



THE FUTURE OF SOYA FOR HEALTH & SUSTAINABILITY

Part 1 of 3

Why consider soya alternatives to
dairy and meat: *building a healthy
sustainable diet*

June 2022

Proceedings from the **first of a three-part series: *the future of soya for health and sustainability – sharing global learnings***. Internationally-acclaimed experts present the latest research from across the globe.

Organised by the Alpro Foundation in partnership with the Fuji Foundation for Protein Research and MyNutriWeb.

Symposium held on 14th June 2022

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About

Alpro Foundation

Alpro Foundation has been a scientific platform for over 25 years dedicated to supporting research and the dissemination of evidence-based knowledge on plant-based nutrition and its impact on health and environment amongst academics, healthcare professionals and key stakeholders in nutrition.

The ultimate aim is to help drive the transition to more healthful plant-based diets for human and planetary health.

Underpinning Alpro Foundation's scientific integrity is an independent Scientific Advisory Board of seven leading academic experts who provide direction and advice and ensure the scientific credibility of the education tools.

Additionally, Alpro Foundation celebrates and supports innovative scientific research by providing research grants and awarding young scientists for plant-based nutrition research. Alpro Foundation's research grant scheme has resulted in over 34 scientific publications to date.

Fuji Foundation for Protein Research

Recognising soya as an important plant-based source of protein, the Research Committee of Soy Protein Nutrition was established in 1979 in Japan by the Fuji Oil Group to advance both basic research and applications knowledge relating to soya. This Committee was the forerunner of the Fuji Foundation for Protein Research, a Japan-registered charity that promotes research on plant protein, in particular soya.

Since 1991, the Foundation has made grants to Japan-based research groups investigating plant protein in 4 subject areas:

- Nutrition & health
- Functionality
- Plant cultivation
- Food culture

There is an annual call for project proposals, which are then judged by the Foundation Committee's eminent panel of researchers and awards are distributed across the four categories given above. To date, these awards are only made to Japan-based researchers and the focus has been on soy protein research. However, the Foundation plans to expand the range of its activities in future years. New activities open to overseas researchers will be announced on this website from 2022 onwards.

MyNutriWeb

MyNutriWeb's mission is to empower all professionals who act as change agents in food and health, through online learning. The MyNutriWeb team is made up of experts with over 20 years' experience in nutrition and health communications.

They offer CPD-accredited and free to attend and on-demand, online learning opportunities to enable health professionals to keep up-to-date with the latest scientific evidence and everyday practice. The learnings cover a broad range of hot nutrition and health topics presented by leading experts in the field in various formats including webinars, symposia, journal clubs and round tables.

Executive summary

- There is consensus that the adoption of more plant-based eating is key to healthy and more sustainable dietary patterns.
- Studies have shown advantages from the use of soya as a plant protein alternative to meat and dairy for a range of [environmental impacts](#).
- Soya intake has also demonstrated a range of [health benefits](#) including reductions in [cardiovascular disease](#) (CVD) and associated risk factors such as [dyslipidaemia](#). Soya intake has also been associated with reduced risk of some [cancers](#) and alleviation of [menopause symptoms](#).
- Provided energy requirements are met, soya protein is as effective as animal protein for promoting [muscle strength](#) and [function](#) in older adults.
- [β-conglycinin](#), a storage protein found in soya, has a range of physiological roles in the body and has been identified as key to a number of the health benefits attributed to soya food consumption involving [lipid metabolism](#) and [carbohydrate metabolism](#).
- The effective dose of [one to two daily servings](#) of soya foods can be practically and palatably incorporated into the diet as an alternative to animal foods such as meat and dairy.

Soya dairy alternatives for adults and children

In the opening session Professor Ian Rowland, Emeritus Professor of Human Nutrition, at the University of Reading in the UK, explored the nutritional composition of soya. He emphasised the high-quality protein content, comparable to animal proteins with a similar digestibility score,¹ the favourable fat profile and the dietary fibre content. He illustrated clearly how fortified soya dairy alternatives are nutritionally equivalent to their dairy counterparts and fit well with current dietary recommendations. See Table 1.

Table 1. Nutritional benefits of fortified soya alternatives to dairy

- A rich source of protein containing all the essential amino acids in sufficient quantity to help meet the body's requirements for adults and children over 2 years of age.¹
- The mainstream variants are fortified with calcium to the same level as that found in dairy with a comparable bioavailability.
- Contain vitamin D, riboflavin (B2) and B12.
- Isoflavones: naturally occurring phytoestrogens.²
- A lower saturated fat profile with essential polyunsaturated fats (n-6 and n-3).
- Low energy density.

