Probiotics: Are Supplements Really Better Than Yoghurt?

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Abstract

A review of the health promoting qualities of the probiotic bacteria found in Australian yoghurts.

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For years it has been believed that probiotic supplements are far more effective in the treatment of human ills than the use of yoghurt. Yoghurt was believed to be a healthy food to eat, but for the treatment of specific conditions, supplements were generally recommended. This supposition was based on two main beliefs:

1) that the species and strains used by probiotic manufacturers are superior to those found in yoghurts, and
2) that yoghurt does not contain sufficient numbers of beneficial bacteria to have a therapeutic effect.

The purpose of this article is to address these issues.

Probiotics

Probiotics have been defined as 'microbial dietary adjuvants that beneficially affect the host physiology by modulating mucosal and systemic immunity, as well as improving nutritional and microbial balance in the intestinal tract'[1]. In broad terms, this definition includes fermented foods such as yoghurt, sauerkraut, kimchi and kefir, as well as specific supplements containing freeze-dried bacteria. The microorganisms found in these products are usually lactobacilli and bifidobacteria[2].

Humans have been consuming probiotics for many thousands of years. Microbial cultures have been used to produce beer, wine, yoghurt, tempeh, sauerkraut, olives, cheese and many other fermented foods. Thus probiotic microorganisms have always been an important component of the human diet[1].

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Currently there is renewed interest in fermented foods and probiotics. This interest has been stimulated by the recent explosion of research in the area of probiotics and their associated health benefits. Postulated health benefits associated with probiotic consumption are listed in table 1.

Uses of Probiotics

Treatment of Intestinal Disorders
- Constipation
- Lactose intolerance
- Prevention of GIT infections
- Flatulence
- Diarrhoea
  - Infantile
  - Antibiotic-associated
  - Travellers
- Inflammatory bowel disease
- Irritable bowel syndrome
- Intestinal hyperpermeability

Other Conditions and Uses
- Suppression of cancer
- Treatment of high cholesterol levels
- Prevention and treatment of vaginal infections
- Treatment of hepatic encephalopathy
- Prevention of alcohol-induced liver disease
- Stimulation of GIT immunity
- Improved digestion
- Alleviation of atopic eczema
- Treatment of food allergies
- Recolonisation of GIT after antibiotic use
- Stabilisation of GIT flora

Table 1: Postulated health benefits of probiotics[3-8].

Desirable Properties of Probiotics

Probiotic Characteristics	Technological and Functional Properties
Human origin	Species specific health effects and viability
Gastric acid and bile salt stability	Survival through stomach and small intestine
Adherence to intestinal mucosa	Immune cell modulation; competitive inhibition of pathogens
Colonisation of intestinal tract	Multiplication in the intestines; immune cell modulation
Safety in food and documented clinical safety	Accurate identification (genus, species, strain)
Production of antimicrobial compounds	Normalisation of GIT flora; suppressed growth of pathogens
Antagonism against pathogenic organisms	Prevention of adhesion by pathogens
Clinically documented and validated health effects	Dose-response data for minimum effective dosage in different formulations
Increased shelf life and stability during processing	All of the above properties should be maintained during storage and processing

Table 2: The desirable characteristics of effective probiotic organisms [13].

Yoghurt

The origin of fermented dairy products is somewhat obscure, but their consumption is believed to date back to at least 5000 BC[9]. Sour milks have always been popular throughout Europe, Asia and Africa as nutritious, long-lasting foodstuffs. Fermented milks were also considered as medicine by ancient physicians like Hippocrates, Galen and Avicenna who advocated their use for the treatment of gastrointestinal ills[10].

Early in the twentieth century Nobel Prize laureate Elie Metchnikoff popularised the idea that fermented milk products could beneficially alter the microflora of the gastrointestinal tract. He attributed the long life of Bulgarian peasants to their consumption of soured milk, which he believed to arrest the abnormal putrefaction of proteins within the bowel. Metchnikoff later researched the bacteria found in Bulgarian milk ie *Bacillus bulgaricus* (now known as *Lactobacillus delbruekii* subspecies *bulgaricus*) and a type of cocci (now known as *Streptococcus thermo-philus*)[10]. He utilised these cultures in the manufacture of a type of sour milk which he launched in Paris at the beginning of the 20th century[9].

