Formulating high protein, low viscosity medical nutrition beverages.

Drive patient preference and improve compliance.
Introduction

Although whey proteins have significant potential for use in Oral Nutritional Supplements (ONS), simply put, the low number of whey protein beverages available on today’s market signals the difficulties producers are facing when processing whey proteins under high temperature conditions.

With a growing aging population and malnutrition affecting a large number of elderly patients, the opportunities and challenges for producers in this market are a-plenty.

A GROWING MARKET OPPORTUNITY

The generation of baby boomers is rapidly challenging the traditional stereotypes of the ‘old’ being averse to modern technology and quietly sitting around. With 58% of consumers over 65 exercising at least once a week and 68% embracing technology and checking online before making a purchase (TrendSights Analysis: Aging populations, 2017), there are exciting new opportunities for this active and positive generation.

Unfortunately, with increasing age comes a reduction in physical capacity, particularly starting in your fifties and onwards. This decline in physical capacity is caused by a reduced function of most tissues such as the heart, lung as well as bone and muscle (Stein & Moritz, 1999). A wide range of external factors, like childhood nutrition, pollution and smoking impact the rate of this decline.

Consumers, are taking a more and more proactive approach to ageing, defying decay by paying attention to nutrition, their emotional wellbeing and keeping their body active and their mind sharp (Age gap survey, 2014).

Early interventions improving lifestyle can slow the rate of decline and ensure a greater chance of maintaining health and mobility into older age as well as supporting recovery from illness. Increasing the protein content in the diet can provide further support here (Houston et al, 2008), especially when this higher protein is consumed in conjunction with an exercise program.

Consumers taking a pro-active approach to aging is all the better as elderly malnutrition is particularly striking its effect in hospital and residential settings. Over 80% of elderly patients are likely to suffer from it (Acute Market Reports, 2017) and 10 to 20% will lose their independence because of it. It doubles the risk of mortality and increases the length of hospital stay by 2.3 days (Stratton, 2007) (Philipson, 2013).

Early discovery and treatment of malnutrition is gaining increased attention and for a good reason – see also the latest ESPEN conference in Madrid in September 2018*. Addressing malnutrition adequately is estimated to save $93,000 per 100,000 people. ((NICE), 2012) Or put differently, for every euro spent on nutrition therapy, the benefit is three to 22 times greater depending on the disease area ((NVD), 2015).

NOT ALL PROTEINS ARE CREATED EQUAL

Although the benefits of protein to support muscle maintenance have widely been documented there are still challenges in terms of formulating the best quality products that are tasty, easy to consume and appealing to patients and aging consumers.

When you are sick, you want the best protein to make it as easy as possible for the body to absorb essential nutrients. Whey protein is that high-quality protein – with fast absorption and high content of indispensable amino acids that the body cannot make itself. One of these essential amino acids is leucine and whey has a particularly high content of that. Leucine is thought to be the critical amino acid to trigger muscle protein synthesis. The high level of leucine, as well as its fast digestion and absorption, enables whey to stimulate muscle protein synthesis to a greater extent than casein and soy protein. (Tang 2012), (Pennings, 2009), (Burd 2012), (Yang 2012).

In comparison, casein is a slow digesting protein because, when consumed, it forms a curd in the stomach, which slows its release into the small intestine, causing the amino acids to appear in the blood over a longer period of time. In comparison, whey protein is released from the stomach to the small intestine without forming a curd. It is quickly broken down into its component amino acids, taken up in the bloodstream and thus quickly available for use by the body.

THE CHALLENGES INVOLVED IN PROCESSING WHEY PROTEIN

So how come there are no high whey protein medical beverages available on the market today? Well, although whey proteins have significant potential for use in beverage formulations at high concentrations, most producers struggle to use them because of their susceptibility to heat–induced destabilisation. Medical beverages, like many other liquid food products, are subjected to high-heat treatments during processing [i.e. retorting or ultra–high temperature (UHT)] to ensure product safety and shelf life stability. However, the thermal treatments applied to liquid formulations to provide microbial control cause whey proteins to denature irreversibly and to polymerise into aggregates or gels. As a consequence, the products show unwanted chalkiness, sandiness, lumpiness and high viscosity, and limited shelf life because of sedimentation or gelation soon after production.

The reason for whey’s superiority for muscle protein synthesis stimulation over casein is believed to be due to the combination of the high levels of available essential amino acids and its digestive properties (Devries & Phillips, 2015). Because of its abundant and quick supply of essential amino acids, whey protein is preferred by many in the sports and active field. For medical nutrition whey protein could also be a key ingredient because of its abundant and quick supply of essential amino acids, easy digestibility and promotion of muscle protein synthesis, can help to slow down the degradation of muscle mass in hospitalised and convalescing patients in the best way possible.

These problems obviously increase with higher whey protein levels, leading to products with unwanted aggregates and a risk of extensive fouling and blocking of the production plant, such as UHT heating equipment.

It seems therefore that producers are faced with a dilemma: either make high whey protein beverages that have unappealing taste and texture, or make casein or milk protein based beverages that are heat-stable during production yet do not contain the highest quality protein in terms of fast absorption of most essential amino-acids.

As taste and texture are key drivers in patient intake – so-called compliance - formulating highly concentrated whey protein medical beverages are currently not in the market. But that can change soon!
SOLVING THE TRADITIONAL PROCESSING CHALLENGES OF WHEY

Fonterra’s NZMP Medical Nutrition and Healthy Aging has put a lot of formulation and processing expertise into developing its bespoke, unique 14% protein medical beverage consisting of 9% whey protein – the highest percentage of whey compared to market references.

Key ingredient is our whey protein concentrate WPC 550, that compared to standard Whey Protein Concentrate does not become chalky or curdy during production as the images of our laboratory trial show:

IMPROVING PATIENT PREFERENCE

And what about the taste and texture? You might be surprised but in laboratory tests, our recipe proved to have the lowest viscosity compared to its market references, even lower than a standard 10% medical beverage formulated with milk protein:

Also in terms of taste, a sensory study done by the Wageningen University & Research (WUR) corroborates the preference for formulations with our WPC 550, even at higher protein levels and with the inclusion of whey protein ingredients:
Fonterra is currently continuing its research program to further evaluate clinical outcomes resulting from our higher compliance rate. Based on physiological features of the newly developed medical beverages and the preference shown in trials so far, patients will be inclined to drink more of our medical drink than other existing medical beverages products resulting in higher volume and therefore increased protein intake. On top of that, this protein is of the highest quality and faster available for absorption -> a double effect on muscle protein synthesis improving the lives of patients and their caretakers alike!

**KEY TAKEAWAYS**

✔ **Whey protein is a premium source of protein.** It is rapidly digested by the body allowing fast absorption of its nutritional benefits into the blood stream and muscles. The best protein, for when you need it most.

✔ Formulating high protein ready-to-drink beverages using whey poses problems of chalkiness, sandiness, lumpiness, high viscosity, sedimentation or gelation during shelf life. Not the type of features that will get you a patient-winning product.

✔ Fonterra’s innovative solution WPC 550, is a specialty micro-particulated heat stable whey ingredient solving the traditional processing challenges of whey, allowing an innovative consumer and patient proposition of getting more from your medical drink, for when you need it most.

✔ Drink more of our beverage because of its superior taste, from what you ingest you get higher quality protein that is faster available to your body: double effect on muscle build and maintenance!
REFERENCES


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