The MOSS NUTRITION REPORT

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Product Review

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PROBIND SELECT™ – A NEW TOXIN BINDING FORMULA FROM MOSS NUTRITION

INTRODUCTION

Thanks to the urging of one of our clinical advisors, Joseph Mather, MD (who is always available to assist you with use of Moss Nutrition products, particularly for your more challenging cases), we will be introducing to you very shortly a product that we probably should have made several years ago - the toxin binding product - **ProBind Select™**. Interestingly, though, in retrospect, I'm glad we did not produce a product in this category previously. Why? I doubt that we would have produced a formula as well designed as the one that was introduced to us by Dr. Mather that forms the basis for **ProBind Select™**. Of course, we at Moss Nutrition have always taken pride in the fact that all of our products are the result of a team effort where everyone at Moss Nutrition plays a key role in bringing quality, efficacious products to you. Nevertheless, in terms of the initial creation of the formula, which was tweaked in the final version a bit by me, our chief medical officer Nikolas Hedberg, DC, and Diana Allen, MS our product development manager, Dr Mather certainly deserves all the credit.

As you will see when you learn of the ingredient list of **ProBind Select™**, it not only includes excellent binding factors such as activated charcoal, bentonite clay, and chlorella, it also includes four probiotics in the form of three different lactobacillus strains and saccharomyces boulardii. When I first learned about this in my early conversations with Dr. Mather about the composition of the formula, I must admit that I was a bit confused. While I have been studying, writing, and lecturing about probiotic strains such as saccharomyces boulardii and the three lactobacillus strains for many years, I must also reluctantly admit I was not aware of any literature that discusses their role in detoxification. In turn, I was initially a bit hesitant to produce a toxin binding product that would include microbiota strains that are most often considered to be optimizers of gut function.

Fortunately, Dr. Mather was quick to inform me of my ignorance not only with a detailed explanation of why the probiotics are in the formula but with excellent, peer-reviewed references. Subsequently, I did a literature investigation on my own and found that probiotic organisms play a key role in detoxification pathways. So now, because of Dr. Mather, I'm not only a bit smarter but proud to introduce to you an excellent adjunct to our other detoxification products, **Select Cleanse®** and **HepatoDetox Select®**. Thank you, Dr. Mather!!

As I pondered what to include in this newsletter introducing **ProBind Select™** to you, I had the thought that there may be others besides me who have been unaware of the role of probiotic organisms in detoxification. Therefore, I decided to feature a discussion of this topic in this newsletter.

Of all the papers of which I am aware that feature the role of probiotic organisms in detoxification, one of the best in my opinion is the one that will be reviewed below, "Probiotics as a biological detoxification tool of food chemical contamination: A review" by Srednicka et al (Srednicka P et al. *Food and Chemical Toxicology*, Vol. 153, 2021).

THE ROLE OF PROBIOTIC ORGANISMS IN PROBIND SELECT AS SUGGESTED IN THE PAPER "PROBIOTICS AS A BIOLOGICAL DETOXIFICATIN TOOL OF FOOD CHEMICAL CONTAMINATION: A REVIEW"

The first quotes I would like to feature from the Srednicka et al paper come from the introduction where the general value of probiotics in protecting against food contaminants and xenobiotics is emphasized:

"Recently, there has been an increasing interest in probiotics application with high xenobiotic binding capacity that could be utilized to protect against food contaminants, e.g., to alleviate the acute and chronic heavy metals toxicity by *Lactobacillus* strains."

In addition, further research has demonstrated:

"It has been confirmed that oral probiotic supplementation can alleviate the negative health effects of exposure to the food contaminants by modulating the composition of gut microflora, reduction of the oxidative stress, enhancement of intestinal barrier function, modulation of the host gene expression and finally affect the host's capacity to metabolize xenobiotics. Probiotics can directly bind certain xenobiotics to the cell wall, and thus reduce their bioavailability and toxicity. Oral supplementation with xenobiotic-binding probiotic strains can be a simple and effective way to reduce the amount of pollutants absorbed from food in contaminated regions of the world."