These same species of bacteria are still used today in the manufacture of commercial yoghurts. These two bacterial species (*Lactobacillus delbruekii* ssp. *bulgaricus* and *Streptococcus thermophilus)* are responsible for the taste, consistency and smell that we associate with yoghurt[12]. It is now known, however, that these species lack the ability to survive in the human gastrointestinal tract (GIT). Hence, yoghurt manufacturers now routinely add additional probiotic species of bacteria to yoghurt in an attempt to enhance its therapeutic effects (eg *Lactobacillus acidophilus* and *Bifidobacterium bifidum*)[9]. However, the therapeutic efficacy of a specific yoghurt depends substantially upon the characteristics of the strains of bacteria that it contains.

Characteristics of Probiotics

It has been suggested that probiotic organisms require certain characteristics to enable them to exert maximum therapeutic effects. These qualities are outlined in table 2.

From these characteristics, there are some that are considered almost essential for a probiotic to have therapeutic effects. These are:

1) gastric acid and bile salt stability
2) an ability to adhere to the intestinal mucosa, and
3) ability to colonise the intestinal tract.

Other vital characteristics include the ability to produce antimicrobial compounds and directly antagonise more pathogenic organisms[14]. Unfortunately, most commercially available probiotic supplements and yoghurts contain organisms that do not exhibit these vital characteristics. If a strain does not exhibit these essential characteristics, then it will be nowhere near as effective as those that do. Thus there are some specific species and strains of bacteria that will be more effective probiotics than others.

Probiotics in Use

There are many different microorganisms currently used as probiotics. Table 3 lists commonly used probiotic organisms. Some of these organisms have been much more extensively studied than others.

Bacteria are named and classified according to the fol-

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lowing system. Genus is the first name of a bacterium (eg *Lactobacillus*). It is somewhat general and refers to a grouping of organisms based on similarity of qualities, such as physical characteristics, metabolic needs and metabolic end products. Species is a bacterium's second name (eg *acidophilus*). It is a much more narrow classification based on shared common characteristics that distinguish them from other species. Strain is an even more specific classification that divides members of the same species into subgroups based on several properties that these bacteria have in common that are distinct from other members of the species (eg strain LA5)[17].

Different strains of bacteria are similar to the various breeds of dogs. All dogs belong to the genus *Canis* and the species *familiaris*. Within this one species there is great diversity in shape, size, strength and other physical characteristics – ranging from the Irish wolfhound to the chihuahua. A similar division occurs within species of bacteria.

Within each species of bacteria there is a multitude of strains. Some strains are strong and resilient, able to survive passage through the GIT and kill pathogenic bacteria, while others are weak and cannot survive the GIT or inhibit pathogenic bacteria. It is important to note that just because one strain of bacteria in a specific species has a proven action does not mean that another strain will too, even if they are closely related. Furthermore, actions found in one strain of *L .rhamnosus* cannot be extrapolated to a strain of *L. acidophilus*. The actions and qualities are extremely strain specific[18].

Some supplement manufacturers will quote a study that utilised *L. rhamnosus* strain GG and then say that their probiotic supplement containing a strain of *L. acidophilus* will do the same. This is incorrect. Unless proven, one cannot assume that a given strain of *L. acidophilus*, *Bifidobacterium bifidum* or any other species of lactic acid bacteria will survive transit through the upper GIT, let alone colonise the intestines or have specific therapeutic actions.

A recent clinical trial demonstrated this strain specificity. Two strains of *L. rhamnosus* were utilised in a trial assessing their efficacy in the treatment of viral gastroenteritis. One strain was *L. rhamnosus* strain GG (LGG), the other was a strain found in a supplemental product (Lactophilus®). LGG accelerated recovery from the diarrhoea, whereas the closely related strain did not. This result demonstrates that different bacterial strains within the same species may have significantly different actions[19].

Dosage of Probiotics

For probiotics to be effective, it is believed that a minimum of 10^8—10^9 living microorganisms need to be consumed in a single sitting[20]. The area of dosage is suppose to be the Achilles heel for yoghurt, as one is never quite sure how many viable bacteria are at the point of consumption. This may have been true in the past and even in the present for the majority of Australian yoghurts[21]. Some yoghurt manufacturers, however, have begun to put much more emphasis on the ability of their yoghurt to maintain large quantities of viable microorganisms throughout its shelf life[21]. A recent market-basket survey conducted by *Choice* assessed common Australian yoghurts for viable probiotic bacteria (see table 4).

