Soy: Good, Bad, or Just Plain Ugly?

Adam Thompson

Introduction

Soy is something synonymous with vegetarians, not athletes looking to build muscle. If you are an athlete training to increase lean body mass, strength and power chances are you haven't given soy much thought. After all, why would you? You don't consume soy in your diet therefore it is not an issue you say. Think again. More than half of processed and packaged foods contain soy. The products themselves may not be soy based but soy is increasingly being added to our food supply whether we like it or not. If you have any doubt regarding the ubiquity of soy in commonly available foods go have a look at the cans and packages in your pantry and fridge. If the food has been processed in any way there is a good chance soy will be included in the list of ingredients. Many protein supplements also include soy either as a protein source or as an ingredient to improve the mixing of the powder into liquid. Even animals reared for food production are fed a diet that contains soybean meal. Soy is certainly becoming harder to avoid in modern life.

So what is the big deal about soy? This humble little legume has received a lot of attention in recent times due its purported health benefits. Consumption of soy has been positively associated with a reduced incidence of a number of diseases including a variety of cancers, heart disease, stroke and osteoporosis. Despite the scientific evidence in support of these health claims some people are convinced soy has a dark side. If you were to do a Google search for soy you would find a vast amount of information. For every page extolling its virtues there is a page warning of its risks. Soaring oestrogen levels, falling testosterone levels, thyroid dysfunctions, infertility and gynecomastia are some of the alleged dangers associated with soy consumption. This is the stuff of nightmares for hard training athletes. If these claims are indeed true then soy is something you need to avoid at all costs.

In a perfect world our diets would be based on fresh fruits, vegetables, whole grains and lean meat. Reality though is a far cry from this ideal. Long hours at work, long daily commutes and commitments to family and friends consume most of the hours in our day. Trying to fit in regular workouts at the gym is hard enough let alone finding time to spend in the kitchen preparing nutritious meals. At times like these you may be tempted by the convenience of a pre-packaged meal or a protein bar. You check the nutrition panel to make sure the fat, salt, sugar and protein levels are ok. How about the list of ingredients though? As you scan the list you see soy is one of the ingredients. Does this mean the food is less healthy? Does it mean the food is healthier? Does it even have a bearing on the nutritional value of the food at all? Is it going to benefit you weight training goals or is it going to sabotage them?

With soy seemingly everywhere in our food supply this *Muscle Building Science Special Report* will take a critical look at the scientific evidence on soy as it relates to the business of building muscle. The two key questions to be answered are whether soy can influence hormone levels and is soy protein safe to consume by athletes training to increase muscle size and strength. In the following pages we will separate the evidence from the myths and try to get to the bottom of the soy issue.

What is Soy?

Soy is the common name given to any product or ingredient that uses all or part of the soybean. A staple of traditional Asian diets, soy is becoming more popular in western countries due to the increasing scientific interest in its purported health benefits. In 1999 the US Food and Drug Administration gave approval for the claim to be used that soy protein can lower cholesterol[1]. Since then there has been an explosion in the number of foods soy has been added to. One study found that soy is present in some 60% of processed foods[2]. Soy is often added to food in the form of soy protein or soy lecithin. Its primary purpose is functional, not necessarily nutritional, as it is used for emulsification and improving texture. Your protein powder for example may include soy lecithin as an ingredient that allows the powder to be more easily mixed in liquids thereby producing a smoother consistency. The addition of soy to food is not a new practice either as food manufacturers have been adding soy protein to their products since the 1960's[3]. Apart from the addition of soy to many common foods, it can also be consumed in different forms such as whole soybean, soy flour, soybean oil, soy milk, tofu, tempeh, and soy sauce. Soy is becoming ever more prevalent in our diets whether we like it or not.

Statistics from the American Soybean Association show that in 2010 90.6 million metric tonnes of soybeans were cultivated in the United States.

47.3 million metric tonnes were for domestic consumption while the remainder was exported. If you are an individual who consciously avoids soy for whatever reason, simply reading ingredient labels may not guarantee avoidance to exposure. A 2006 report from the USDA Economic Research Service stated that 98% of the soybean meal produced in the United States was used for animal feed[4].