Soya and health

Professor Rowland linked these nutritional factors with a range of health benefits. He presented data from meta-analyses of epidemiological studies which indicate an overall **10 to 30% risk reduction for breast cancer** associated with soya intake which is highest when soya foods are eaten from childhood.^{3,4,5,6,7,8}

¹ Hughes GJ, Ryan DJ, Mukherjee R, et al. Protein digestibility-corrected amino acid scores (PDCAAS) for soy protein isolates and concentrate: criteria for evaluation. *J Agric Food Chem*. 2011;59(23):12707-12. doi: 10.1021/jf203220v

² Messina M, Mejia SB, Cassidy A, et al. Neither soyfoods nor isoflavones warrant classification as endocrine disruptors: a technical review of the observational and clinical data. *Crit Rev Food Sci Nutr*. 2022;62(21):5824-5885. doi: 10.1080/10408398.2021.1895054

³ Wu A, Yu M, Tseng CC, et al. Epidemiology of soy exposures and breast cancer risk. *Br J Cancer*. 2008; 98: 9–14. doi.org/10.1038/sj.bjc.6604145

⁴ Chen M, Rao Y, Zheng Y, et al. Association between Soy Isoflavone Intake and Breast Cancer Risk for Pre- and Post-Menopausal Women: A Meta-Analysis of Epidemiological Studies. *PLoS ONE*. 2014; 9(2): e89288. https://doi.org/10.1371/journal.pone.0089288

⁵ Dong JY, Qin, LQ. Soy isoflavones consumption and risk of breast cancer incidence or recurrence: a meta-analysis of prospective studies. *Breast Cancer Res Treat*. 2011;125: 315–323. doi.org/10.1007/s10549-010-1270-8

⁶ Zhao TT, Jin F, Li JG, et al. Dietary isoflavones or isoflavone-rich food intake and breast cancer risk: A meta-analysis of prospective cohort studies. *Clin Nutr*. 2019 ;38(1):136-145. doi: 10.1016/j.clnu.2017.12.006.

⁷ Wu AH, Yu MC, Tseng CC, et al. Dietary patterns and breast cancer risk in Asian American women. *Am J Clin Nutr*. 2009; 89(4):1145-54. doi: 10.3945/ajcn.2008.26915

⁸ Lee SA, Shu XO, Li H, et al. W. Adolescent and adult soy food intake and breast cancer risk: results from the Shanghai Women's Health Study. *Am J Clin Nutr*. 2009; 89(6):1920-6. doi: 10.3945/ajcn.2008.27361

Studies have also indicated corresponding risk reductions for endometrial and prostate cancer.^{9,10}

In addition, there appear to be health benefits from soya for menopausal women in reducing both the frequency and the severity of hot flushes.^{11,12}

The largest and most consistent clinical evidence is for the role of soya foods and drinks in the reduction of serum cholesterol levels and its consequent impact on reducing cardiovascular disease (CVD) risk. Recent epidemiological research supports the role for soya foods in reducing CVD risk and all-cause mortality.¹³ Several randomised controlled trials (RCTs) have shown modest but significant benefits in risk factors for CVD including blood pressure, endothelial function, arterial stiffness and blood lipid levels.^{14,15,16,17} Soya has approved health claims in relation to CVD in many countries See Figure 1.

Figure 1. Health claims relating to soya and heart health

Direct benefit: intrinsic to soya	Indirect benefits: food displacement
25 grams of soy protein a day, as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease.	Replacing saturated fats with unsaturated fats in the diet contributes to the maintenance of normal blood cholesterol levels.
<i>Approved health claim in the US & Canada</i>	<i>Approved health claim in the UK & European Union</i>

Soy and sustainability

Professor Rowland moved on to outline how soya foods and drinks require significantly lower land and water use, have lower greenhouse gas (GHG) emissions and cause less eutrophication in water compared with meat and dairy. He also went on to highlight modelling studies which have

⁹ Applegate CC, Rowles JL, Ranard KM, et al. Soy consumption and the risk of prostate cancer: an updated systematic review and meta-analysis. *Nutrients*. 2018;10(1):40. doi: 10.3390/nu10010040

¹⁰ Zhang GQ, Chen JL, Liu Q, et al. Soy intake is associated with lower endometrial cancer risk: a systematic review and meta-analysis of observational studies. *Medicine (Baltimore)*. 2015; 94(50):e2281. doi: 10.1097/MD.0000000000002281

¹¹ Taku K, Melby MK, Kronenberg F, et al. Extracted or synthesized soybean isoflavones reduce menopausal hot flash frequency and severity: systematic review and meta-analysis of randomized controlled trials. *Menopause*. 2012; 19(7):776-90. doi: 10.1097/gme.0b013e3182410159

¹² Furlong ON, Parr HJ, Hodge SJ, et al. Consumption of a soy drink has no effect on cognitive function but may alleviate vasomotor symptoms in post-menopausal women; a randomised trial. *Eur J Nutr*. 2020; 59(2):755-766. doi: 10.1007/s00394-019-01942-5

