

What are Probiotics

- And what differences can they make?

A summary
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Biosa Danmark ApS

Probiotics

Content

1 WHAT IS A PROBIOTIC	3
2 REQUIREMENTS FOR A PROBIOTIC	3
2.1 I SAFETY ASPECTS	3
2.2 II FUNCTIONAL ASPECTS	3
2.3 III CLINICAL ASPECTS	4
2.4 IV TECHNICAL ASPECTS.....	4
3 WHY WE NEED PROBIOTICS.....	4
4 THE OCCURRENCE OF PROBIOTICS.....	5
5 FERMENTING MICROORGANISMS WITH PROBIOTIC POTENTIALS	6
6 HOW MUCH PROBIOTICS DO WE NEED.....	7
7 WHY CHOOSE BIOSA’S PROBIOTIC PRODUCTS.....	7
8 REFERENCES.....	8

1 What is a probiotic

The word "probiotic" stems from two Greek words "pro" and "bio", which mean "for life". Probiotics were first defined in 1965 and are the opposite of antibiotics. Knowledge about probiotics dates all the way back to the beginning of the 1900s though, when a Russian researcher observed the intestinal bacteria *Lactobacillus*' importance in the intestinal micro flora.

The term probiotic covers a range of living microorganisms, hereof primarily lactic acid bacteria and bifidobacteria. These are attributed a range of health improving abilities when they are present in the digestive system. This means, that one can create a harmonious digestive system through the intake of probiotics, which helps strengthen the immune system and thus prevents illness.

(Axelsson 1998; Fooks *et al* 1999; Lilly & Stillwell 1965; Heymann & Ménrad 2002).

A combined definition of a probiotic could be as follows:

"Probiotics are a food supplement containing one or more bacteria cultures from living microorganisms. They benefit the consumers health through maintaining and/or improving the microbial balance in the intestines when taken in sufficient quantities".

(Fuller 1998; Guarner & Schaafsma 1998; Havenaar & Huis in't Veld 1992; Larsen *et al* 2006)

2 Requirements for a probiotic

A series of different criteria need to be fulfilled for a microorganism to have probiotic effects.

The criteria are divided into the following four categories:

2.1 I Safety aspects

(Safe intake / harmless)

All food products for humans and animals need to be safe and thus the probiotic microorganisms also need to be safe to consume. Probiotic microorganisms must not be pathogen, must not have relations to illnesses and must not carry transmitted antibiotic resistant genes. Probiotic bacteria must be safe to use in all kinds of food products.

(Adams 1999; Donohue *et al* 1993; Donohue & Salminen 1996; Lee & Salminen 1995; Saarela *et al* 2000; Salminen *et al* 1999; Wolf *et al* 1995).

2.2 II Functional aspects

(Survive the acidic environment in the stomach, adhere to the intestinal wall, reproduce and create balance)

The probiotic microorganism is exposed to different environments in the digestive system. If the probiotic organism can survive the acidic environment in the stomach and keep unaffected by the bile, there are good chances it can provide probiotic qualities in the intestines. In the gut, the probiotic bacteria must be able to

adhere to the epithelial surfaces in the intestinal tract, reproduce, produce antimicrobial substances and last for a certain amount of time. With these functional abilities, the probiotics help balancing the intestinal micro flora. The micro flora is in balance when the microorganisms in the intestines are combined in a way that improves the health and at the same time prevents the intrusion of illness causing microorganisms.

(Adams 1999; Collins *et al* 1998; Donohue & Salminen 1996; Havenaar & Huis in't Veld 1992; Hyronimus *et al* 2000; Salminen *et al* 1999).

2.3 III Clinical aspects

The clinical effects from the probiotic microorganisms are manifold and even if numerous studies have shown that probiotics have beneficial effects, there still is a range of areas that need more scientific research.

The basic demands for the clinical effects for a probiotic are:

- the probiotic microorganism shall be able to modulate the immune response without showing pro-inflammatory effects,
- have a beneficial influence on the metabolic activity,
- have antimutagenic qualities
- prevent the growth of cancer and
- be able to oppress the presence of illness causing pathogen bacteria.

Probiotic microorganisms shall be clinically validated and have well documented scientific health benefiting effects.

(Donohue & Salminen 1996; Heyman & Ménard 2002; Lee & Salminen 1995; Rolfe 2000)

2.4 IV Technical aspects

During the production of products containing probiotic microorganisms, they are usually exposed to technical processes that can harm the probiotic abilities. Hence, the probiotic microorganism needs to be resistant to technological processes. Hereafter they need to be stable and able to survive during a given time of storage.

(Ouweland & Salminen 1998; Saarela *et al* 2000; Simmering & Blaut 2001)

It is ideal if one microorganism stem meets all the criteria! (Saarela *et al* 2000; Salminen *et al* 1999). Conversely, there are many lactic acid bacteria, which for various reasons not is labeled as probiotics (research takes time etc), but easily may have one or multiple probiotic properties.