Phytoestrogens The soybean is a legume that has some unique properties that sets it apart from other legumes. One of those properties is its high phytoestrogen content. Phytoestrogens are plant-based compounds that have a structural similarity to human oestrogens. Due to the influence phytoestrogens have on the endocrine system they are considered endocrine disrupting compounds[5]. Other synthetic endocrine disrupting chemicals include bisphenol A (BPA), polychlorinated biphenyls (PCB's) and the pesticide DDT.

Phytoestrogens are by no means limited to soy as they are found in a wide variety of foods such as nuts, seeds, grains and fruit[2]. Soy does however have the highest concentration[6]. It is the high phytoestrogen content of soy that is at the centre of both the health claims and the health concerns.

Far from being a single compound, phytoestrogens are a diverse group of chemicals represented in four distinct classes; flavinoids (which comprise flavones and isoflavones), stilbenes, lignans and coumestans. The flavinoids, of which there are over 4000 individual compounds, are the most studied of all the phytoestrogens[7]. The isoflavones which display estrogenic activity are not limited to soybeans but are found almost exclusively in all legumes and beans[8]. Furthermore, whole grains, legumes and vegetables are all sources of lignans[7]. Other sources of phytoestrogens include tea, coffee, beer, wine, nuts and seeds[9].

You may have heard in the media reports on the latest super-supplement resveratrol. Scientific studies have shown this compound to have beneficial metabolic effects, anti-inflammatory and anti-cancer properties as well as providing cardiovascular protection[10]. Some studies have even shown it can extend the lifespan of animals[11]. Resveratrol is a natural product found among other places in the skins of red grapes. Guess what? Resveratrol is also a phytoestrogen belonging to the stilben class. Phytoestrogens are therefore universal in virtually all plant based foods and trying to avoid them completely in your diet is virtually impossible.

For an individual trying to restrict or even monitor their soy phytoestrogen intake it is an impossible task as quantities can vary between different soy products and manufacturers may not place quantities on their products that have added soy. Even whole soybeans can have varying levels of phytoestrogens depending on growing conditions and geographic locations. Setchell states that a reasonable calculation of phytoestrogen consumption can be based on 2-5 mg of isoflavones per gram of soy protein[12]. This may be an approximate indicator for whole soybeans but it fails to take into account the loss of phytoestrogens during processing into other products. Wang and colleagues reported that 74% of the isoflavone content of soy flour was lost during its processing into soy protein isolate[13]. This is supported by Wang and Murphy who reported that 53% of isoflavones were lost during the production of soy protein isolate[14].

Hormonal Effects

The processing of soybeans eliminates some of the phytoestrogens but what of those remaining? What are the consequences of consuming these plant based estrogens? The predominant phytoestrogens in soy are genistein, daidzin and glycitein[15] with much of the scientific investigation into the impact of phytoestrogens on human health focussing on the first two.

Throughout the male and female body there exist two forms of estrogen receptor: estrogen receptor alpha (ER-α) and estrogen receptor beta (ER-β). Isoflavones are sufficiently similar in structure to bind to both receptor types however their affinity for binding to ER-β is around 20 times higher than their binding affinity for ER-α[15]. Does this ability to bind with estrogen receptors produce changes in the natural hormonal balance of the body though?

Mitchell et al[16] reported on a study where volunteers were given a daily supplement containing 40mg of isoflavones for 8 weeks. At the conclusion there was no change to testosterone or estradiol levels in the volunteers (estradiol is the predominant estrogen found in the female body). A similar study by Habito et al[17] reached the same conclusion after a 4 week study where volunteers consumed 70mg isoflavones per day.

These results reflect those of Hamilton-Reeves et al[18] who conducted a meta-analysis of 32 studies on the hormonal effects of dietary isoflavone intake in males. Experiment durations ranged from 1 week to 1 year and isoflavone intake across all the studies ranged between 20mg and 449mg/day. Sources of isoflavones for the studies examined included supplements, soy milk, soy protein isolate, soy protein concentrate, tofu, soy grits, soybeans and soy flour. Analysis of all 32 studies did not show any statistically significant effects of either soy protein or isoflavone supplements on male testosterone levels.

One Japanese study involved 34 males, half of whom consumed an average of 343ml of soy milk (76.8mg isoflavones) per day for 8 weeks[19]. At the conclusion of the study the researchers could find no statistically significant changes in levels of testosterone, estradiol or Sex-Hormone binding Globulin (SHBG) in the soy consuming group. There was also no significant difference in hormone profiles between the soy milk consumers and the control group who did not consume any soy milk.