¹³ Xue T, Wen J, Wan Q, et al. Association of soy food with cardiovascular outcomes and all-cause mortality in a Chinese population: a nationwide prospective cohort study. *Eur J Nutr*. 2022; 61(3):1609-1620. doi: 10.1007/s00394-021-02724-8

¹⁴ Mosallanezhad Z, Mahmoodi M, Ranjbar S, et al. Soy intake is associated with lowering blood pressure in adults: a systematic review and meta-analysis of randomized double-blind placebo-controlled trials. *Complementary Therapies in Medicine*. 2021; 59:102692. doi.org/10.1016/j.ctim.2021.102692

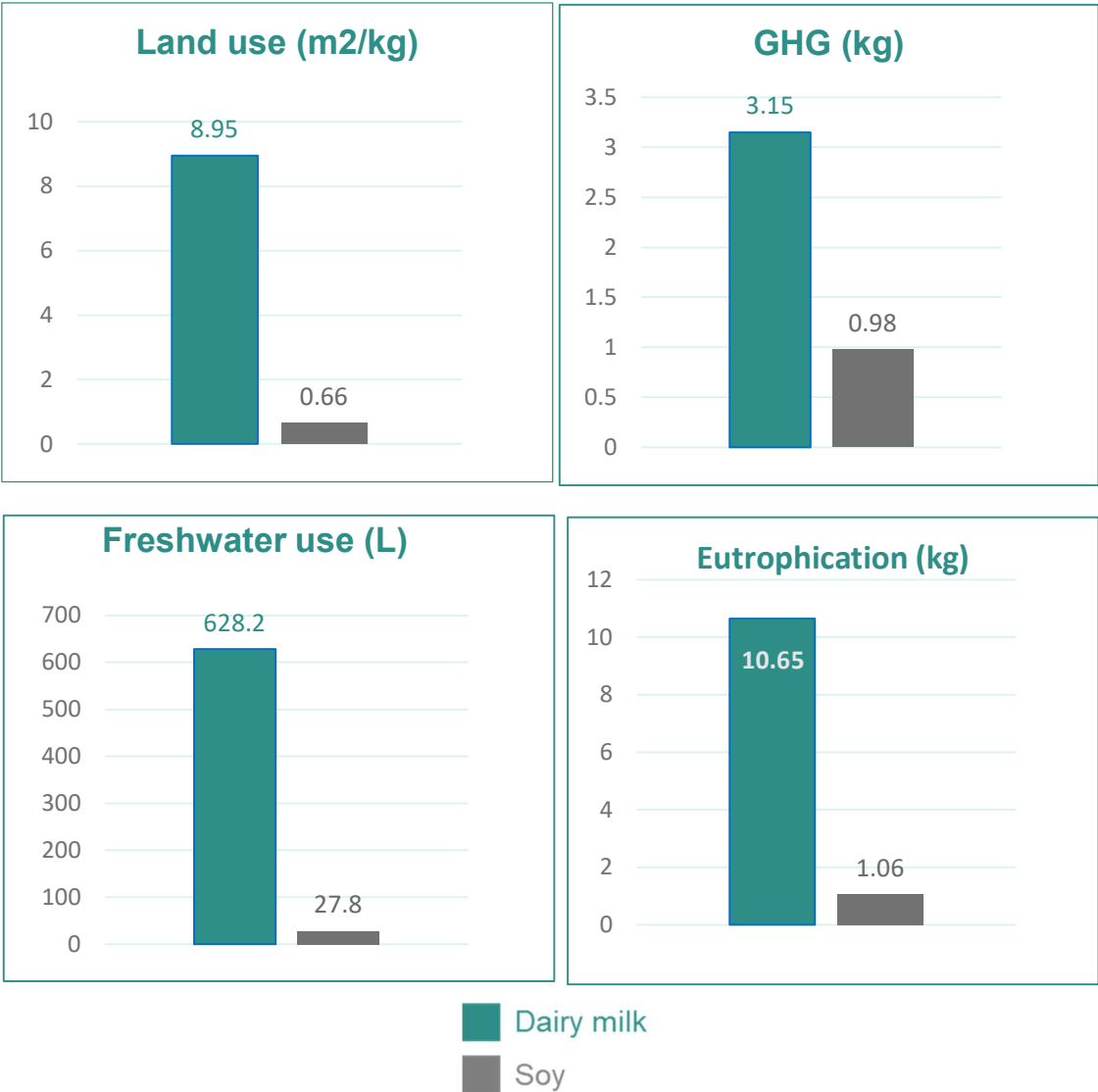
¹⁵ Beavers DP, Beavers KM, Miller M, et al. Exposure to isoflavone-containing soy products and endothelial function: a Bayesian meta-analysis of randomized controlled trials. *Nutrition, Metabolism and Cardiovascular Diseases*. 2012;22 (3); 182-191. doi.org/10.1016/j.numecd.2010.05.007

