**Summary**

One of the most topical areas of human nutrition is the role of the gut in health and disease. Probiotics involve the use of live micro-organisms in food; prebiotics are carbohydrates selectively metabolized by desirable moieties of the indigenous flora; synbiotics combine the two approaches. Dietary intervention of the human gut microbiota is feasible and has been proven as efficacious in volunteer trials. The health bonuses of such approaches offer the potential to manage many gut disorders prophylactically.

**Key words:** probiotics, health, disease, clinical studies

**Probiotics**

Probiotics are live microbial food supplements which have a beneficial effect on the intestinal balance of the host animal (Fuller, 1989). Much recent effort has concentrated on identifying probiotics bacteria and characterising their beneficial credentials. It is generally considered that probiotics must possess certain properties, they must survive passage through the upper regions of the gastrointestinal tract and persist in the colon, there must be no adverse response to the bacteria, their components or metabolic end products, they should be antagonistic to mutagenic or pathogenic organisms in the gut and must be genetically stable, for successful introduction of the probiotic concept into the food market, chosen micro-organisms must be amenable to industrial processes and remain viable in the final food products (Ziemer, Gibson, 1998; Collins, Gibson 1999).

The health benefits associated with probiotics ingestion are listed in Table 1. Care must be taken when considering many of the suggested health-promoting capabilities, since much of the supportive scientific data have been generated from studies in vitro or small-scale human volunteer trials (Ziemer, Gibson, 1998). There is a clear need only for large-scale human volunteer studies to support such claims but also for fundamental research into the mechanisms by which probiotics affect human health. In this respect, the correlation of probiotic activities, such as anti-pathogenicity, with specific health outcomes in vivo will allow rational choice of probiotic strain and targeting of subpopulations at particular risk of gastrointestinal complaints. Thus, directed probiotic application may be achieved, enabling specific health claims to be investigated in clear defined clinical trials.

**Table 1 Probiotic bacteria and their reported health benefits in clinical studies (Lee - Salminen, 1995, Ziemer - Gibson, 1998)**

<table>
<thead>
<tr>
<th>Reported effects</th>
<th>Probiotic species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulation of immune system</td>
<td>Lactobacillus acidophilus, L. casei, L. plantarum, L. delbrueckii, L. rhamnosus</td>
</tr>
<tr>
<td>Balancing of gut microbiota</td>
<td>L. acidophilus, L. casei, Bifidobacterium bifidum</td>
</tr>
<tr>
<td>Reduced faecal enzyme activities</td>
<td>L. acidophilus, L. casei, L. gasseri, L. delbrueckii</td>
</tr>
<tr>
<td>Antitumor</td>
<td>L. acidophilus, L. casei, L. gasseri, L. delbrueckii, L. plantarum, B. infalis, B. adolescentis, B. bifidum, B. longum</td>
</tr>
<tr>
<td>Prevention of traveller’s diarrhoea</td>
<td>Saccharomyces spp., mixture of L. acidophilus, B. bifidum, Streptococcus thermophilus, L. bulgaricus</td>
</tr>
<tr>
<td>Prevention of rotavirus diarrhoea</td>
<td>L. rhamnosus, B. bifidum</td>
</tr>
<tr>
<td>Prevention of other diarrhoea</td>
<td>L. acidophilus, L. rhamnosus, B. bifidum</td>
</tr>
</tbody>
</table>

**Probiotics and the immune system**

Some of the most convincing research on the efficacy of probiotics comes, from the area of food intolerance and allergy: this includes in particular, intolerance to cow’s milk protein and lactose and the ability of probiotics to aid digestion of these components (Sanders, 1993). Members of the gut microbiota, occupying a juxtamucosal niche in the intestine, have been shown to modulate specific immune responses in gut-associated lymphoid tissue. Sudo et al. (1997) demonstrated that the gut microflora contributes towards generation of T-helper cells which induce oral tolerance, and this has led to the possibility of using probiotic strains as therapeutic agents in hypersensitive disorders. Lactobacilli and bifidobacteria have a natural association with the gut mucosa and are able to promote normalization of the increased intestinal permeability that occurs during exposure to food allergens (Isolauri et al. 1999). In addition probiotic strains are capable of reducing the production of interleukin (IL)-4 during casein fermentation, excess production of IL-4 being one of the key features of a topic patients and
responsible for initial sensitisation (Sütas et al. 1996). Human studies have recently been conducted on the ability of probiotics to prevent development of an immunological memory capable of producing an abnormal response to cow’s milk at an early age (Majamaa and Isolauri, 1997). Table 2 outlines how probiotics are able to modulate allergic inflammation.