Only one study could be located in the literature examining the effects of isoflavones on the hormonal response to resistance training[20]. 20 volunteers took part in a 12 week resistance training program that was supplemented with 50g/day (25g twice per day) of protein powder as either soy protein concentrate, soy protein isolate, whey protein blended with soy protein isolate or whey protein only. Each protein powder contained different quantities of isoflavones. At the conclusion of the study there was no difference in testosterone or SHBG levels between any of the groups. This indicates that daily consumption of 50g of either soy or whey protein powder does not influence hormone levels when taken in conjunction with a 12 week resistance training program.

All the studies discussed so far have found no effect of soy or soy isoflavones on levels of testosterone or estradiol. Only three studies could be found with contradictory results. One study published in 2003 had volunteers eat three scones per day made with soy flour (120mg isoflavones/day). After 6 weeks the volunteers had a statistically significant reduction in testosterone levels of 6%[21]. The second study reported by Dillingham et al[22] had volunteers consume either a high isoflavone (62mg/day) or low isoflavone soy protein isolate drink (2mg/day) for 8 weeks. At the conclusion there was no change in total testosterone levels in either group. Free testosterone in the low isoflavone group decreased 3% while in the high isoflavone group levels did not change. Estradiol levels in the low isoflavone group increased by 3% while in the high isoflavone group it increased by 1%. A third group that consumed milk protein isolate with no measurable isoflavone content saw a 6% decrease in total testosterone, a 4% decrease in free testosterone and a 4% decrease in estradiol. These results would seem to suggest that the changes to the hormone profiles of the study participants was due to factors other than isoflavones.

One study which stands out is that of Goodin et al[23] who reported an average 19% decrease in testosterone levels among 12 volunteers taking a supplement of soy protein isolate. This striking result is in contrast to the relatively modest decreases reported by Gardiner-Thorpe et al[21] and Dillingham et al[22]. This study unfortunately did not measure the isoflavone content of the soy protein so a comparison with other studies is not possible. The volunteers consumed 56g of the supplement per day which is approximately the same quantity consumed by the volunteers in the study by Kalman et al[20] (50g/day). Both studies used soy protein isolate so it would be reasonable to suggest that isoflavone content would be approximately similar across both study groups. Both studies used healthy young males and both used similar quantities of soy protein isolate yet vastly different results were obtained.

While a 19% decrease in testosterone was reported it needs to be kept in mind that this is an average among the 12 volunteers. Examination of the raw data shows that one subject commenced the study with testosterone levels significantly higher than any other individual. This particular subject also showed a significantly greater decrease in testosterone than anyone else in the study. The results of this one individual may have skewed the overall final result. The authors of the study note that even though average testosterone levels fell across the study group no individuals displayed a level that was below the normal physiological range at the conclusion of the study.

So what are we to make of these three studies? Their results are at odds with the majority of the evidence which indicates that neither soy nor isoflavones have any significant effect on hormone levels. Why the contradictory results? In regards to the soy flour, those subjects were consuming 120mg of soy isoflavones per day. This is significantly higher than that used in many of the other studies. It is possible that a threshold needs to be reached before physiological effects are seen. This theory is contradicted though by Kalman et al[20] who gave one group of test subjects 138mg of soy isoflavones per day yet did not observe a statistically significant reduction in testosterone level. The authors of this study did note however that this group was the only one in the study to show a numerical decrease in testosterone however the decrease was so minor it was ruled not statistically significant. This suggests a possible dose-response where increasing isoflavone levels correlate with a decrease in testosterone levels. Kalman et al argues against this however[20].

Another possible explanation for the contradictory results is the manner in which the soy isoflavones are consumed. The study using soy flour had the volunteers consume the isoflavones in the form of a scone. This requires baking, so could it be possible that the high temperatures associated with baking somehow makes the soy isoflavones more absorbable by the body? This is only speculation however it is a possibility.

Experimental design is another possible explanation to consider. The time of day blood samples were collected, the methods used to measure hormone levels and the accuracy in measuring isoflavones may have contributed to the different results. The subjects in each of these studies still lived their normal daily lives. Diet and lifestyle factors other than soy consumption may have also have contributed to the observed hormone changes. In the study by Goodin et al[23] it was reported that testosterone levels in the volunteers began to increase 2 weeks after cessation of the supplement. This would seem to suggest that for this study at least the decrease in testosterone was likely caused by the consumption of isoflavones.