¹⁶ Man B, Cui C, Zhang X, Sugiyama D, Barinas-Mitchell E, Sekikawa A. The effect of soy isoflavones on arterial stiffness: a systematic review and meta-analysis of randomized controlled trials. *Eur J Nutr*. 2021;60(2):603-614. doi:10.1007/s00394-020-02300-6

¹⁷ Mejia BS, Messina M, Li SS, et al. A Meta-Analysis of 46 Studies Identified by the FDA Demonstrates that Soy Protein Decreases Circulating LDL and Total Cholesterol Concentrations in Adults. *J Nutr*. 2019;149(6):968-981. doi:10.1093/jn/nxz020

demonstrated an environmental advantages from the use of soya alternatives to meat and dairy.^{18,19,20} See Figure 2.

Figure 2. Soya drink vs dairy milk environmental footprint



Values shown per litre of milk based on meta-analysis of food system impact studies across the supply chain including land use change, on-farm production, processing, transport, and packaging.¹⁹

¹⁸ Aiking H and Erismann JW. Reversing of the nitrogen crisis: the role of plant based diets and sustainability . 2021. <http://www.alprofoundation.org/scientific-updates/reversing-the-nitrogen-crisis-with-sustainable-diets-report>. Accessed June 21 ,2022.

¹⁹ Poore J and Nemecek T. Reducing food’s environmental impacts through producers and consumers. Science. 2018; 360(6392): 987-992. doi.org/10.1126/science.aag0216

²⁰ Sandstrom V, Valin H, Krisztin T et al. The role of trade in the greenhouse gas footprints of EU diets. Global Food Security. 2018; 19:48-55. doi.org/10.1016/j.gfs.2018.08.007

Professor Rowland concluded by recommending that consumption of soy foods at around 1 to 2 servings per day as part of an overall balanced diet will have benefits for populations transitioning towards more healthful and sustainable dietary patterns as proposed by the recent Eat Lancet report.²¹

Take home messages

Soya food alternatives to dairy and meat provide a beneficial nutrition profile for all ages and have a significantly lower environmental burden compared to their meat and dairy counterparts.

Soya foods and drinks have been associated with improved health outcomes including lower cholesterol levels and incidence of breast cancer.

Consuming 1-2 servings of soya foods and drinks daily should be encouraged in food based dietary guidelines as they are a simple behaviour change strategy for consumers to adopt in the urgently needed transition towards more plant-based dietary patterns to help protect both human and planetary health.

²¹ Willett W, Rockström J, Loken B, et al. Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. Lancet. 2019; 393 (10170):447-492. doi: 10.1016/S0140-6736(18)31788-4

Incorporating soya into the diet

Continuing with the theme of increasing consumption of soya food in the diet, Professor Shigeru Yamamoto from the Graduate School of Jomonji University in Japan, shared his research carried out in the Association of Southeast Asian Nations (ASEAN). Concern has arisen as many member countries have shown marked changes in dietary behaviour associated with increased rates of heart disease, stroke, type 2 diabetes and obesity over the past 10 years.

Dietary intervention studies

Professor Yamamoto and his team developed a high protein, textured soya-based meat substitute (TSP), with a low fat and high fibre profile which they have tested in RCTS with a sample of Vietnamese participants with type 2 diabetes and in Indonesian overweight post-menopausal women diagnosed with pre-diabetes.^{22,23}

Participants were asked to consume 40-50g of TSP daily to replace meat in their traditional dishes over a period of 4 weeks. Those consuming TSP found the switch very easy to adopt with the products scoring highly for palatability and acceptability as an alternative to meat. See Figure 3

Figure 3. Results of sensory evaluation of textured soy protein (TSP) compared with traditional meat dishes²²



²² Ta NT, Hien Ngo TT, Nguyen PM, et al. Effectiveness of Textured Soybean Protein on Blood Biochemistry in Vietnamese Type 2 Diabetes Mellitus Patients. *Journal of Nutritional Science and Vitaminology*. 2022; 68 (1): 32-38. doi.org/10.3177/jnsv.68.32

²³ Utari DM, Kartiko-Sari I, Kohno M, et al. Textured soybean protein improved level of glycated albumin, LDL-Cholesterol, and protein intake in prediabetes postmenopausal overweight women. *AIMS Agriculture and Food*. 2022; 7(2): 326-340. doi: 10.3934/agrfood.2022021

Benefits for health and dietary profile

Participants using TSP as an alternative to meat showed significant reductions in body weight alongside improvements in glycaemic control and lipid profiles compared with control participants following their usual diet. In addition, nutrient profiles of diet improved with a significant reduction in total fat and an increase in fibre intakes. It was suggested that the use of TSP as an alternative to meat could be used more widely to improve population dietary patterns.

Take home messages

Textured soya-based protein (TSP) as a meat alternative can easily be incorporated into the diet and is well accepted by consumers.