The next section of the paper I would like to highlight provides more detail as to how the most common probiotic organisms perform xenobiotic detoxification:

"The most commonly used probiotics are lactic acid bacteria (LABs), *Bifidobacterium* sp., and the yeast *Saccharomyces (S. cerevisiae* var. *boulardii)*. These strains have various beneficial properties that can be important in xenobiotic detoxification, such as strong ability to bind, tolerate or detoxify, high tolerance to acid and bile, strong adhesion to the gut mucosa, and strong antioxidant or immunoregulatory capacities enabling them to adapt to xenobiotic-induced changes in the gut environment. Recent *in vivo* studies have demonstrated that during intestinal transit, probiotics might competitively inhibit the intestinal absorption of food contaminants such as mycotoxins and heavy metals, evidently lowering their availability for the host. Moreover, it has been revealed that probiotics can also stimulate peristalsis, thus facilitate xenobiotics excretion from the body in feces as well as limit their entrance into systemic circulation by enhancing intestinal barrier function and regulating the tight junction of the epithelium in the small intestine."

Of course, as we all know, probiotic organisms can also have a major impact on the composition of resident microflora, which can also have an impact on xenobiotic detoxification:

"…the gut microbiota modified by probiotics alters the absorption and metabolism of food xenobiotics via acting as a physical barrier and by modifying the intestine pH and oxidative balance as well as the expression of host detoxification enzymes involved in xenobiotic metabolism."

Srednicka et al then comment on some specific detoxification properties of lactobacillus and saccharomyces organisms:

"Extensive studies have demonstrated that LABs and some *Saccharomyces* yeast can remove food contaminants due to various mechanisms such as physical absorption onto the cell surface and/or enzymatic biotransformation via the production of various enzymes and certain metabolites."

Next, more detail is provided about these mechanisms.

Physical absorption

"Many probiotic strains possess the ability to reduce the level of xenobiotics, particularly by binding. Physical absorption is a reversible, metabolically passive physicochemical process, therefore chemical might interact with both alive or dead microbial cells."

In respect to physical absorption, how do lactobacillus organisms accomplish this aim? The author's comment:

"The absorption of xenobiotics into the LAB cell wall is due to the presence of a negative charge on the surface caused by many negatively charged functional groups such as carboxyl and phosphoryl groups. The main xenobiotic-binding site is peptidoglycan, other minor elements are teichoic acids and lipoteichoic acids."

Biotransformation

As we all know, the liver is generally regarded as the primary site for phase I and II detoxification/biotransformation enzymes. Srednicka et al point out that probiotic organisms also possess the ability to engage in biotransformation:

"The biotransformation of xenobiotics via probiotics with gut microflora cooperation can alter xenobiotic half-life, toxicity, and bioavailability as well as the endocrine-disrupting potential. An example of intestinal xenobiotic metabolism is the biotransformation of the mycotoxin ZEN by *Lactobacillus paracasei* to a less toxic form."

Microbial metabolites and their impact on xenobiotics

It is well known that probiotic organisms can produce bioactive metabolites. As noted in the quote below, these metabolites can have an impact on xenobiotic biotransformation:

"Another mechanism of xenobiotic biotransformation is due to interactions with LAB metabolites, e.g. acids, phenolic compounds, fatty acids, low molecular weight bioactive peptides, reuterin, which can bind to xenobiotics and alter their toxicity."

Next, Srednicka et al discuss the role of probiotics in detoxification of specific toxins.

Bisphenol A

As many of you know, bisphenol A (BPA) is a common plasticizer found in containers such as plastic water bottles and has caused concern due to its potential impact on endocrine function. In relation to the ability of probiotics to facilitate elimination of bisphenol A, the first quote I would like to feature discusses the impressive findings in an animal study:

"Oishi et al. described the potential of the probiotic *Bifidobacterium breve* and *L. casei* to increase the excretion of orally administered BPA in rats. Both bacterial strains caused a decrease in the concentration of unconjugated BPA in the blood over time and increased excretion of BPA in the feces of tested rats compared to the control group."

The authors go on to point out that the mechanism of elimination is binding rather than facilitation of phase I and II enzymes:

"…hydrophobic BPA binding by lactobacillus can be the primary pathway of BPA detoxification rather than enzymatic mechanisms."