Common Probiotic Microorganisms

Lactobacillus spp.	*Bifidobacterium* spp.	*Lactococcus* spp.	*Streptococcus* spp.	*Enterococcus* spp.	*Saccharomyces* spp.
acidophilus *plantarum* *rhamnosus* *paracasei* *reuteri* *fermentum* *johnsonii* *brevis* *lactis* *delbruekii*	*breve* *infantis* *longum* *bifidum* *adolescentis* *thermophilum* *animalis* *lactis*	*cremoris* *lactis*	*thermophilus*	*faecium*	*boulardii* *cerevisiae*

Table 3: A listing of organisms that are currently used as probiotics (listed by genus and species)[13,15,16].

Product	Claimed Cultures	Enough *L.acidophilus*?		Enough Bifidobacteria?		Enough *L.casei*?		Enough *L.rhamnosus* ?	
		Start of shelf-life	End of shelf-life	Start of shelf-life	End of shelf-life	Start of shelf-life	End of shelf-life	Start of shelf-life	End of shelf-life
Yoghurts									
Bornhoffen Natural	AB	✓✓	✓	✗	✗	NA	NA	NA	NA
Jalna Skim Milk Natural	ABC	✓✓	✓	✗	✗	✗	✗	NA	NA
Nestle LC1 Vanilla	A	✓✓	✓✓	NA	NA	NA	NA	NA	NA
Ski Breakfast Bio Vanilla and Honey Reduced Fat	AB	✓	✗	✗	✗	NA	NA	NA	NA
Vaalia French Vanilla Reduced Fat	ABR	✓✓	✓✓	✓✓	✓	NA	NA	✓ ✓	✓ ✓
Yoplus Light 100% Natural Reduced Fat	AB	✓✓	✓✓	✓✓	✓✓	NA	NA	NA	NA
Drinks									
Vaalia French Vanilla Drink	ABR	✓✓	✓✓	✓✓	✓	NA	NA	✓ ✓	✓ ✓
Jalna Bio Garde Swiss Vanilla Drinking Yoghurt	ABC	✓✓	✓✓	✗	✗	✓	✗	NA	NA
Bulla AB Strawberry Reduced Fat Drinking	AB	✓	✓	✗	✗	NA	NA	NA	NA
Bios Fermented Milk	C	NA	NA	NA	NA	✓✓	✗	NA	NA
Yakult Fermented Milk Drink	C	NA	NA	NA	NA	✓✓	✓✓	NA	NA

Table 4: Results of investigation into bacterial survival in yoghurts available in Australian supermarkets.
A= *Lactobacillus acidophilus*; B= *Bifidobacterium* spp.; C= *Lactobacillus casei*; R= *Lactobacillus rhamnosus*; NA= not applicable - bacteria not claimed; ✓✓= Contains enough of this type of bacteria to potentially have a beneficial effect (≥10^6 bacteria/ml); ✓= Doesn't have quite as many of this type of bacteria, but does come close; ✗=Doesn't contain enough of this type of bacteria to have a beneficial effect (adapted from the September 1999 issue of *Choice*)[22]

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The minimum amount of viable bacteria in yoghurt to produce therapeutic effects is 10^6 bacteria/mL, and this is not all the different bacteria added together. Each individual strain of bacteria has to number at least 10^6 bacteria/mL of yoghurt[20]. Thus a serve of 100 mL will meet the minimum single dose of 10^8 bacteria per sitting.

The problem of adequate dosage is not just confined to yoghurts. Recently Hamilton-Miller et al investigated the microbiological content of probiotic supplements found in Britain. They found that only 15% of products contained the species and quantity of bacteria listed on the label. In fact, many supplements contained less than one-tenth the quantity of bacteria they were labelled as containing[23]. If this trend is similar in Australia, then many supplements may not be the concentrated and reliable sources of probiotics they are believed to be.