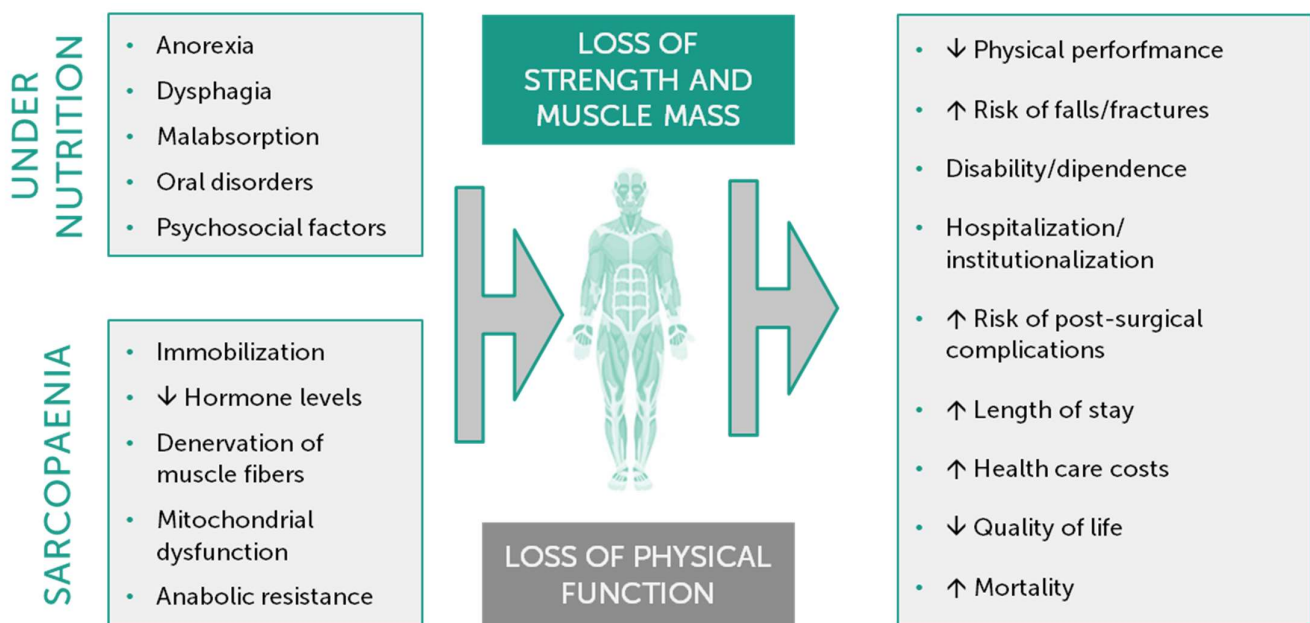
The use of TSP in the diet can significantly lower consumer barriers to reducing meat and dairy intakes – as it allows consumers to continue to include favourite and familiar dishes that are easily adapted to partly or fully replace meat with TSP.

Partial replacement of meat with TSP in the usual diet has positive impacts on health and on nutrient profile and could be used more widely to improve dietary patterns.

Soya & muscle function

Sarcopaenia, the loss of lean muscle mass and strength with impaired physical function presents a major public health problem in many countries with an ageing population. In turn this is associated with increased healthcare costs, adverse impacts on quality of life and increased mortality. See Figure 4

Figure 4. Sarcopaenia and its consequences



Dr Joan Trabal, Clinical Dietitian-Nutritionist from the Department of Endocrinology and Nutrition at the Hospital Clinic of Barcelona, described how the processes of anabolic resistance, suppressed protein synthesis and increased protein degradation underlie sarcopaenia and how dietary protein and resistance training is critical for muscle health in all age groups.^{24,25,26}

Due to suppressed protein synthesis and increased protein catabolism in older adults, their protein requirements are significantly increased from 0.8g in non-elderly adults to at least 1 to 1.2 g/ kg

²⁴ Shad B, Thompson J & Breen, L. Does the muscle protein synthetic response to exercise and amino acid-based nutrition diminish with advancing age? A systematic review', American Journal of Physiology: Endocrinology and Metabolism.2016; 311 (5) E803-E817. doi.org/10.1152/ajpendo.00213.201

