect and that difficulties remain .

Among the improvements , we can mention that rapid and alternative methods allow to analyse a far higher number in a given period of time than classical ones. Presently, the alternative methods can be used currently subject to their validation .

- Molecular methods allow to help a lot in the traceability approach .

- At the same time (I did not develop this aspect today), we have to recognize that efforts have been done in the field of interpretation of the results , including measurement uncertainty , through the work of standardization groups (one meeting should be held in Valencia next year) .

We have by now, the advantage of Internet communication

Concerning the difficulties , we can say that, even if rapid , alternative methods allow to examine a higher number of samples than the standard ones within the same period of time , we must consider the analysis of a sufficient number of samples will always be insufficient , at least for financial reasons .

- The choice of a method , even for a given objective , will always remain a difficult one. Among the difficulties , we must not forget the eventuality of finding higher positive results than when using a standard method .

But, finally , even if it is realistic to wait for new improvements , my opinion is that, objectively, we can answer that methods used in Food microbiology are presently on the right way to satisfy actual needs in Food safety implementation . The “tornado” had surely profitable consequences...