Probiotic Qualities of Various Bacterial Strains

Probiotic characteristics	LGG	ref	LA5	ref	Bb12	ref	Shirota	ref	La1	ref
Human origin	✓	24	✓	25	u		✓	13	✓	13
Gastric acid and bile salt stability	✓	24	✓	26	✓	27	✓	13	✓	28
Adherence to intestinal mucosa	✓	29	✓	30	✓	31	✓	13	✓	28
Colonisation of intestinal tract	✓	32	u		✓	33	×	13	✓	13
Safety in food and documented clinical safety	✓	34	✓	35	✓	34	✓	13	✓	28
Production of antimicrobial compounds	✓	36	✓	37	u		u		✓	28
Antagonism against pathogenic organisms	✓	38	✓	39	u		u		✓	28
Clinically documented and validated health effects	✓	40	✓	41	✓	33	✓	13	✓	28
Good shelf life and stability during processing	✓	42	✓	43	✓	22	✓	22	✓	28

Table 5: Probiotic characteristics of various bacterial strains found in Australian yoghurts. **LGG**= *Lactobacillus rhamnosus* strain GG; **LA5**= *Lactobacillus acidophilus* strain LA5; **Bb12**= *Bifidobacterium lactis* strain Bb12; **Shirota**= *Lactobacillus paracasei* Shirota strain; **La1**= *Lactobacillus johnsonii* strain La1; **ref**= reference number; ✓= affirmative; ×= negative; **u**= unknown.

An additional benefit of yoghurt is that it works as an ideal transport medium for the bacteria, as it has been shown to enhance the survival of bacteria through the upper GIT[20]. Thus smaller numbers of probiotic bacteria can be given in yoghurt than in supplements to achieve similar numbers of viable organisms in the lower GIT.

It is interesting to note, that many of the yoghurts with the best bacterial 'survival profile' also utilise specific strains with desirable probiotic characteristics. This review focuses primarily on the strains that demonstrated good survival profiles in the *Choice* study.

Vaalia Yoghurt

Vaalia contains three probiotic cultures, *Lactobacillus rham-nosus* strain GG (previously known as *Lactobacillus casei* strain GG), *Lactobacillus acidophilus* strain LA5, and *Bifidobacterium lactis* strain Bb12 (previously called *Bifido-bacterium bifidum* Bb12). These strains have been the subject of extensive research in recent years. The results of this research, in terms of their probiotic characteristics and their additional beneficial actions are outlined in tables 5—8.

Lactobacillus rhamnosus strain GG (LGG) is probably the world's most well researched and therapeutic probiotic strain. As can be seen in tables 6 and 6A, LGG has a wide range of beneficial actions. LGG's most notable actions may be in the prevention and treatment of gastro-intestinal infections, to prevent the side effects of antibiotic administration, to improve and prevent intestinal hyperpermeability and in the treatment of allergic conditions. In fact, a recent clinical trial revealed that the consumption of LGG by women in the last 4 weeks of their pregnancy, and for the following 6 months, reduced the incidence of atopic disease in their children by 50%[44]. Thus LGG appears to be effective in both the treatment and prevention of allergic diseases.

It is interesting to note that the bacteria strains used in Vaalia appear to have a synergistic effect. LGG has been demonstrated to more than double the adherence of *B. lactis* Bb12 to the mucous that lines and protects intestinal surfaces. As adherence to the intestinal lining is regarded as a prerequisite for antagonistic action against pathogens, modification of the immune system and intestinal colonisation, any increase in adherence should result in increased therapeutic efficacy[80]. Vaalia also contains inulin, a type of fructooligosaccharide, which has been demonstrated to significantly increase counts of bifidobacteria within the colon[81].

Nestle LC1

Nestle LC1 contains the probiotic *Lactobacillus johnsonii* La1 (previously known as *Lactobacillus aci*

Additional Actions of *Lactobacillus rhamnosus* GG

Human Trials	
Source	**Action**
Kalliomaki et al[44]	Prevents the development of atopic disease in children at high risk
Hatakka et al[45]	Reduces incidence and decreases severity of respiratory infections in children
Gotteland et al[46]	Protects the integrity of gastric mucosal barrier against NSAID-induced permeability
Armuzzi et al[47]	Reduces antibiotic associated side-effects during *Helicobacter pylori* eradication therapy
Benno et al[48]	Administration results in increased growth of faecal bifidobacteria and lactobacilli, with a concomitant decrease in clostridia levels and faecal ammonia concentration
Ling et al[49]	Significantly decreased faecal glucuronidase, nitroreductase and glycocholic acid hydrolase activities, thereby decreasing formation of carcinogenic compounds in the colon
Majamaa et al[6]	Down-regulates intestinal hypersensitivity reactions and intestinal inflammation in patients with atopic eczema and food allergy
Pessi et al[50]	Enhances generation of interleukin-10 in atopic individuals; which may result in the down regulation of IgE and inflammatory cytokine synthesis
Pelto et al[51]	Down-regulates the immunoinflammatory response after milk consumption in milk-hypersensitive adults
Alander et al[52]	Ability to adhere to, and multiply on, the colonic mucosa
Majamaa et al[6]; Isolauri et al[8]	Improves symptoms of atopic dermatitis (eczema)
Malin et al[53]	Enhances gut IgA immune response to antigens
Vanderhoof et al[54]; Siitonen et al[55]	Concomitant administration reduces the incidence of antibiotic-associated diarrhoea in children treated with oral antibiotics
Isolauri et al[56]; Shornikova et al[57]; Isolauri et al[58]	Shortens duration of viral gastroenteritis
Biller et al[59]; Bennett et al[60]	Eradication of *Clostridium difficile* carrier state and improvement in *C.difficile*-associated diarrhoea
Oksanen et al[61]	Reduces the occurrence of traveller's diarrhoea
Kaila et al[62]	Enhances nonspecific humoral response during rotavirus gastroenteritis, and specifically enhances the response of antigen-specific IgA antibody-secreting lymphoblasts