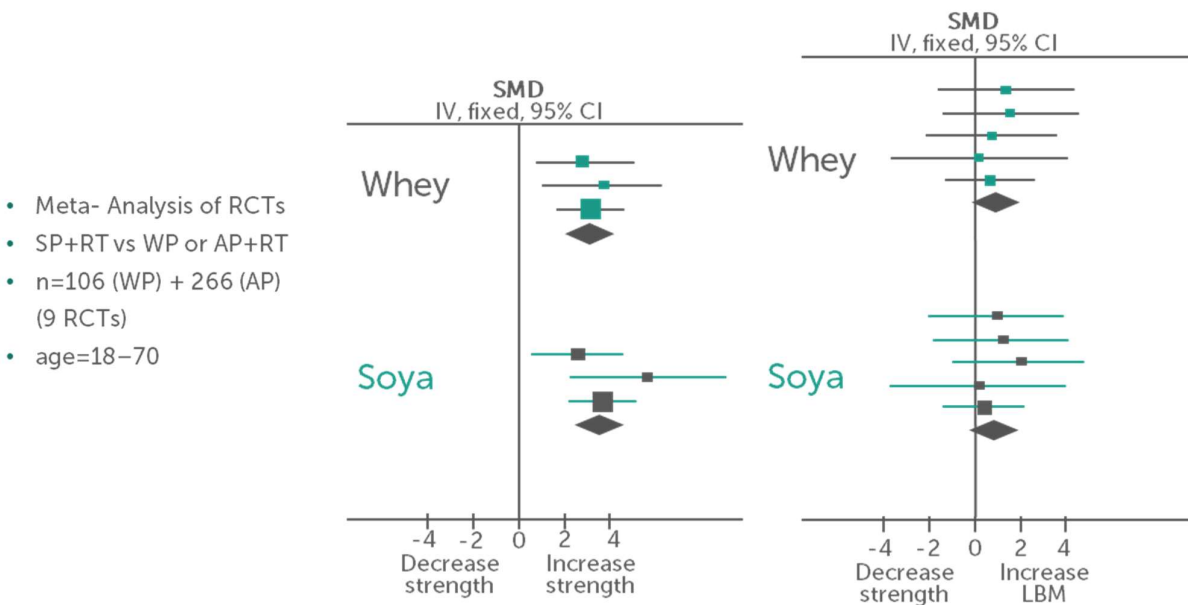
²⁵ Phillips SM, Glover EI, Rennie MJ. Alterations of protein turnover underlying disuse atrophy in human skeletal muscle. J Appl Physiol. 2009 ;107(3):645-54. doi: 10.1152/japplphysiol.00452.2009

²⁶ Moore DR, Churchward-Venne TA, Witard O, et al. Protein ingestion to stimulate myofibrillar protein synthesis requires greater relative protein intakes in healthy older versus younger men. J Gerontol A Biol Sci Med Sci. 2015;70(1):57-62. doi: 10.1093/gerona/glu103

body weight.^{27,28,29,30} Levels beyond 1.2g / kg body weight are needed for those with malnutrition or underlying disease. It is important to meet these increased needs, alongside resistance training, to help maintain muscle strength and mass, but barriers arise with reduced food intakes and loss of appetite in some older adults. As a result, protein supplementation may be a useful adjunct to diet.

There is also a beneficial synergistic relationship between increased protein intake and resistance exercise training for the prevention of sarcopaenia.³¹

Figure 5. Soya protein vs. dairy protein combined with resistance training in adults³²



- Meta- Analysis of RCTs
- SP+RT vs WP or AP+RT
- n=106 (WP) + 266 (AP)
(9 RCTs)
- age=18–70

The role of soya in promoting muscle function

Dr Trabala presented data from RCTs showing that supplementation of the diet with both dairy and soya protein (studied in ranges of 16 to 40g per day over 12 to 16 weeks), is

²⁷ Bauer J, Gianni Biolo G, Cederholm T et al. Evidence-Based Recommendations for Optimal Dietary Protein Intake in Older People: A Position Paper From the PROT-AGE Study Group. *Journal of the American Medical Association*; 2013; 14(8): 542-559, doi.org/10.1016/j.jamda.2013.05.021.

²⁸ Deutz NE, Bauer JM, Barazzoni R, et al. Protein intake and exercise for optimal muscle function with aging: recommendations from the ESPEN Expert Group. *Clin Nutr*. 2014;33(6):929-936. doi:10.1016/j.clnu.2014.04.007

²⁹ Jäger R, Kerkick CM, Campbell BI et al. International Society of Sports Nutrition Position Stand: protein and exercise, *Journal of the International Society of Sports Nutrition*; 2017; 14(1): 20. DOI: 10.1186/s12970-017-0177-8

³⁰ Morton RW, Murphy KT, McKellar SR et al. A systematic review, meta-analysis and meta-regression of the effect of protein supplementation on resistance training-induced gains in muscle mass and strength in healthy adults. *Br J Sports Med*. 2018 ;52(6):376-384. doi: 10.1136/bjsports-2017-097608

³¹ Liao CD, Chen HC, Huang SW et al. The Role of Muscle Mass Gain Following Protein Supplementation Plus Exercise Therapy in Older Adults with Sarcopenia and Frailty Risks: A Systematic Review and Meta-Regression Analysis of Randomized Trials. *Nutrients*; 2019; 11: 1713. doi:10.3390/nu11081713

effective for maintaining and improving lean muscle mass, strength and physical function provided energy requirements are met. It is especially beneficial if combined with resistance training. This has been shown in a variety of populations including post-menopausal women and older adults.^{32,33,34,35,36} Importantly supplementation with soya protein was found to be as effective as animal proteins such as dairy.³² See Figure 5.

