



final report

Commercial in Confidence

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Prepared by: Leonard Grout
NEXGEN Wholefoods
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Beef Liver Capsules – Proof of Concept Development

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Abstract

NXGEN Wholefoods is an Australian pioneer manufacturing Bovine and Ovine Glandular Supplements. Today western cultures eat little organ meat and tend to turn their nose up at the touch, smell, sight and taste of beef liver. Organic Grass Fed Beef Liver is very nutritional and one of the most nutrient dense superfoods, with more than 60% protein and containing antioxidants as well as a host of important natural vitamins and minerals (see Appendix E), but is used predominantly for Vitamin A, Vitamin B12, Vitamin E, Choline, Selenium, CoQ10, Copper and Zinc.

This research project explores the feasibility of manufacturing and marketing Organic, Australian Grass Fed, Desiccated Beef Liver capsules to reduce anemia, increase energy levels, reduce inflammation and to improve skin and eye health.

Iron deficient anemia and pernicious anemia from lack of iron and vitamin B12 can be overcome by taking beef liver capsules. Vitamin A deficiency is common in developing countries and is the leading cause of preventable blindness in children worldwide (World Health Organisation).

Beef Liver is a rich source of soluble Vitamin A (preformed retinol), which is more bioavailable than any plant sources of Vitamin A (pro-formed retinol) that needs to be synthesised by the human body. Soluble Vitamin A from beef liver is essential for protecting the cornea, the outer most layer of the eye and helps prevent night blindness (Feroze & Kaufman, 2019). Vitamin A is also important for maintaining healthy skin, intestines, lungs, bladder and inner ear. It supports immune function by supporting the growth of T-cells, a type of white blood cell that protects your body from infection. Vitamin A also supports male and female reproduction and fetal development (Ross C, 2012).

Beef Liver powder has benefits for muscle development and contains branch chain amino acids (BCAA's) to prevent sarcopenia. Taking beef liver capsules is a convenient method of increasing protein levels compared to taking protein drinks. Athletes use Beef Liver Capsules to keep their body in an anabolic state in the two hour window after exercise to improve muscle development and avoid breakdown of muscle tissue.

The Magnesium Advocacy Group founded by Morley Robins (2018) are a wide user of organic, pasture raised, grass fed beef liver capsules because people deficient in copper use desiccated beef liver that is rich in copper to release iron stored in cells and if not removed contributes to inflammation and sickness.

Sales of Beef Liver Capsules in Australia is estimated to be over \$500,000 per annum, with the major brands being imported into Australia from the US and using New Zealand and Argentinian ingredients. The leading brands in Australia are Vital Proteins Beef Liver, Perfect Supplements Beef Liver and Thankfully Nourished Beef Liver. Globally there is a proliferation of Beef Liver brands available for sale, see attachment D.

Executive summary

Neutraceuticals evolved in the 1980's to describe food products that have a medicinal benefit. This fast growing segment includes functional foods such as vitamin enriched products, nutritional supplements, sport beverages and medically formulated foods.

Dr. A. Kment of Germany demonstrated (through radioactive isotope tracing) that the bloodstream transports specific factors from glandular tissues absorbed by the corresponding glands of the patient. This radioactive isotope confirmation of organ specificity was also demonstrated by Stein (1967) and several years later again by Starzyl (1979). Kment showed that Like for like animal organs helps repair human organs.

The concept of developing Australian Organic Grass Fed Beef Liver Capsules was proposed due to the large number of imported product into Australian and to meet increased demand for Beef Liver supplements. There are a number of Beef Liver Capsule brands using New Zealand beef liver being imported into Australia. It made sense to promote a freeze dried Australian grass fed version made from Organic Beef Cattle from Australia's Channel Country.

Organic Raw Beef Liver was minced, freeze dried and milled into a powder for encapsulation. A number of industries will benefit including the Beef Industry, Freeze Dry Manufacturing Industry and Pharmaceutical Industry. The unique combination of 20 protein amino acids along with vitamins and minerals in Beef Liver makes it a suitable ingredient for nutraceuticals to prevent anaemia, for skin and eye health, for boosting energy, to improve blood health and for protein to prevent sarcopenia.

The value proposition of NXGEN Australian Organic Grass Fed Beef Liver Capsules is it's Organic Provenance plus strong health benefits including unique combination of protein amino acids. No other Organic Beef Liver Capsule is sourced from Australia's Channel Country, with more than 240 native grasses for cattle to graze, humanely raised and sourced animals, free to roam for thousands of kilometres in Australia's famous outback.