Table 6: Additional actions of *L. rhamnosus* GG that are supported by clinical trials and studies.

dophilus La1) in addition to the standard yoghurt bacteria (*Lactobacillus delbruekii* ssp *bulgaricus* and *Streptococcus thermophilus*). Its probiotic qualities are outlined in table 5 and its additional actions in table 9.

Yakult

Yakult contains the probiotic organism *Lactobacillus paracasei* subspecies *paracasei* Shirota strain (previously called *Lactobacillus casei* Shirota strain). There has been lots of research conducted with this strain in Japan over the last 50 years, much of which has assessed the effects of this bacteria administered by injection. This review of the Shirota research will only discuss those studies that utilised oral dosage regimens or in vitro methodology. The probiotic qualities of *L. paracasei* Shirota strain are outlined in table 5 and its additional actions in table 10.

Yoplus

Yoplus contains three different probiotic organisms: *Lactobacillus acidophilus* strain LA5, *Bifidobacterium lactis* strain Bb12, and *Lactobacillus paracasei* subspecies *paracasei* strain Lc-01 (previously named *Lactobacillus casei* strain Lc-01). Both Bb12 and LA5 were discussed in the Vaalia section and their characteristics are outlined in tables 5, 7 and 8. *L paracasei* Lc-01 is a recent addition to Yoplus, and levels of this strain of bacteria were not assessed in the recent *Choice* study. Initial in vitro research conducted on Lc-01 appears to demonstrate both its ability to adhere to human intestinal cells and to inhibit *Salmonella typhimurium* attachment to these cells[95].

Animal Studies	
Source	**Action**
Isolauri et al[63]	Reduces intestinal macromolecular absorption and increases the proportional transport of macromolecules across Peyer's patches in intestinal hyperpermeability eg administration results in the normalisation of increased intestinal permeability and alleviation of intestinal inflammation
Pessi et al [64]	Enhances macromolecular degradation by the gut mucosa, and thereby reduces antigen load
Wagner et al[65]	Reduces *Candida albicans* numbers in the GIT of immunocompromised mice
Nanji et al [66]	Reduces plasma endotoxin levels and severity of liver injury in experimental alcoholic liver disease
In vitro Studies	
Source	**Action**
Mack et al [67]	Inhibits adherence of pathogenic strains of *Escherichia coli* by enhancing intestinal mucin production
Sutas et al [68]	Down-regulates the interleukin-4 production capacity in atopic individuals (ex vivo)
Sutas et al [69]	LGG-derived enzymes generate peptides with suppressive effects on lymphocyte proliferation
Ahotupa et al[70]	Potent scavenger of superoxide anion and inhibits lipid peroxidation reactions in vitro
Silva et al [36]	Produces an antimicrobial substance that inhibits the growth of *Clostridium* spp, *Bacteroides* spp, *Pseudomonas* spp., *Staphylococcus* spp., *Salmonella* spp, and members of the family *Enterobacteriaceae in vitro*, whilst not effecting lactobacilli

Table 6A: Additional actions of *L.rhamnosus* GG that are supported by clinical trials and studies.

Possible Problems Associated with the Consumption of Yoghurt

Lactose Intolerance

Lactose intolerance is a fairly common condition that effects up to 70% of the world's adults, although its prevalence is far lower in communities from Northern European descent (15—25%)[96,97]. Lactose intolerance is caused by a deficiency of the enzyme lactase, which is usually located on the brush border of the small intestine. In the absence of lactase, lactose remains in the gut and osmotically draws water into the intestines. When lactose reaches the large intestine, it is avidly fermented by the colonic microflora into short chain fatty acids, lactic acid, CO_2 and hydrogen gas. These processes result in the symptoms of lactose intolerance ie bloating, diarrhoea, flatulence and abdominal cramping[98].