Even though these three studies reported a decrease in testosterone in response to isoflavone intake their results need to be kept in perspective. The 6% and 3% decreases observed, while statistically significant, are still relatively minor. Even the 19% reduction reported did not cause any of the volunteers' testosterone levels to fall below the normal physiological range. Exactly what physiological effect this would have is uncertain. None of the studies identified any health problems as a result of the reduction in testosterone. The one limitation in all three studies is that their durations were relatively short. Even though changes to hormone profiles were observed and no adverse health effects were noted, the short study periods mean that it is not possible to draw conclusions about potential long-term physiological implications.

The majority of the scientific evidence shows that moderate consumption of soy in any form has no significant effect on hormone levels in the body. There are however at least three studies that have produced results contradictory to the majority of the evidence. The findings of these studies should not be discounted as they are legitimate results which show a statistically significant decrease in testosterone as a result of consuming soy isoflavones. Their results may not be readily explainable but they cannot be ignored. Table 1 provides a summary comparison of results obtained from 8 different studies.

Table 1. Summary of 8 studies examining hormonal effect of isoflavone intake on healthy males.

Study	No. Participants	Isoflavone intake (mg/day)	Source	Study length (wk)	Results		
					Testosterone	**Estradiol**	**SHBG**
Mitchell et al[16]	15	40	Tablet	8	No change	No change	Not measured
Habito et al[17]	42	70	Tofu	4	No change	No change	9% increase
Hamilton-Reeves et al[18]	Meta-analysis of 32 studies	20 - 449	Varied	1 wk – 1 year	No change		
Nagata et al[19]	34	77	Soymilk	8	No change	No change	No change
Kalman et al[20]	20	49	SPI	12	No change	No change	No change
		138	SPC	12	No change	No change	No change
		24	SPI/Whey blend	12	No change	No change	No change
Gardiner-Thorpe et al[21]	20	120	Soy flour	6	6% decrease	No change	No change
Dillingham etal[22]	35	2	Low SPI	8	3% decrease	3%increase	No change
		62	High SPI	8	No change	No change	No change
Goodin et al[23]	12	Not measured	SPI	4	19% decrease	Not measured	Not measured

Low SPI: Low isoflavone Soy Protein Isolate

High SPI: High Isoflavone Soy Protein Isolate

SPI: Soy Protein Isolate

SPC: Soy Protein Concentrate

Soy Protein

In order to build muscle you need protein. Animal sources such as beef, chicken, fish, eggs and dairy have been the traditional mainstay of most muscle building diets. Even protein supplements which are predominantly based on whey and casein are products of the dairy industry. These protein sources are considered superior to plant based proteins as they contain all the essential amino acids required by the human body. Based on equal weights plant based foods usually have much lower levels of protein and are often deficient in one or more of the essential amino acids. Soy is different however in that it is a complete protein containing all the essential amino acids[3]. Protein content of the soybean is exceptionally high compared to other legumes, with protein levels of 36-56%[24]. The variation in nutritional composition can be attributed to factors such as season, soil fertility, environmental conditions and even the location the soybeans were grown in.

Much like whey protein, soy protein also comes in the form of concentrate and isolate. Soy protein concentrate contains 65% or more protein while soy protein isolate contains 90% or more protein. Soy flour is another source of soy protein and has a protein content of around 40-50%[25]. Another form of soy protein is textured soy protein. This is what is used for making meat substitutes such as meat free burgers. These products are designed to have a similar appearance, texture and eating quality to their equivalent animal-derived product. Textured soy protein has a lower protein content compared to either soy protein isolate or concentrate.

Of particular interest to anyone training to build muscle is not only the protein content of a food but the quality of the protein. This is measured by a Protein digestibility-corrected amino acid score (PDCAAS) which is simply a measure of how well a protein delivers essential amino acids to the body. The range is 0-1 with 0 being the poorest protein and 1 being the highest quality protein. Soy protein isolates and concentrates have a PDCAAS score of 0.95-1[26]. This makes the quality of soy protein close to or equivalent to animal proteins such as egg white and whey which also have a PDCAAS score of 1.