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Appendix A - Freeze Dried Beef Liver Amino Acid Analysis

1 Background

Australia is well known for its clean, green food production. The provenance of beef cattle grown in the Channel Country of Central Australia is unique to Australia and the rest of the world, as cattle graze on over 240 native grasses, where there is no cropping and only natural plants and grasses found in the famous Australian Outback. The vast open spaces where cattle roam freely and some of the best organic food from the Lake Eyre Basin is worth sharing. This research report aims to increase awareness of the benefits of consuming grass fed desiccated beef liver capsules daily from the Channel Country, as a natural vitamin, to help support muscle recovery, brain function, blood health, skin and eye health.

2 Project objectives

This research project was for proof of concept development of Beef Liver Capsules using Beef Liver from Australia's Channel Country to determine feasibility of scaling up and marketing an Australian product to compete with a growing number of imported brands, using material from New Zealand and Argentina. This report endeavours to provide the following information.

- Provide a brief overview of the meat-origin supplement market
- Develop proof of concept beef liver capsule, including preliminary process map, product costings, lab assays, specifications and brand development
- Market feedback on concept and value proposition(s) for Australian Organic Beef Liver capsules
- Completion of Business Model Canvas tool and next steps recommendations
 - Desirability: What is the job to be done for target product-market fit value proposition(s)
 - Feasibility: Technically can it be produced, who are the key partners to scale up
 - Viability: commercially what is the created/captured value in transforming input red meat organs into a supplement; what are the forecast sales and COGS and supply/demand drivers
- Final Report – key findings, prototype brief, cost benefit analysis (CBA) and lessons learned on approach taken and next steps

3 Methodology

Frozen organic grass fed beef liver was minced then freeze dried and milled into a shelf stable powder. The powder underwent microbial testing for pathogens and amino acid analysis. Desiccated beef liver powder was then encapsulated into 500mg capsules using a private label pharmaceutical company. The capsules were sent to a number of customers for feedback.

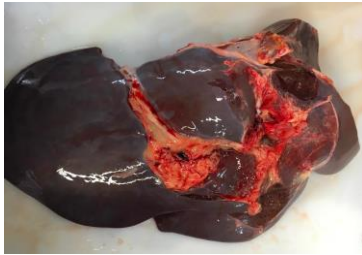


Fig 1 Grass Fed Beef Liver



Fig 2 Freeze Dried



Fig 3 milling

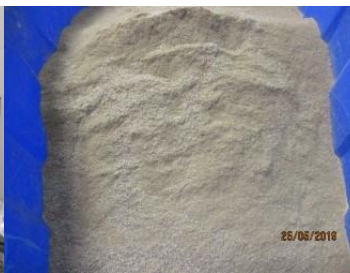


Fig 4 Liver Powder.



Fig 5 Capsules

PROCESS MAP

Purchase Organic Grass Fed Beef Liver

Mince beef liver

Freeze dry beef liver

Mill beef liver

Pack beef liver into 10kg nitrogen flushed mylar bags

Conduct testing on batch – microbial and protein

Encapsulate beef liver powder and pack into containers

Distribute and ship to health stores and end users

4 Results

Technically Organic Grass Fed Australian Freeze Dried Beef Liver Capsules are able to be produced. Market feedback on supply of Organic Grass Fed Beef Liver Capsules from Australia's unique Channel Country has been met with positive feedback with online stores and consumers. The protein content for freeze dried powder was 65% dry weight, the amino acid analysis was high quality. The microbial results proved Australian Freeze Dried Beef Liver Powder is suitable for pharmaceutical grade ingredients.

5 Discussion

Glandular Therapy and Natural Therapy is an alternative to using synthetic drugs manufactured by Pharmaceutical Companies. Beef Liver and Glandular Supplement manufacturing and branding is not as well supported in Australia as other countries like South America, New Zealand and the USA, because of little marketing and product awareness amongst Australian Processors. The majority of Beef Liver Supplements are sold online and by international brands.

Grass Fed Beef Liver Powder is an established market globally and locally, however product made in Australia is quite new. No beef liver capsules are sold on the shelves in Health Stores or Pharmacies throughout Australia, which offers an opportunity. When health stores and pharmacies were contacted there was not a great amount of interest from the large pharmacies or health store chains to stock Beef Liver Capsules. The opportunity to grow manufacturing of Beef Liver Capsules on a large scale in Australia rests with support from these groups.

Pharmacy and Health Store owners didn't seem to know much about the benefits of Beef Liver Capsules. That they were popular with women and men for improving blood health due to Heme Iron content, to boost energy from Vitamin B12, being high in Vitamin A for skin and eye health and one of the richest copper supplements to remove iron stored in cells.