Take home messages

Older adults are at risk of loss of muscle mass and strength with age (sarcopaenia) which can have significant impacts on physical function, quality of life and morbidity.

To prevent sarcopaenia, older adults have an increased requirements for dietary protein which is most effective when combined with resistance training exercise.

Provided energy requirement have been met, soya foods and soya-based supplements are as effective as animal protein foods and supplements for promoting muscle strength and function in older adults.

³² Messina M, Lynch H, Dickinson JM, Reed KE. No Difference Between the Effects of Supplementing With Soy Protein Versus Animal Protein on Gains in Muscle Mass and Strength in Response to Resistance Exercise. *Int J Sport Nutr Exerc Metab.* 2018;28(6):674-685. doi: 10.1123/ijsnem.2018-0071

³³ Shenoy S, Bedi R, Sandhu JS. Effect of soy isolate protein and resistance exercises on muscle performance and bone health of osteopenic/osteoporotic post-menopausal women. *J Women Aging.* 2013;25(2):183-98. doi: 10.1080/08952841.2013.764252.

³⁴ Orsatti FL, Maestá NE, de Oliveira P, et al. Adding Soy Protein to Milk Enhances the Effect of Resistance Training on Muscle Strength in Postmenopausal Women. *J Diet Suppl.* 2018 ;15(2):140-152. doi: 10.1080/19390211.2017.1330794.

³⁵ Thomson RL, Brinkworth G, Noakes M et al. Muscle strength gains during resistance exercise training are attenuated with soy compared with dairy or usual protein intake in older adults: A randomized controlled trial. *Clinical Nutrition* 35. 2016; 35 (1):27-33 doi: 10.1016/j.clnu.2015.01.018.

³⁶ Chunlei L, Meng H, Wu S et al. Daily supplementation with whey, soy, or whey-soy blended protein for 6 months maintained lean muscle mass and physical performance in older adults with low lean mass. *J Acad Nutr Diet.* 2021; 121(6):1035-1048.e6. doi: 10.1016/j.jand.2021.01.006

Soya beta-conglycinin for preventing dyslipidaemia

In the final session Professor Mitsutaka Kohno, from the Sports Nutrition Research Centre at Kyushu Kyoritsu University in Japan, provided some fascinating new insights into the potential mechanisms of action behind the health benefits of soya.

Approximately 20% of the total protein in soya beans is made up of β -conglycinin, a storage protein which has been shown to have multiple physiological and regulatory functions within the body.³⁷

See figure 6.