However, the development of these symptoms is entirely dependent upon two factors:

1) the load of intact lactose that reaches the intestines, and

2) the fermentation capacity of the colonic microflora.

Research suggests that the majority of individuals suffering from lactose intolerance can consume 6g of lactose in a single sitting without developing any symptoms[99]. People with lactose intolerance have also been shown to tolerate yoghurt much better than equivalent amounts of milk[100]. This is believed to be due to the lower levels of lactose found in yoghurt and the presence of bacterial beta-galactosidases (a lactose-digesting enzyme, similar to the human enzyme lactase) produced by yoghurt bacteria. A recent study has shown that live yoghurts (plain or flavoured) have a mean lactose content of 3.5% and drinking yoghurts (plain or flavoured) a mean lactose content of 3.1%[101]. Hence, a 100g serve of yoghurt would contain approximately 3.1—3.5g of lactose, which is below the amount needed to produce symptoms in the majority of individuals who suffer from lactose intolerance.

Nevertheless, if this dose of yoghurt does produce symptoms in extremely sensitive patients, the dose of yoghurt can be reduced and slowly increased until the 100g mark is reached. The colonic microflora has an incredible ability to adapt to the food that we eat, and over time its

Additional Actions of *Bifidobacterium lactis* Bb12

Human Trials	
Source	**Action**
Saavedra et al [71]	Reduces incidence of acute diarrhoea and rotavirus shedding in infants
Isolauri et al[8]	Improves infantile atopic eczema.
Ouwehand et al [72]	Prophylactic ingestion of Bb12 in combination with LA5, *L. delbruekii* ssp. *bulgaricus* and *Streptococcus thermophilus* significantly reduces incidence of traveller's diarrhoea.
Schiffrin et al [73]; Schiffrin et al[33]	Increases phagocytic activity in peripheral blood leukocytes.
In vitro Studies	
Source	**Action**
Biffi et al[74]	Produces a biologically active substance that inhibits growth of human breast cancer cells.

Table 7: Additional actions of *B. lactis* Bb12 that are supported by clinical research.

ability to consume lactose will increase. Therefore if a given quantity of lactose is consumed regularly, abdominal symptoms will cease[102]. Thus individuals suffering from lactose intolerance should be able to safely consume the recommended daily dose of yoghurt without ill effect.

Cow's Milk Allergy

If clients react badly to milk or other dairy foods it does not necessarily mean they will react to yoghurt. Milk allergy occurs through an immune mediated adverse reaction to proteins found in milk[69]. These proteins include casein, whey, beta-lactoglobulin and alpha-lactalbumin[103]. Acute symptoms may include hives, itchy skin, rashes, diarrhoea, vomiting, abdominal pain, sneezing and wheezing[104]. Delayed onset eczematous and gastrointestinal reactions such as chronic diarrhoea, malabsorption and loose stools may also occur. In order for these reactions to occur, two circumstances must be present:

1) dietary allergens must penetrate the intestine's mucosal barrier, and

2) the absorbed allergens must elicit harmful immune responses[105].

Food mediated allergic reactions can thus be prevented through intervention at one, or both of these areas.

Probiotics have great potential to mediate both these situations. In vitro studies have demonstrated that LGG (one of the bacteria found in Vaalia products) has the ability to alter cow's milk proteins into forms that don't cause allergic reactions. These protein degradation products (tolerogenic peptides) may even decrease overall responsiveness to food allergens[69]. This bacteria has also demonstrated a capacity to decrease interleukin 4 production[68], suppress lymphocyte proliferation[69], increase intestinal IgA secretion[106], enhance allergen degradation by the intestinal mucosa[64], enhance generation of interleukin 10[50], normalise increased intestinal permeability and alleviate intestinal inflammation[63]. These actions all result in decreased immune reactions to ingested allergens. Further research has confirmed the ability of LGG to down regulate milk induced immunoinflammatory responses in individuals suffering from milk hypersensitivity[51]. Thus it may be worth trying Vaalia yoghurt in individuals who suffer from mild to moderately severe cow's milk allergy. It may not only be well tolerated, but it may significantly improve other symptoms and conditions related to altered intestinal permeability and food allergies.