Different size capsules were tested. Size 00 capsules with 750mg were found to be too large and difficult to swallow for children, size 0 capsules with 500mg were easier to swallow.

The three year sales plan forecast is to make 1000Kg of Beef Liver Powder in the first year, 1500 Kg in the second year and 2200 Kg in the third year. Australia has no manufacturing of glandular supplements. US has Advanced Bionutritionals and Ancient Supplements, New Zealand has Genesis Bio plus Waitaki Biosciences and companies buying from them include Vital Proteins, Ancestral Supplements, Pure Natura, Code Age, and Nutricology.

TABLE 1 BUSINESS MODEL CANVAS TOOL

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segment
Stanbroke Freeze Dry Industries Yandina Butchery Bluegum Pharmaceuticals	*Manufacture organic liver capsules *Pick up a wholesaler / large health store distributor *Develop relationships with customers eg Magnesium Advocacy Group	*BLC increase red blood cell count for people with anaemia because it contains bioavailable <i>heme iron</i> *BLC contains <i>vitamin A (retinol)</i> to support heart, brain & immune health, hair, nails and clear skin health *BLC contains <i>tryptophan</i> to help normalise levels of serotonin and other neurotransmitters. To help reverse behavioural symptoms including irritability, mood disorders, anxiety, and stress.	*Pharmacy chains require large financial advertising campaigns & sales reps in each state. *Independent health food chains need training and product literature. *Support for an Australian wholefoods brand	This is a niche market specific to consumers aware of the benefits of offal meats. Non vegan customers. Non plant based protein. The market segment is aware of the benefits of retinol from beef liver, heme iron and B vitamins for energy.
	Key Resources *Reliable source of organic beef liver supplier *Staff to search for a wholesaler / distributor *Financial support to create stock & for an advertising campaign on social media and to create brochures	*BLC provides <i>B vitamins</i> to increase energy *BLC is 70% protein to help repair and build lean muscle *Fertility multivitamin *Premium Australian brand	Channel *Health stores *Online health stores *Paleo health stores *Amazon *Facebook *Website	

6 Conclusions/recommendations

The value multiplier for converting frozen beef liver into beef liver capsules is in the high teens. Beef Liver Capsules is an established niche market in Australia and globally. Desiccated beef liver powder is made using either freeze dried or air dried technology. Freeze dried technology offers better microbial control and has better nutritional value than air dried. Nutraceuticals and encapsulating animal organ meat for nutritional health benefits and use as dietary supplement, vitamins and minerals is a growth industry and an opportunity for Australian Beef Processors.

There is an opportunity to make freeze dried beef organ meat powder in Australia. The largest demand for organic meat powder is with the export market. The use of freeze dry technology creates a shelf stable product and avoids the obstacle of perishable products and cost of on-going refrigeration and offers the highest quality product for pharmaceutical use.

7 Key messages

Manufacturing of value added nutraceutical products made from grass fed beef organs increases the value of beef organ meat 10 fold, increasing the economic value that the red meat industry contributes to society and creates potential new manufacturing and employment opportunities for Australia, rather than send raw material to other countries for processing. Acknowledgement goes to the Commonwealth Government and MLA for part funding this research project.

8 Bibliography

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9 Appendix

APPENDIX A - FREEZE DRIED BEEF LIVER POWDER AMINIO ACID ANALYSIS

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AMINO ACID PROFILE ANALYSES including CYSTEINE AND TRYPTOPHAN QUANTITATION.

RESULTS

Sample ID: Beef Liver			
Amino Acid	Amount (-H ₂ O; mg/g)*	Amount (mg/g)**	Mole %
Histidine	16.2	18.3	2.5
Serine	24.1	29.1	5.9
Arginine	34.1	38.1	4.7
Glycine	27.6	36.4	10.4
Aspartic acid	47.2	54.6	8.8
Glutamic acid	68.9	78.5	11.4
Threonine	24.4	28.8	5.2
Alanine	27.4	34.3	8.3
Proline	25.2	29.9	5.6
Lysine	39.7	45.3	6.6
Tyrosine	19.2	21.3	2.5
Methionine	13.9	15.8	2.3
Valine	32.4	38.3	7.0
Isoleucine	24.9	28.8	4.7
Leucine	50.9	59.0	9.6
Phenylalanine	30.4	34.1	4.4
Total	506.5	590.5	100.0

Amino Acid	Amount (-H ₂ O; mg/g)*	Amount (mg/g)**
Cysteine	9.0	10.6
Tryptophan	7.9	8.7

Comments

* Calculation based on amino acid residue mass in protein (molecular weight minus H₂O).

** Calculation based on free amino acid molecular weight.