Next Srednicka et al report on the ability of a combination of lactobacillus acidophilus and lactobacillus plantarum to bind BPA:

"The effectiveness of probiotic mixtures (*L. acidophilus* and *L. plantarum*) in the binding of BPA was evaluated by Solouki et al. The synergy of *L. acidophilus* and *L. plantarum* showed the highest binding capacity of 80% in the first 30 min of incubation."

The authors then feature the results of a study employing a commercial probiotic supplement:

"In rats, Baralic et al. investigated the possible utilizing of a commercial probiotic supplement containing *S. boulardii, L. rhamnosus, L. plantarum* LP 6595, and *L. plantarum* HEAL9 to alleviate toxicity induced by phthalates (DEHP,

DBP) and BPA mixture. The oral treatment with probiotic formulation significantly reduced systemic inflammation in rats and had protective effects on the liver, kidneys, spleen, lipid status, and serum glucose level."

Benzo(a)pyrene

Another common foodborne toxin is benzo(a)pyrene often found in food as the result of cooking:

"A significant food safety issue is the presence of the cancerogenic polycyclic aromatic hydrocarbon benzo(a)pyrene (B(a)P). B(a)P is found in grilled meat, smoked fish, seafood, vegetables, fruits, oil, grain, and cereals."

Concerning the ability of probiotics to detoxify B(a)P, the authors report the following:

"Several studies have evaluated the ability of probiotic strains to detoxify B(a)P. Zhao et al. reported that *L. plantarum* CICC 22135 and *Lactobacillus pentosus* CICC 23163 possessed the highest efficacy of B(a)P detoxification with removal rates of 66.76% and 64.31% respectively."

Heavy metals and metalloids

Concerning heavy metals, Srednicka et al point out the following:

"Increasing evidence has indicated that lactobacillus as well as *Saccharomyces* yeast, possess the ability to facilitate heavy metals detoxification and bioremediation. The main probiotic detoxification mechanism is the biosorption if metal ions into the cell wall followed by bioaccumulation inside the bacteria by cell membrane transition."

Specifically in relation to mercury, the authors note the following:

"In mice, Majlesi et al. reported that *L. plantarum* and *Bacillus coagulans* had protective effects after Hg intoxication via alleviation of the absorption and accumulation of Hg in the liver. *In vitro*, Alcantara et al. demonstrated the capacity of *L. casei* BL23 strain to facilitate biosorption of the Hg^{2+} as well as methylmercury (CH_3Hg^+), which is the main Hg form in food. The mechanism of Hg transformation to less toxic forms depended on the cell wall anionic polymer lipteichoic acid associated with increased Hg biosorption."

In addition:

"A few researchers have shown that supplementation with *L. rhamnosus* GR-1 can alleviate human exposure by binding or sequestering heavy metals and finally increasing their excretion in feces. A study of the human population in Tanzania showed the potential of yogurt supplemented with *L. rhamnosus* GR-1 in lowering the level of toxic metals in the blood such as Hg and arsenic in both pregnant women and children."

Pesticides

Srednicka et al go on to state the following about probiotic organisms and pesticides:

"The effectiveness of lactobacillus organisms such as *L. delbrueckii* subsp. *Bulgaricus, L. acidophilus, L. casei, L. rhamnosus,* and *S. thermophilus* to eliminate pesticides like chlorpyrifos, chlorpyrifos-methyl, diazinon, dichlorvos, fenthion, malathion, phorate, pirimiphos-methyl, and trichlorfon from skimmed milk was reported."

Furthermore:

"*L. bulgaricus, L. paracasei,* and *L. plantarum* exhibited strong acceleration of the degradation of organophosphorus pesticides (OPPs) in skimmed milk."

As you can see, as evidenced by the Srednicka et al paper, Dr. Mather was certainly wise in his recommendation to include probiotic organisms in the **ProBind Select™** formula. At this time (August 2024) we anticipate that **ProBind Select™** will be available for purchase in mid-September 2024. When it is available we will be sending notifications via e-mail.

ProBind Select™ – 120 Vegetarian Capsules. Serving size is 4 capsules.