Table 2 Modulation of the immune system by probiotic micro-organisms (Isolauri et al. 1999)

- Altering the immunogenicity of allergens via proteolytic activity
- Normalising the composition of the intestinal microbiota
- Reducing the secretion of inflammatory mediators in the gut
- Reversing increased intestinal permeability
- Reversing enhanced absorption of macromolecules
- Enhancing the mucosal immunoglobulin A response to enteral antigens
- Modifying the systemic changes related to allergic inflammation
- Alleviating the clinical symptoms of food allergy

Probiotics and antitumour properties

Lyophilised cultures of probiotic strains, *Bifidobacterium longum* in particular have been shown to suppress the development of aberrant crypt foci in rats given azorymethane-induced colon cancer (Rafter 1995, Reddy 1998). However, most animal studies have been carried out with specifically breed strains of rodents and the question of whether these results can be extrapolated to humans is still unclear. Of the human feeding studies that have been carried out, treatment groups tend to be small and of short duration. Although these studies do show a reduction in faecal enzymes that may be associated with the formation of carcinogens, it is still unclear whether these would affect long-term cancer rates. Report published to date are not consistent in finding reductions in the same enzymes (Hyatsa and Hayatsu, 1993).

Probiotics and diarrhoea

Ingestion of probiotic strains as prophylactic agents against diarrhoea is based on the ecological principle of competitive exclusion. Effectiveness depends on the strain of bacteria, its suitability to an individual and the ability to displace pathogens (O’Sullivan and Kullen, 1998). Such probiotics have potential for the prevention and treatment of gastrointestinal infections, one specific example being the application of *Bifidobacterium bifidum* and *Streptococcus thermophilus* in the case of infant viral diarrhoea (Saavedra et al. 1994). Future studies need to provide dose-response data and details on the etiological agents causing diarrhoea in different destinations. A recent review (Buddington and Weiher, 1999) has suggested the use of probiotics in combination with oral rehydration therapy and antibiotics, to prevent antibiotic-associated diarrhoea. Scientific approach to establishing the functional benefits of probiotic bacteria Despite much research into the health benefits of probiotics, progress has been hampered by a variety of factors. Individual studies provide insight into a specific probiotic strain, however, as bacteria have a very heterogeneous nature and differ according to genera, species and strain, it is difficult to make general conclusions about probiotics as whole. In addition, the variety of health benefits of probiotics means that, at present a diversity of end points is being studied in clinical trials. It is, therefore, problematic to reach a scientific consensus on the effect of probiotics on health outcome (Sanders, 1998), in each area of potential health benefits here is a need for current research to focus on well-controlled human trials.

References


THE CALCULATION OF THE LETHAL EFFECT OF HEAT STERILISATION OF CANNED FOODS AND OPTIMIZATION OF NUTRIENT RETENTION

Igor MRÁZ
LikoSpol a.s. Bratislava, e-mail : mraz@likospol.sk

Summary

The modern sterilisation process aims to destroy microbiological life and to inactivate enzymes in the product with the least possible effect on the sensory properties and nutritive value of the product. The process must comply with the requirements on food safety, what is provided by control of lethal effect of the thermal sterilization expressed with F-value. From the view point of human nutrition, it is appropriate that the process conditions secure the maximum nutrient retention. For optimization of this process, C-value parameter is used for the evaluation of the effect of heat on the nutrients. This paper submitts the calculation of the lethal effect of heat sterilisation of canned foods with use of F-value and optimization of nutrient retention with use C-value.

Introduction

The treatment and preservation of foodstuffs has already been one of the main activities of the human society. Thermal processing of food is the most prominent way of preserving food and of making it edible. The primary object of the thermal processing of canned foods is to destroy living microorganisms capable of causing deterioration of the food or endangering the health of the consumer. It is important to heat the food in such a way that it is satisfactorily preserved and still retains its expected taste, aroma and appearance, together with its functional properties. Moreover, the biological value of the food product must be taken care of, so that as much as possible of its nutritional properties will remain when the food product reaches the consumer [2,10].

Process evaluation

Theoretical principle of the thermal process assessment is based on the thermoinactivation kinetics of decisive microorganism (Fig. 1). Then, the efficiency of the thermal preservation process (F-value for canned product) is determined from the experimentally found time-temperature profiles (Fig.2)