3 Why we need probiotics

Probiotic bacteria, lactic acid bacteria and bifidobacteria help creating a healthy digestive system. A good digestive system leads to a good immune system as 70-80% of the immune system has its base in the

digestive system (Collins *et al* 1998). Many studies have proven that probiotics have a beneficial effect on the health, if one is weakened by illness or just wants to strengthen ones state of health. Especially studies on *Lactobacillus acidophilus*, *Bifidobacterium* and *Lactobacillus casei* have shown that they establish and stabilise a harmonious micro flora in the digestive system. (Chouraqui *et al* 2004; Larsen *et al* 2006; Malinen *et al* 2002; Saavedra *et al* 2004; Satokari *et al* 2001; Schiffrin *et al* 1995; Wildt *et al* 2006).

Probiotics can:

- balance the digestive system, improve the digestion, ease constipation, provide a better consistence of the faeces (softer) for children and adults and improve the bowel movements
- prevent the growth of ‘normally occurring’ intestinal pathogen bacteria and hence improve the mucous membrane’s resistance to intestinal infections
- prevent diarrhoea and light chronic diarrhoea caused by an over growth of intestinal pathogen bacteria
- strengthen the immune system through stimulating the production of immunoglobulin A (IgA) in the intestinal system/increase mucosal IgA
- contribute to prevent diet related cancer, e.g. colon cancer, bladder cancer, etc.
- contribute to ease food allergies and lactose intolerance
- contribute to lower the cholesterol level and the blood pressure (Bb-12 binds the bile salts and thus prevents the transportation through the intestinal wall to the bloodstream, and in stead leads it through the digestive system and out)
- contributes to prevent and ease infections in the urinary system
- contributes to reduce the cases of colic and provide fewer stomach problems for babies
- contributes to reduce the use of antibiotics
- contributes to prevent and ease diarrhoea when travelling
- contributes to ease/improve atypical dermatitis (skin irritation/eczema)

(Chouraqui *et al* 2004; de Roos & Katan 2000; Erickson & Hubbard 2000; Fooks *et al* 1999; Hirayama & Rafter 1999; Jain 1998; Larsen *et al* 2006; Malinen *et al* 2002; Mattila-Sandholm *et al* 1999; Peters *et al* 1992; Reid & Buton 2002; Saarela *et al* 2000; Saavedra *et al* 2004; Satokari *et al* 2001; Savaiano & Kotz 1989; Schiffrin *et al* 1995; Wildt *et al* 2006; Zubillaga *et al* 2001)

4 The occurrence of probiotics

There are probiotic organisms, lactic acid bacteria and bifodobacteria everywhere. This does not mean that they are ideal probiotic microorganisms, but they can still provide moderate probiotic qualities.

In the human body we can find probiotic organisms in the mouth cavity, the digestive system, the urinary system, etc. In nature the organisms are found on the surface of crops etc. In food there are many varieties of probiotics as a result of fermenting processes. Meat, milk and vegetables, as well as crops, have been fermented since 6000 BC. Examples of this are salami and salt ham, yoghurt and cheese, sauerkraut and

olives. Further, probiotics can be found as tablets and powders in combinations of one or more probiotic microorganisms.

(Caplice & Fitzgerald 1999; Holzapfel 2002; Olasupo 1999; Oyewole 1997)

5 Fermenting microorganisms with probiotic potentials

In the following table 5.1 the most used fermentation microorganisms with probiotic potentials are listed (Fooks *et al* 1999; Fuller 1991; Heyman & Ménrad 2002). It is important to be aware that the strains probiotic abilities can vary on a subspecies level.

Table 5.1. Most used fermentation bacteria, with probiotic potentials, used in food production.

Lactobacilli	Bifidobacteria	Streptococci	Enterococci
<i>L. acidophilus</i> ^A	<i>B. adolescentis</i>	<i>S. thermophilus</i>	<i>Ent. Faecalis</i>
<i>L. bulgaricus</i>	<i>B. animalis</i>		<i>Ent faecium</i>
<i>L. casei</i> ^A	<i>B. bifidum</i>		
<i>L. delbrueckii</i> ssp. <i>bulgaricus</i>	<i>B. breve</i>		
<i>L. fermentum</i>	<i>B. infantis</i>		
<i>L. gasseri</i> ^A	<i>B. lactis</i>		
<i>L. helveticus</i>	<i>B longum</i>		
<i>L. johnsonii</i> ^A			
<i>L. lactis</i>			
<i>L. plantarum</i> ^A			
<i>L. paracasei</i> ^A			
<i>L. reuteri</i> ^A			
<i>L rhamnosus</i> ^A			
<i>L. salivarius</i> ^A			

(Fooks *et al* 1999; Fuller 1991; Heyman & Ménrad 2002)

^A: Is scientifically proved to occur naturally in the human body, however the others may also occur in the human body too (Adams 1999)

NB: Be aware that subspecies can vary.