Conclusion

This review has demonstrated the fallacy of the superiority of probiotic supplements over yoghurts. The two main tenets upon which this belief was based have been shown to be false.

The first tenet is that the species and strains used by probiotic manufacturers are superior to those found in yoghurts. If anything, the opposite is true. The strains of bacteria used in Vaalia, Nestle LC1, and Yakult have far more research supporting their beneficial effects than most strains found in Australian supplements. Most strains used in probiotic supplements have little to no research conducted on their characteristics or effects. Thus it is un-

Additional Actions of *Lactobacillus acidophilus* LA5

Human Trials	
Source	**Action**
Ouwehand et al [72]	Ingestion of LA5 in combination with Bb12, *L.delbruekii* ssp. *bulgaricus* and *Streptococcus thermophilus* significantly reduced incidence of traveller's diarrhoea.
Hilton et al[41]	Daily consumption resulted in a six fold decrease in incidence of vulvovaginitis and reduced vulvovaginal candidal colonisation by nearly four-fold; daily ingestion was also associated with vaginal colonisation of LA5.
Black et al[75]	Concomitant administration reduces the incidence of antibiotic-associated side-effects and quickens normalisation of microflora post antibiotic treatment.
Animal Studies	
Source	**Action**
Perdigon et al [76]	Increases phagocytic activity of peritoneal macrophages and the reticuloendothelial system, as well as enhancing lymphocyte activation.
Tejada-Simon et al[77]	Enhances mucosal and systemic immunoglobulin A (IgA) responses to bacterial toxins.
In vitro	
Source	**Action**
Plockova et al [39]	Produces a compound that reduces the growth of yeasts, including *Candida* spp.
Noh et al[25]	Demonstrates β-galactosidase activity; thus may improve lactose digestion in the GIT.
Hatcher et al [78]	Enhances phagocytic function of macrophages.
Miettinen et al [79]	Stimulates production of immuno-stimulatory cytokines in white blood cells; thus may be useful in stimulating nonspecific immune responses in the body when ingested.
Biffi et al[74]	Produces a biologically active substance that inhibits growth of human breast cancer cells.
Hilton et al[41]	Exhibits an ability to produce hydrogen peroxide (H_2O_2).

Table 8: Additional actions of *L.acidophilus* LA5 that are supported by clinical research.

Additional Actions of *Lactobacillus johnsonii* La1

Human Trials	
Source	**Action**
Schiffrin et al[73], Schiffrin et al[33]	Increases phagocytic activity in peripheral blood leukocytes; effect lasts up to 6 weeks post-administration
Marteau et al[82]	Increases serum IgA concentrations
Link-Amster et al[83]	Consumption significantly increases faecal bifidobacteria counts
Michetti et al[84]	Administration of *L.johnsonii* La1 supernatant has a suppressive effect on *Helicobacter pylori* growth and activity
Lin et al[85]	Decreases breath hydrogen values in lactose maldigesters; presumably through prevention of excess lactose fermentation in the colon
Link-Amster et al [83]	Enhances gut IgA immune response to antigens
Animal Studies	
Source	**Action**
Bernet et al[86]	Reduces intestinal Salmonella counts in mice infected with *Salmonella typhimurium*. Prior administration protects against *S. typhimurium* infection
In vitro	
Source	**Action**
Bernet et al[87]	Inhibits colonic mucosal attachment by toxic strains of *Escherichia coli, Yersinia pseudotuberculosis,* and *Salmonella typhimurium*
Michetti et al[84]	Supernatant has a bactericidal effect on *Helicobacter pylori*
Jiang et al[88]	Enhances adaptation of colonic microflora to increased loads of lactose
Bernet et al[86]	Produces an antimicrobial substance that inhibits the growth of *Staphylococcus aureus, Listeria monocytogenes, Salmonella typhimurium, Shigella flexneri, Klebsiella pneumoniae, Pseudomonas aeruginosa* and *Enterobacter cloacae,* whilst not effecting species of the normal gut flora, such as lactobacilli and bifidobacteria

Table 9: Additional actions of *L. johnsonii* La1 that are supported by clinical research

known whether these strains can actually survive transit through the upper GIT, let alone have specific therapeutic effects.