Building Muscle with Soy Protein

How does soy stack up against other proteins such as whey and casein when used in conjunction with a resistance training program? Wilkinson et al reported that subjects who consumed either skim milk or soy milk while undertaking a resistance training program both gained lean muscle mass however it was concluded that the group drinking the skim milk did so at a faster rate[27]. Other studies have similarly concluded that milk based proteins are superior to soy protein for the accretion of muscle tissue when used in conjunction with a resistance training program[28-30].

Table 2 compares the essential amino acid profiles of dairy and soy proteins with that of human muscle tissue. Overall, it can be seen that on an equal quantity basis dairy proteins are able to deliver greater quantities of essential amino acids compared to soy protein. The superiority of dairy proteins in supporting resistance training adaptations may be attributable to their high leucine content. Leucine stimulates anabolic pathways that lead to an increase in muscle protein synthesis[31]. Leucine may be a trigger for anabolism however it is not the only one. Large concentrations of essential amino acids (but not non-essential amino acids) in the blood stream also result in activation of anabolic pathways independent of leucine[32]. The superiority of a protein for the purposes of increasing lean muscle mass is therefore related to the concentrations of essential amino acids it is able to deliver to the body.

Table 2. Comparison of Essential Amino Amino Acid values of dairy and soy proteins. Adapted from Phillips, S, Tang, J, Moore, D. 2009[30].

Essential Amino Acid content (mg/g protein)				
	Casein	**Whey**	**Soy**	**Human Muscle**
Histidine	**27**	**20**	**28**	**27**
Isoleucine	**54**	**76**	**44**	**35**
Leucine	**82**	**108**	**62**	**75**
Lysine	**73**	**101**	**62**	**73**
Methionine	**28**	**48**	**20**	**35**
Phenylalanine	**100**	**67**	**88**	**73**
Threonine	**54**	**44**	**32**	**42**
Tryptophan	**12**	**26**	**10**	**12**
Valine	**64**	**72**	**54**	**49**

Tang and colleagues published results of a 2009 study that measured the effects of whey, casein and soy protein on muscle protein both at rest and after exercise[33]. It was reported that whey protein produced the greatest increase in muscle protein synthesis under both conditions. Soy protein was the second most effective followed by casein. The high leucine and other essential amino acid content of whey protein explains why it is so effective at stimulating muscle protein synthesis both at rest and following exercise. Interestingly though is the finding that soy was more effective at stimulating muscle protein synthesis than casein. Casein has a significantly higher leucine content compared to soy yet it was the least effective protein source for stimulating protein synthesis.

Studies involving infusions of amino acids into the bloodstream have shown that protein synthesis in non-exercised muscles reaches a peak around 2 hours post infusion. The anabolic response appears to be dose related where higher concentrations of essential amino acids in the blood result in a higher rate of muscle protein synthesis[34]. This relationship has also been demonstrated in muscles that have undergone resistance exercise[35]. It therefore stands to reason that the faster a protein is digested and its amino acids absorbed into the blood the greater the increase in muscle protein synthesis. Soy protein is rapidly digested which results in a rapid rise in blood amino acid levels[36]. Casein on the other hand is digested much more slowly due to its tendency to clot in the acidic environment of the stomach[37]. This means casein is useful for supplying a steady supply of amino acids over a prolonged period, however it is unable to provide the rapid rise in amino acids like whey or soy protein required to stimulate a maximum anabolic response. This explains the result obtained by Tang et al[33].

Of the two studies discussed so far it seems that their respective results are contradictory. One says milk protein is superior to soy in promoting gains in muscle mass while the other says soy is superior to the milk protein casein for stimulating muscle protein synthesis. Why the two apparently contradictory results? The answer to this lies in the protein composition of milk which contains around 80% casein and 20% whey[38]. The whey content of milk is sufficient to cause a rapid rise in amino acids in the blood which signals the anabolic pathways in the body to increase the rate of muscle protein synthesis. This increase in the rate of muscle protein synthesis cannot be sustained by whey protein alone however as the rapid absorption of amino acids also results in their rapid clearing from the blood. Casein on the other hand has a much slower rate of digestion, providing a slow but steady release of amino acids into the blood which is capable of sustaining protein synthesis for a longer period. Soy protein may be superior to casein for stimulating muscle protein synthesis however it is unable to provide a steady supply of amino acids needed to support long-term protein synthesis. Milk protein containing a combination of whey and casein is therefore superior to soy protein for supporting increases in muscle mass associated with resistance exercise.

Kalman et al[20] reported that a 12 week resistance training program supplemented with either whey or soy protein powder produced similar increases in lean muscle mass. This result suggests that soy and whey protein are equally effective at promoting increases in lean muscle mass during a 12 week resistance training program. While this study was well designed to achieve its stated aims there are a few limitations in drawing conclusions from the data. Firstly, all the test subjects were novice trainers with limited weight training experience. The initial rapid adaptation that occurs when an individual undertakes unaccustomed exercise may involve factors other than nutritional. It is possible that at least some of the muscle mass increase may be unrelated to the type of supplement used. Secondly, the study was too short to definitively conclude that soy and whey are equally effective in promoting increases in muscle mass as part of a long term resistance training program. Thirdly, overall diet plays an important role in maximising resistance training adaptations. Protein supplements will not make up for a diet that is deficient in protein and other macronutrients. Assuming that all the study participants were consuming diets with approximately equal quantities of calories, protein, carbohydrates and fats then the results can be considered reliable. If it just happened that the soy protein supplement group were consuming more dietary protein or calories compared to the whey group then this could potentially have contributed to the increase in body weight observed. What can be concluded from this study is that for novice trainers undertaking a 12 week resistance training program soy protein is unlikely to alter hormone levels in the body and can be equally effective as whey protein at promoting increases in lean body mass.

One characteristic of soy that makes it less favourable for weight training adaptations is that milk proteins are more likely to be directed towards muscle protein synthesis while soy proteins are more likely to be directed towards other parts of the body[39,40].

Is this *all* the evidence?

All the evidence discussed so far has focussed on human studies. Scientific investigation regularly relies on research using animal models as a means of testing a particular hypothesis. There are studies showing negative hormonal effects of soy or isolated isoflavones on test animals and these studies are regularly cited by opponents of soy. One such example is the evidence linking consumption of the soy isoflavone genistein with thyroid disorders in laboratory animals[41-43]. Human trials with healthy individuals have failed to reproduce these results over both short and long term periods[44-46]. An exception to this may be those individuals with an existing thyroid disorder or are on the borderline to having one. Consumption of soy isoflavones for these individuals may potentially worsen their condition[47].

This report has deliberately focussed only on human studies as these most closely reflect the conditions that athletes will face. Those reading this report will unlikely care too much whether soy produces any undesirable effects in rats or mice. The question that readers undoubtedly want to know is whether soy consumption is going to negatively impact on both *their* health and *their* training.

Conclusion

Scientific research often contains contradictory results and soy is no different. The overwhelming majority of the evidence points to the conclusion that moderate consumption of soy isoflavones does not decrease testosterone levels or increase estrogen levels. That being said, there is some evidence to suggest that under certain conditions soy may alter the natural hormonal balance of the body. Exactly what those conditions are is unclear. Until these results are adequately explained it is not possible to conclude with absolute certainty that consumption of soy isoflavones will not result in altered hormone profiles. What the available evidence does show however is that these changes, if they do occur, are relatively minor.

For individuals undertaking resistance exercise for the purposes of increasing lean body mass, strength and power the evidence shows that moderate soy consumption is unlikely to have any adverse effects on their physiology or training. Consumption of soy-based foods is unlikely to cause testosterone levels to fall significantly or estrogen levels to rise. Moderate soy consumption can therefore be considered safe for athletes wanting to do so. Considering that consumption of these foods has no significant effect on hormone levels, the small amounts found in processed foods is also unlikely to negatively impact on endocrine function.

In regards to soy as a protein source, it can be considered a legitimate addition to any muscle-building diet. The research shows that soy is not as effective as dairy-based proteins in supporting hypertrophy but it is still a useful protein source for weight training athletes.

Despite the demonstrated safety of soy consumption it must be kept in mind that all the studies discussed involved soy consumption at what could be considered a 'moderate' level. If soy was to become your only source of protein and you were to consume it in large quantities throughout the day in both supplements and food over many months or years then there is the possibility that endocrine function may be altered.

This report is not intended to be an exhaustive review of every study on the subject of soy and it should not be viewed as an endorsement of soy consumption. The evidence presented here has been reviewed in an unbiased manner and the conclusions reached do not support the claims of soy being damaging to weight training athletes by altering hormone profiles. The few studies that have identified soy as an endocrine disrupting food still need to be explained however the majority of the scientific evidence demonstrates that athletes have little to fear from soy.

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