Biosa Danmark uses the following microorganisms with probiotic abilities in their products:

- *Bifidobacterium animalis* subsp. *Lactis*, BB12®
- *Lactobacillus acidophilus* LA5®
- *Lactobacillus paracasei* subsp. *paracasei*, L.casei 431®
(® Patented with Chr. Hansens, Hørsholm, Danmark)

To make the products unique and to offer a varied supply of different beneficial microorganisms then these lactic acid bacteria are also added in the production of Biosa Danmarks products:

- *Leuconostoc pseudomesenteroides*
- *Lactococcus lactis* subs. *lactis* biovar *diacetylactis*
- *Lactococcus lactis* subs. *lactis*
- *Streptococcus thermophiles*

6 How much probiotics do we need

The viability, the activity and the dosage of probiotic microorganisms are the basis for an optimal probiotic function. Some studies have shown that non-viable probiotic microorganisms also can have beneficial effects for the host, but the most optimal probiotic microorganisms are living.

Several clinical studies have shown that the most beneficial probiotic effect is reached with the intake of at least 10^9 probiotic microorganisms per day (10^9 cfu/day). (Chouraqui *et al* 2004; Larsen *et al* 2006; Malinen *et al* 2002; Saavedra *et al* 2004; Satokari *et al* 2001; Schiffrin *et al* 1995; Wildt *et al* 2006).

It is under no circumstance possible to take too much probiotics, lactic acid bacteria and/or bifidobacteria. A large number of studies have shown that probiotics are safe to consume. Humans and animals that have taken extremely large doses of probiotic bacteria ($6g$ *Lactobacillus* $\times 10^{12}$ cfu/g per day) have not shown any toxic implications (Adams 1999; Donohue *et al* 1993; Wolf *et al.* 1995).

7 Why choose Biosa Danmark's probiotic products?

Biosa Danmark is a certified organic company. It is Biosa Danmark's wish to be able to make a difference in the life of individual people and to contribute to a sustainable society in balance with the surroundings – on a local, national and global plan. Biosa Danmark produces organic microbial products focused on four categories: 1) Body & Health, 2) Animals & Feed, 3) Soil & Plants and 4) Environment & Waste.

For Body and Health a unique and sour drink Vita Biosa Probiotic (since 2001) is produced by fermentation with three strong well-documented probiotic microorganisms and four lactic acid bacteria strains. The amount of these viable probiotic microorganisms (cfu/ml) increases a lot during the production. This is a desired development which enhances the quality of the product. While the amounts of microorganisms are increased, a formation of organic acids are generated which results in a lower pH of 3.5. This is also a desired development which enhances the quality of the product as the Vita Biosa Probiotic becomes self-preservative.

The amount of these microorganisms decreases during a given shelf-life. When bottling the Vita Biosa Probiotic contains approximately 100-million probiotic microorganisms/ml (10^8 cfu/ml). After one year, the cfu/ml is decreased to approximately 20 million probiotic microorganisms (2×10^7 cfu/ml). This is equal to a daily intake of 50 ml Vita Biosa Probiotic to obtain the beneficial effects; improves the stomach and digestive system & strengthens the immune system. Vita Biosa Probiotic is available with three sour flavours: 1) herbs, 2) rosehips and 3) aronia, blackcurrant and blueberries.

Another product from Biosa Danmark with probiotics and lactic acid bacteria is Biokay (since 2009). Biokay is a refreshing soft drink with fizz and a high content of probiotic microorganisms and lactic acid bacteria. Other beneficial advantages of Biokay are as follows: 1) it is sugar free and free of sweeteners, 2) it does not contain any preservatives and food colouring, 3) it is long lasting before opening and does not require cool storage and 4) it is healthy and natural.

The beneficial advantages mentioned above are also applicable for the Vita Biosa Probiotic.

A daily bottle of Biokay (50 cl) fulfils the recommended daily intake of probiotic microorganisms which gives 1 billion probiotic microorganisms a day (10^9 cfu/day). Biokay is available with natural kiwi-cactus flavour, strawberry-liquorice flavour, and with citrus flavours.

The following table 7.2 lists a range of advantages with the Biosa products and their production.

Table 7.2. Advantages in the production of Biosa Denmark’s products and the basic content and abilities of the products. Moreover Biosa Danmark further holds a large amount of scientific references which have been confirmed through customer responses over the years.

Basic content of the products	Production
Probiotic Vital Organic Sugar free Self preserving Free of Genetic Modified Organisms (no-GMO) Microbiologically safe Long shelf life Simple combination	Environment friendly production Environment friendly cleaning
Product qualities	References
Ready for consumption Can be mixed with other drinks Do not require cool storage before opening	SCIENTIFIC DOCUMENTATION Empirical documentation
Product use (Human)	Biosa Denmark's strength
Health improving due to the probiotics	Stability of deliverance

Denmark has a well-documented reputation for good food safety and control. Biosa Danmark was awarded with the “Elite Smiley” at the last food product control from the Danish Food and Veterinary Administration.

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