The second tenet is that yoghurt does not contain sufficient numbers of beneficial bacteria to have a therapeutic effect. This has clearly been shown to be false by the recent survey conducted by the Australian Consumers Association at least for some yoghurts[22]. It is these yoghurts that are the ones to use. They have high enough levels of probiotic bacteria to have beneficial effects and many contain strains of bacteria that have been proven to survive GIT transit and have therapeutic actions. In both these areas Vaalia, Nestle LC1, Yoplus and Yakult excel.

The probiotic characteristics outlined in table 2 are extremely important. Ask your supplement manufacturer if the strains used in their products have been proven to have these characteristics and for the supporting documentation. If they can't provide evidence demonstrating that their probiotics have these vital characteristics, then utilising yoghurts that contain bacteria that do have these characteristics, may be the best option.

It is our duty as practitioners to prescribe the most therapeutic and cost effective agents possible. In the area of probiotics, the evidence suggests these are currently yoghurts. It is important to keep in mind the old Hippocratic aphorism — 'let thy food be thy medicine and thy medicine be thy food'. It is often better to use specific foods as therapeutic tools rather than supplements or even herbs. I think this plays an important empowering role and encourages clients to take better care of themselves.

Obviously there will still be situations where the use of yoghurts would be inappropriate. In these cases, probiotic supplements will need to be used. However, it is important to ensure that the supplement used contains strains of bacteria that can at least survive transit through the upper GIT and can temporarily colonise the intestinal tract. This should increase the probability of achieving good clinical outcomes.

Additional Actions of *Lactobacillus paracasei* ssp. *paracasei* Shirota strain

Human Trials	
Source	**Action**
Spanhaak et al[89]	Consumption significantly increases faecal bifidobacteria numbers
Aso et al [90]	Significantly reduces recurrence of superficial bladder cancer
Spanhaak et al[89]	Significantly decreases faecal glucuronidase and glucosidase activities, thereby decreasing formation of carcinogenic/toxic compounds in the colon
Animal Studies	
Source	**Action**
Matsuzaki et al [91]	Consumption inhibits immunoglobulin E (IgE) production
Matsuzaki et al [92]	Consumption decreases plasma glucose and insulin levels in non-insulin-dependent diabetic mice
In vitro	
Source	**Action**
Kato et al[93]	Induces the production of interleukin (IL)-12 and interferon-gamma (IFN-gamma), which are important cytokines for antitumor and antimicrobial immunity
Shida et al[94]	Suppressed total and antigen-specific IgE production through induction of IL-12 secretion by macrophages

Table 10: Additional actions of *L.paracasei* ssp. *paracasei* Shirota strain that are supported by clinical research.

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In Memorium: Gwen Nettlefold

Bill Pearson

Gwen Nettlefold passed away in Hobart in December last year.

I was a tutor at Nature Care College in the 80's when Gwen enrolled to study naturopathy. Students and staff alike were soon aware of her vibrancy, commitment to study and that extraordinary Gwen Nettlefold smile which melted the most stubborn heart and warmed the coldest spirit.

Upon graduation, Gwen made her mark not only as a naturopath but also as a broadcaster, lecturer and writer.

More recently she settled here in Hobart, and when I established the Community Clinics she immediately came on board as an original member of the Steering Committee. As with my earliest memories she attacked the cause with passion and great wisdom.

Gwen Nettlefold quietly entered my life nearly twenty years ago, and equally quietly, she passed away last December. But the impact she created whilst with us was far from quiet and her memory will be cherished by all who knew her.

I was devastated to hear of her death, but honoured to have known her in life. ❖

In Memorium: Maurice Copeland

17 July 1939 to 13 February 2002

Sadly, Maurice Copeland aged 62, a member of ATMS, died in Melbourne on Wednesday 13 February 2002.

Maurice Copeland established the Malvern School of Massage and Kinesiology in 1984. He was also a dedicated Practitioner of Traditional Chinese Medicine and pioneered the acceptance of TCM by the Australian Health Funds.

Maurice was highly respected by his peers and students. He was a teacher, a mentor and a friend to many people. These influences have created many exceptional practitioners who were blessed by his gift to extend knowledge and encouragement to do what you love.

He will be sorely missed by his family, friends and colleagues.

Our sympathy goes to his partner Marilyn and his children.

Ancient Celtic Blessing

Deep peace of running waves to you,
Deep peace of the flowing air to you,
Deep peace of the quiet earth to you,
Deep peace of the shinning stars to you,
Deep peace of the gentle night to you,
Moon and stars pour their healing light on you,
Deep peace to you. ❖