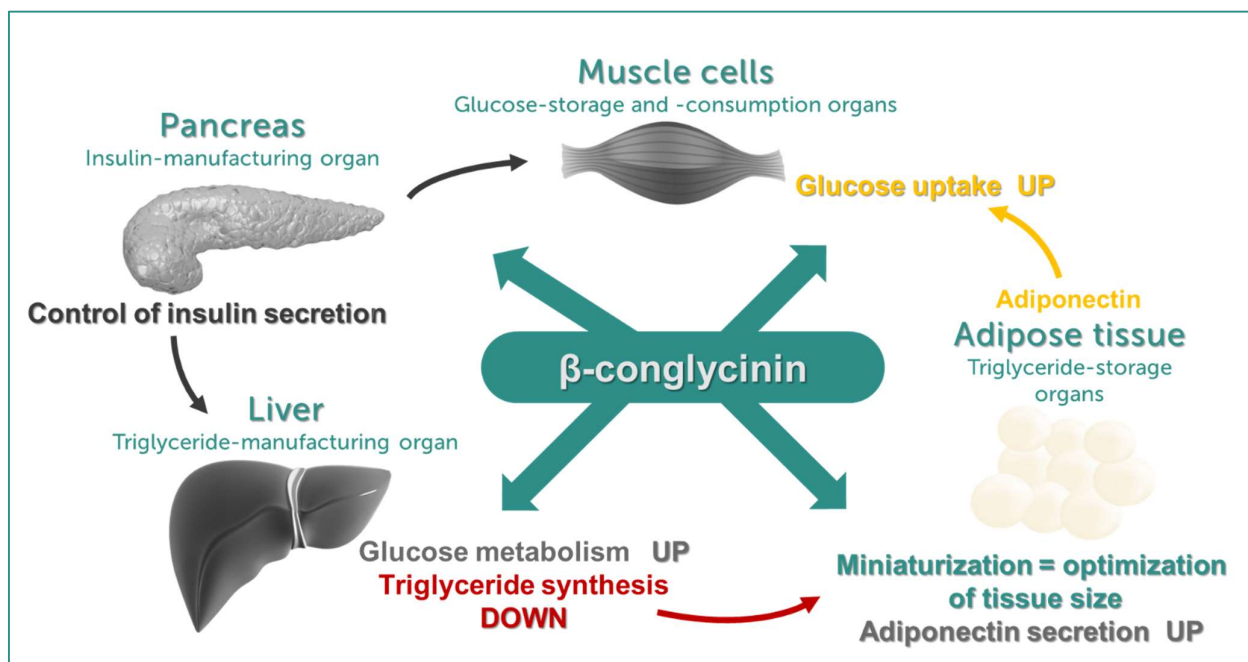


Figure 6. Interactions of β -conglycinin with tissues and organs

Clinical trials have shown β -conglycinin can lead to significant reductions in visceral or centrally distributed body fat in overweight participants and reductions in serum triglycerides in those with hyperlipemia.³⁸

The mode of action for improved lipid metabolism appears to be via a reduction in fatty acid synthesis in the liver and increased faecal fat excretion.^{39,40}

³⁷ Samoto M, Maebuchia M, Miyazakia C, Kugitania H, Kohnoa M, et al. Abundant proteins associated with lecithin in soy protein isolate. Food Chem. 2007; 102(1):317–22 doi.org/10.1016/j.foodchem.2006.05.054

³⁸ Kohno M, Hirotsuka M, Kito M, Matsuzawa Y. Decreases in serum triacylglycerol and visceral fat mediated by dietary soybean β -conglycinin. Journal of Atherosclerosis and Thrombosis. 2006;13(5):247-55. doi.org/10.5551/jat.13.247

³⁹ Fukui K, Kojima M, Tachibana N, Kohno M, Takamatsu K, Hirotsuka M, Kito M. Effects of soybean β -conglycinin on hepatic lipid metabolism and fecal lipid excretion in normal adult rats. Biosci Biotechnol Biochem. 2004;68(5):1153-5. doi.org/10.1271/bbb.68.1153

⁴⁰ Moriyama T, Kishimoto K, Nagai K, et al. Soybean β -conglycinin diet suppresses serum triglyceride levels in normal and genetically obese mice by induction of β -oxidation, downregulation of fatty acid synthase, and inhibition of triglyceride absorption. Biosci Biotechnol Biochem. 2004; 68(2):352-9. doi.org/10.1271/bbb.68.352

β -conglycinin also has benefits for carbohydrate metabolism in insulin resistance by improving the glycaemic response to carbohydrate containing foods and improving insulin sensitivity.^{41,42}

In addition, several studies also indicate β -conglycinin has powerful anti-inflammatory effects in the body with a role in reducing fatty liver and impacts on appetite suppression as a gastrointestinal hormone.^{43,44,45}

Professor Kohno suggested soya foods showed huge potential for contributing to improvements in public health. From clinical trials the dose needed to achieve significant outcomes on physiological parameters was 2.5 g/ β -conglycinin per day but lower intakes also showed beneficial trends. Intakes could be met in practice by consuming 1 to 2 servings of soya foods or drinks daily, a level which is practical and palatable to achieve.

Take home messages

β -conglycinin, a storage protein component of the soya bean, has beneficial physiological effects on lipid levels, insulin sensitivity and inflammation.

This may be a key mediating factor in health benefits of soya.

Consumption of 1 to 2 servings of soya foods and drinks daily is effective and achievable for many people.

⁴¹ Tachibana N, Iwaoka Y, Hirotsuka M et al. β -Conglycinin lowers very-low-density lipoprotein-triglyceride levels by increasing adiponectin and insulin sensitivity in rats. *Biosci Biotechnol Biochem.* 2010; 74(6):1250-5. Doi.org/10.1271/bbb.100088

⁴² Kohno M. Soybean protein and peptide as complementation medical food materials for treatment of dyslipidemia and Inflammatory Disorders. *J Food Sci Tech Res.* 2017 23 (6) 773-782. <https://doi.org/10.3136/fstr.23.773>

⁴³ Shan D, Yu H, Lyu B et al. Soybean β -Conglycinin: Structure characteristic, allergenicity, plasma lipid-controlling, prevention of obesity and non-alcoholic fatty liver disease. *Current Protein and Peptide Science.* 2021; 22 (12) : 831-847
doi.org/10.2174/138920372266621120215155

⁴⁴ 44. Hira T, Maekawa T, Asano K, et al. Cholecystokinin secretion induced by beta-conglycinin peptone depends on Galphaq-mediated pathways in enteroendocrine cells. *Eur J Nutr.* 2009 ;48(2):124-7. doi: 10.1007/s00394-008-0764-1

⁴⁵ 45. Nakato J, Aoki H, Iwakura H, et al. Soy-ghrelin, a novel ghrelin-releasing peptide derived from soy protein. *FEBS Lett.* 2016 ;590(16):2681-9. doi: 10.1002/1873-3468.12306

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A collaboration between:

