

Hydrolyzed soy protein contains bioactive peptides that release cholecystokinin from enteroendocrine cells



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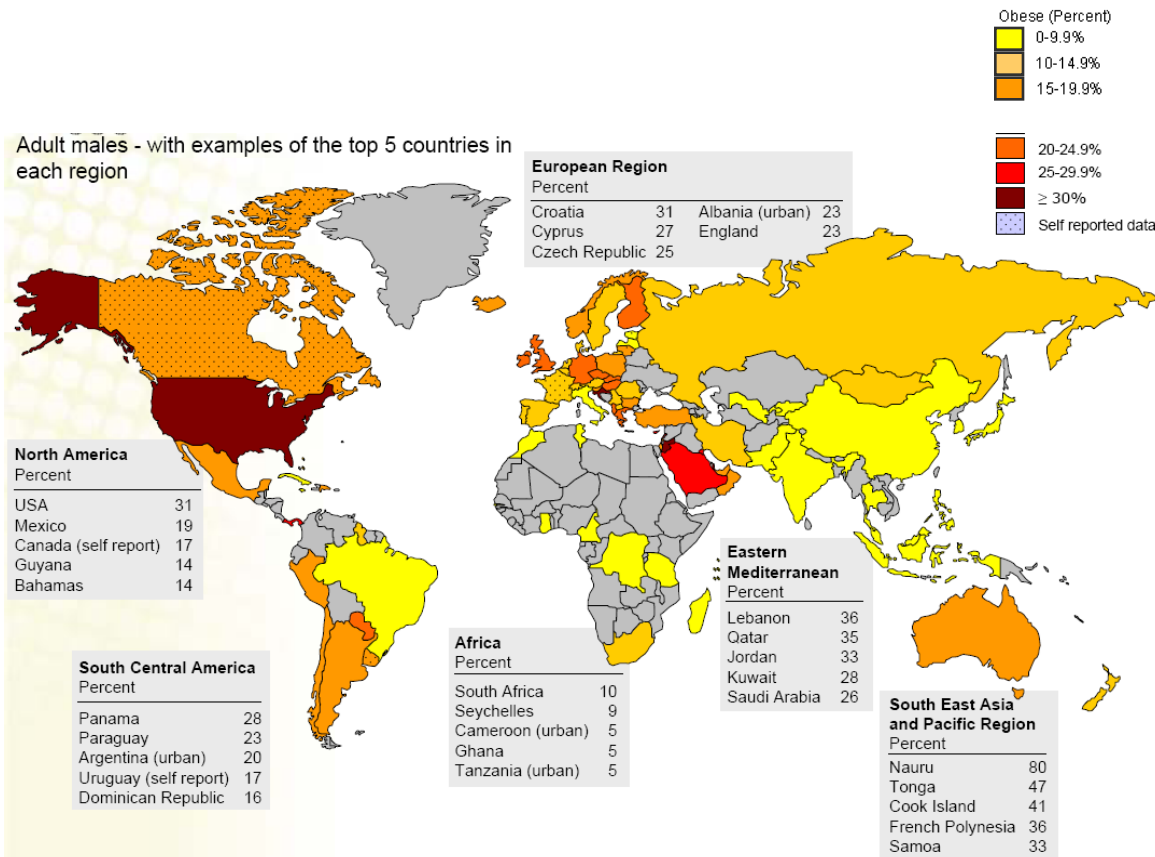
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Presentation Outline

1. Introduction
 - Obesity and Health
 - Weight Management
 - Soy protein and nutrition
2. Increasing protein functionality
3. Satiety peptides
4. Summary

Growing Obesity Creating Need for Better Weight Management Solutions



Source: International Obesity TaskForce, London –January 2007

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- Approximately half the world's population is overweight with a 17% global obesity rate, led by the U.S. (34%), Mexico (30%)
- Prevalence of obesity in the U.S. has doubled over the last 15 years
- Cost of obesity healthcare in the U.S. \$350B by 2018 or 21% of total healthcare spending

Sources: *American Journal of Preventative Medicine*, Packaged Facts, Organization for Economic Cooperation and Development (OECD)



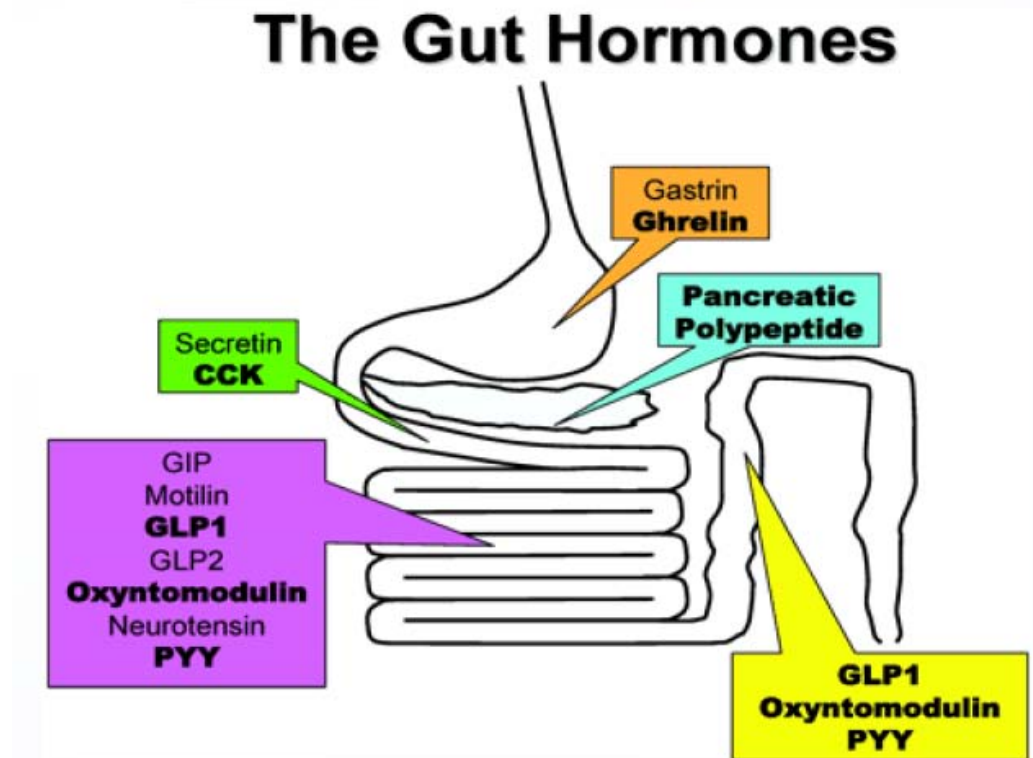
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Weight Management

- Many products exist in the marketplace to help people manage their weight.
- There are three main strategies used in weight management products:
 - Increase energy expenditure
 - Maintain lean body mass
 - Induce satiety
- Protein consumption leads to all three phenomena.

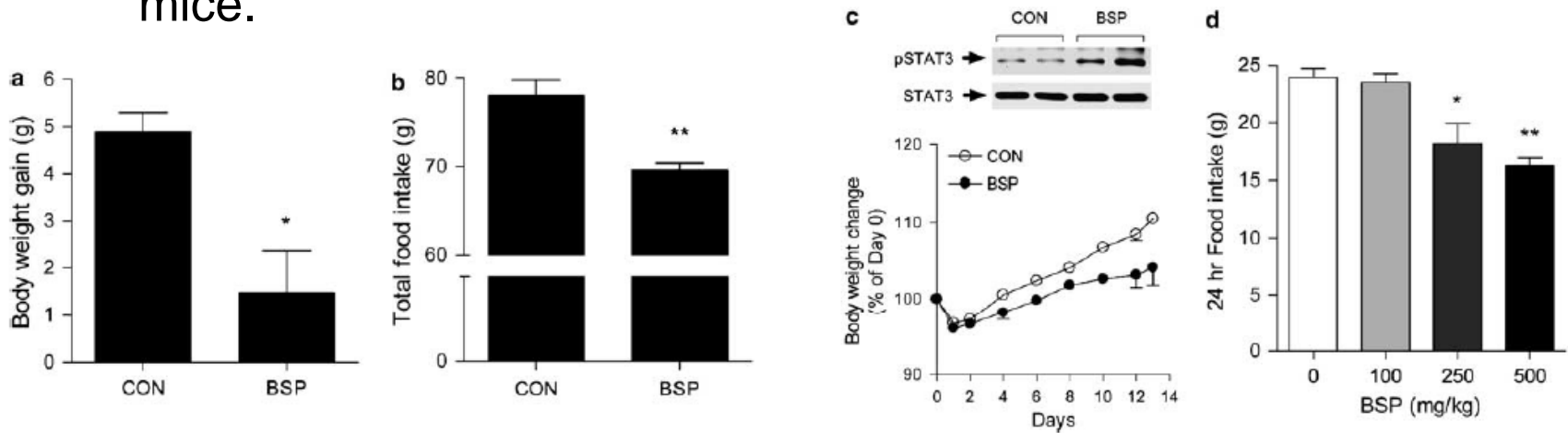
Satiety is a key component of weight management strategies

- Regulation of food intake is complex. Gut hormones play a major role.
- Protein consumption is associated with satiety. Soy protein is as good as milk or animal proteins at inducing satiety.



Soy Protein Consumption results in lower weight gain in ob/ob mice

- Body weight gain and food intake: Peptides from black soybeans (BSP) shown to reduce both total body weight gain and food intake in an acute study using leptin-deficient (ob/ob) mice.

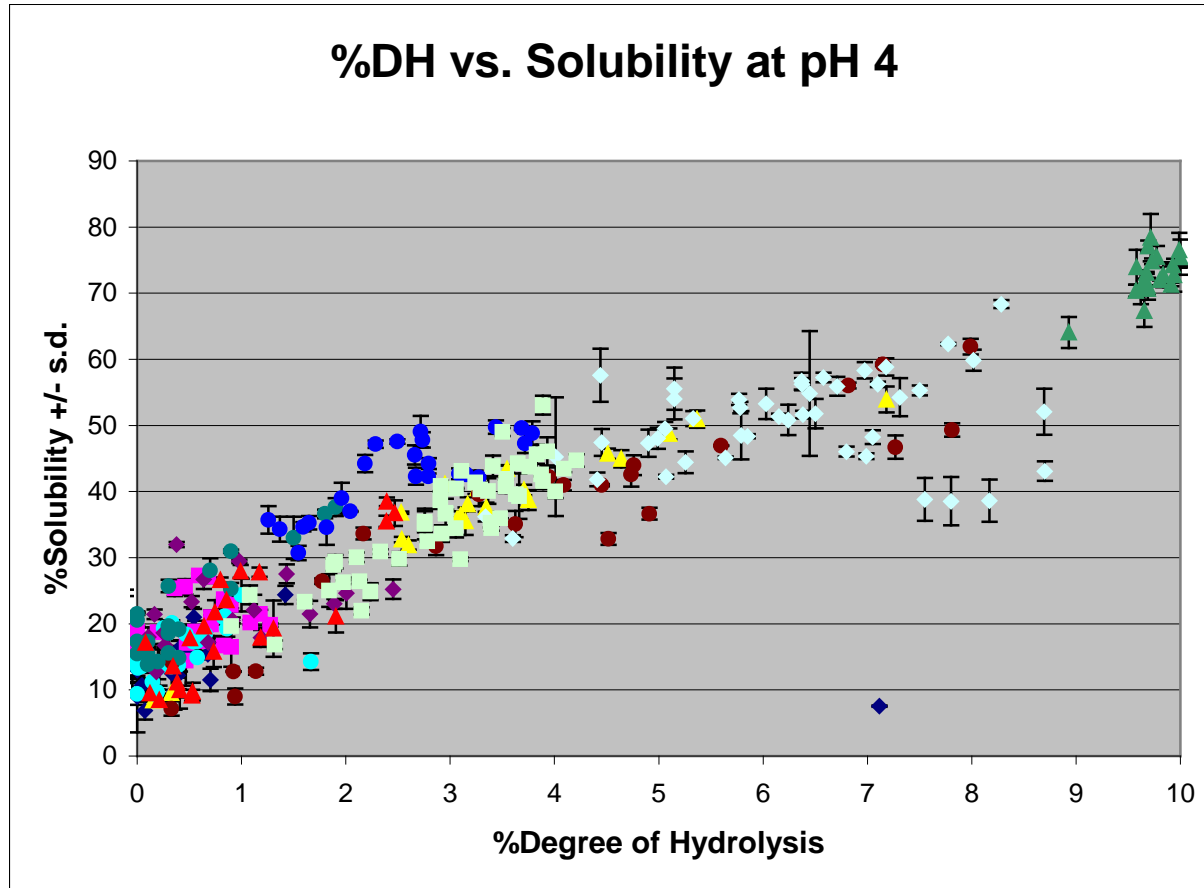


Taken from Jang et al (2008) Intl J. Obesity, 32:1161

Soy Proteins

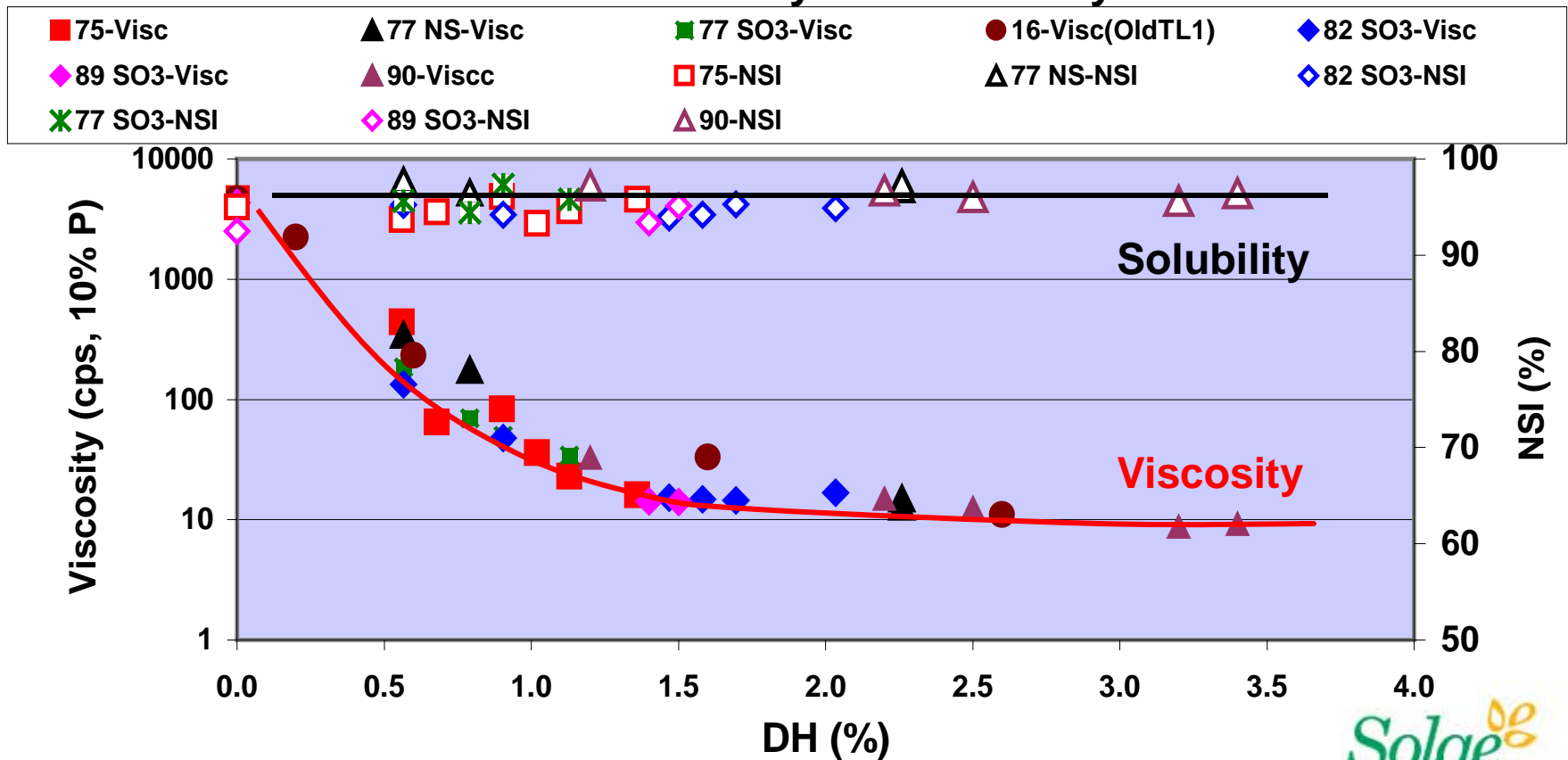
- The only nutritionally complete vegetable protein
- Used in a variety of food applications, but can be difficult to work with due to solubility and viscosity issues.
- Hydrolysis can oftentimes improve functionality, with the added benefit that it releases bioactive peptides.

Hydrolysis of soy proteins improves solubility at acid pH

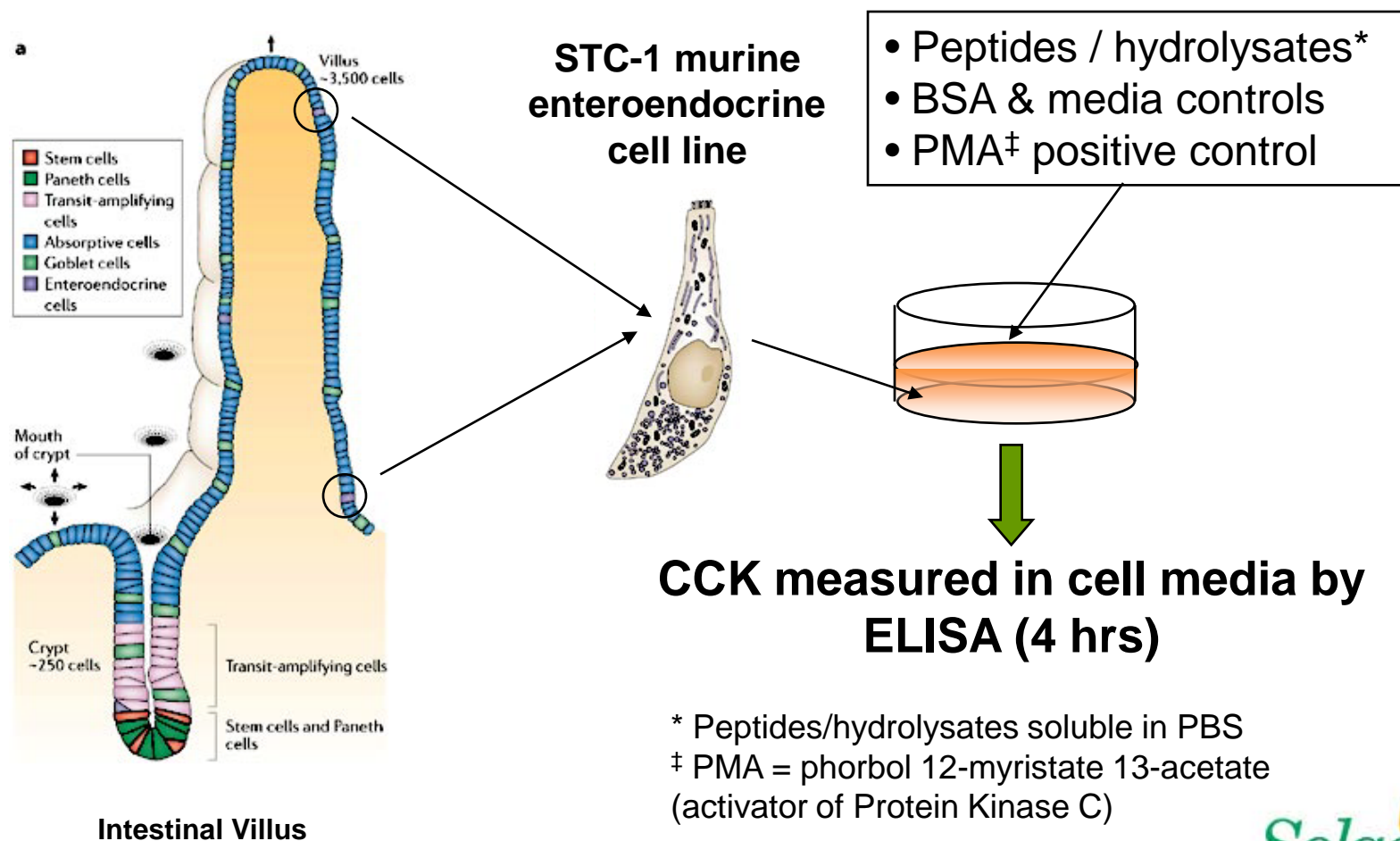


Hydrolysis of soy protein can lead to improvements in viscosity

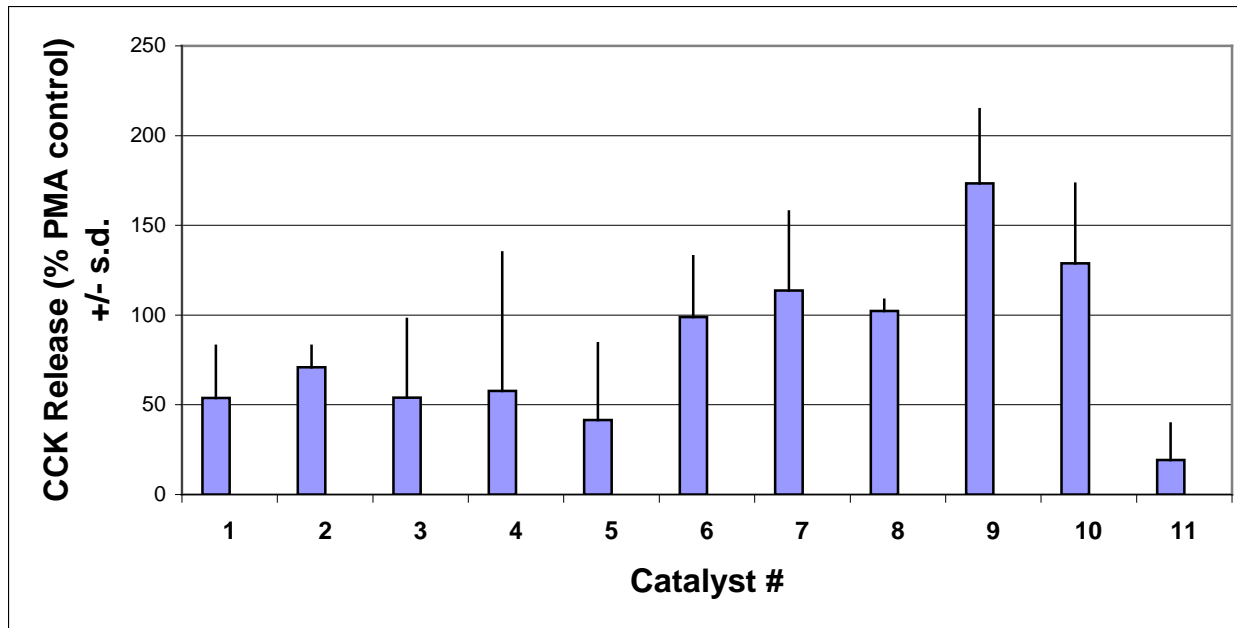
DH vs. Viscosity and Solubility



Enteroendocrine Cell-based Screen for CCK Release



Hydrolyzed soy stimulates CCK release from Enteroendocrine cells



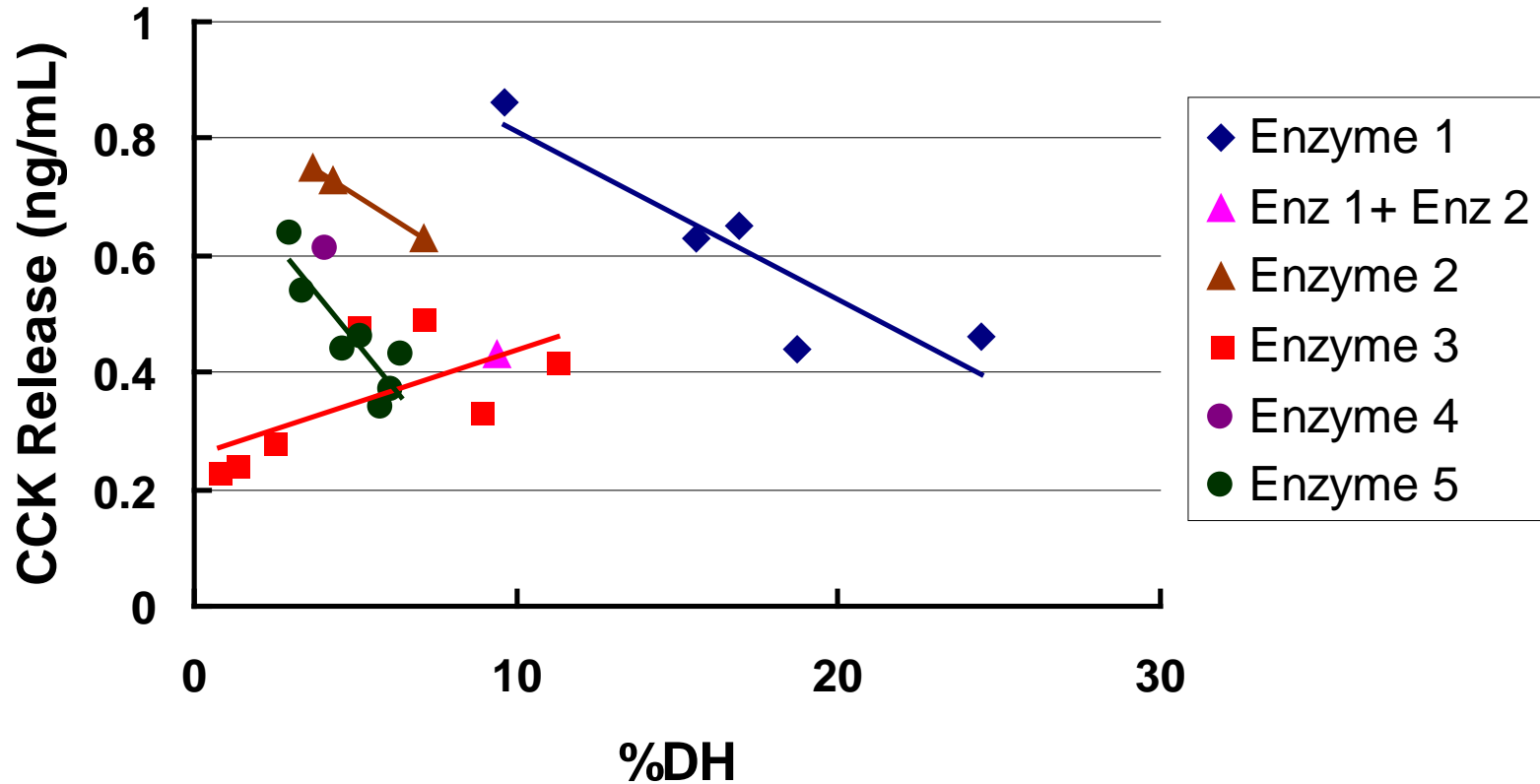
Catalyst	Max CCK release (% control)
1	100.0
2	79.6
3	127.4
4	244.1
5	106.8
6	138.2
7	169.8
8	106.7
9	230.8
10	202.6
11	38.1

Optimal conditions for CCK inducing peptide generation are enzyme dependent



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Correlation between %Degree of Hydrolysis & CCK Release is Enzyme Dependent

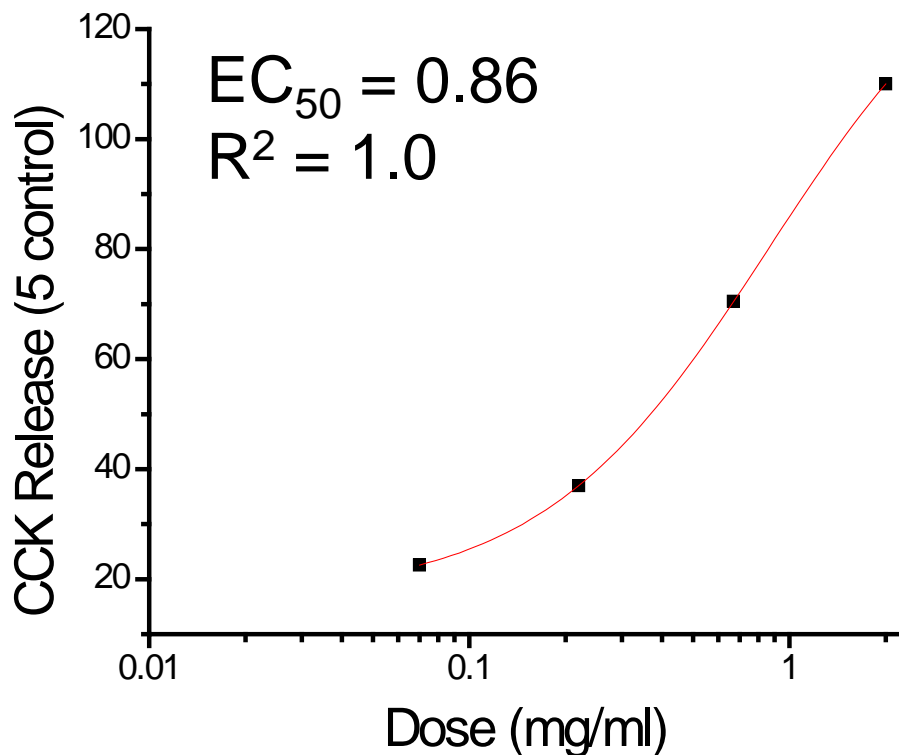


Unique peptides are created with different enzymes & processing conditions



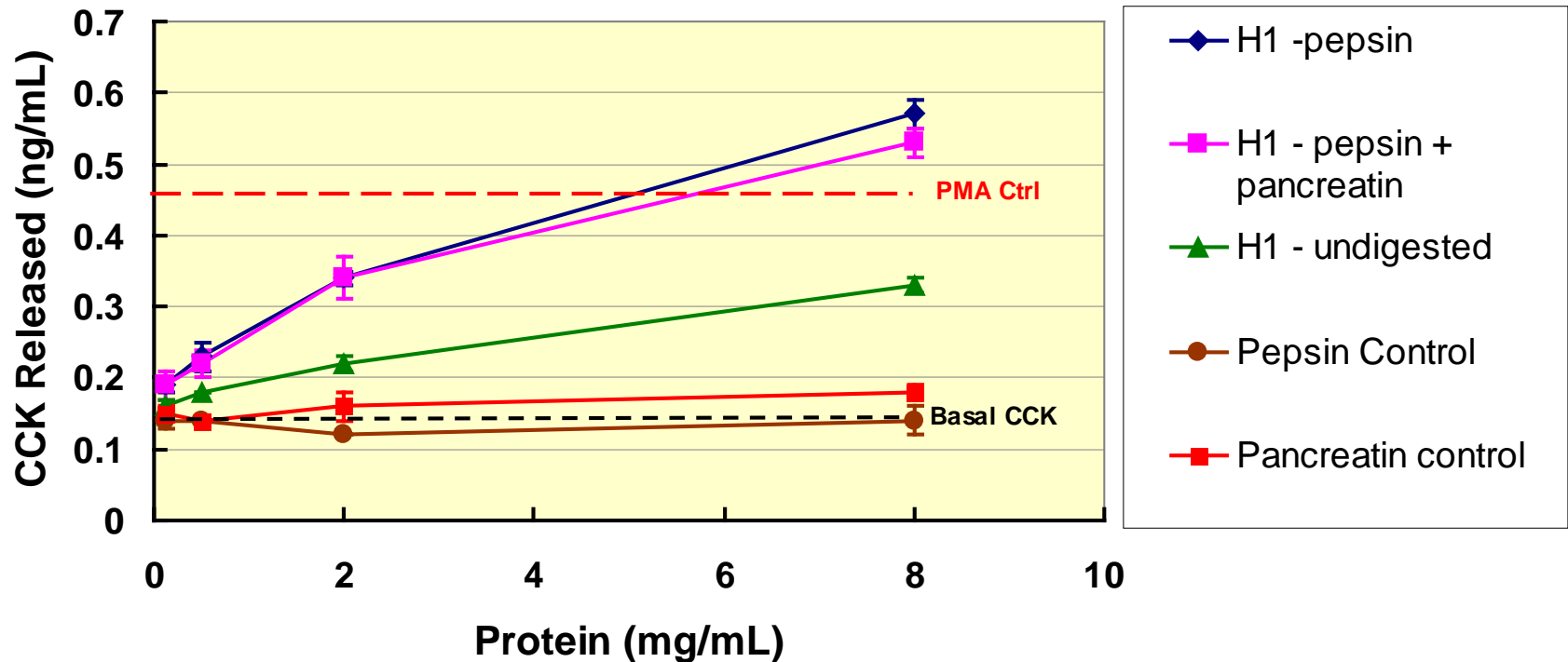
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CCK release by hydrolysates is dose-dependent

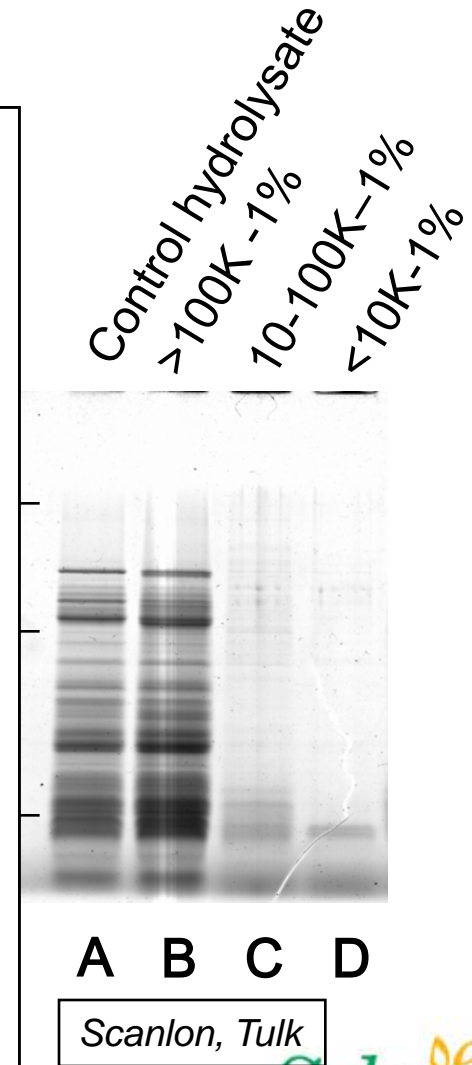
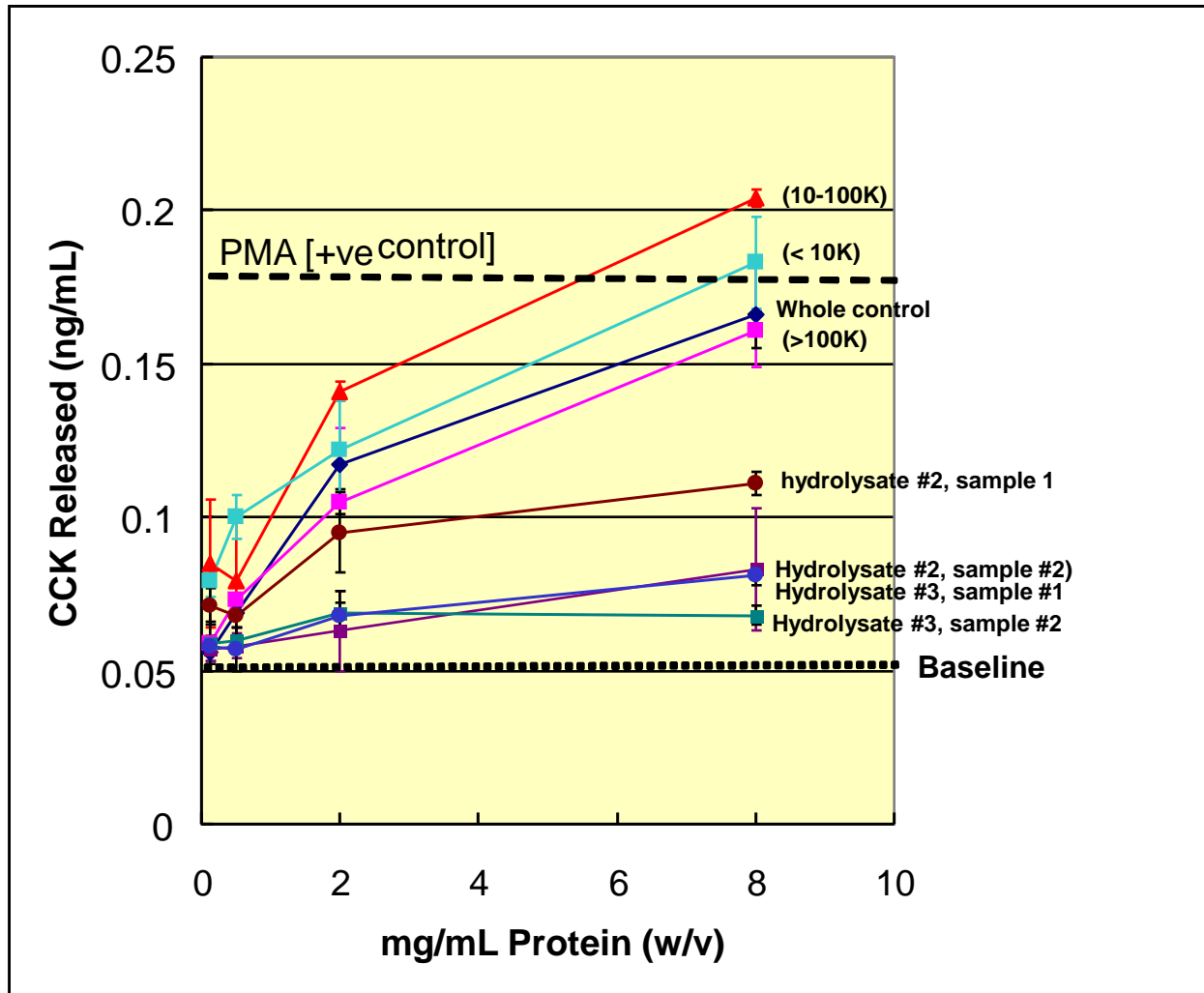


Select hydrolysates have been shown to stimulate release of CCK in a dose-dependent fashion, suggesting a true physiological response.

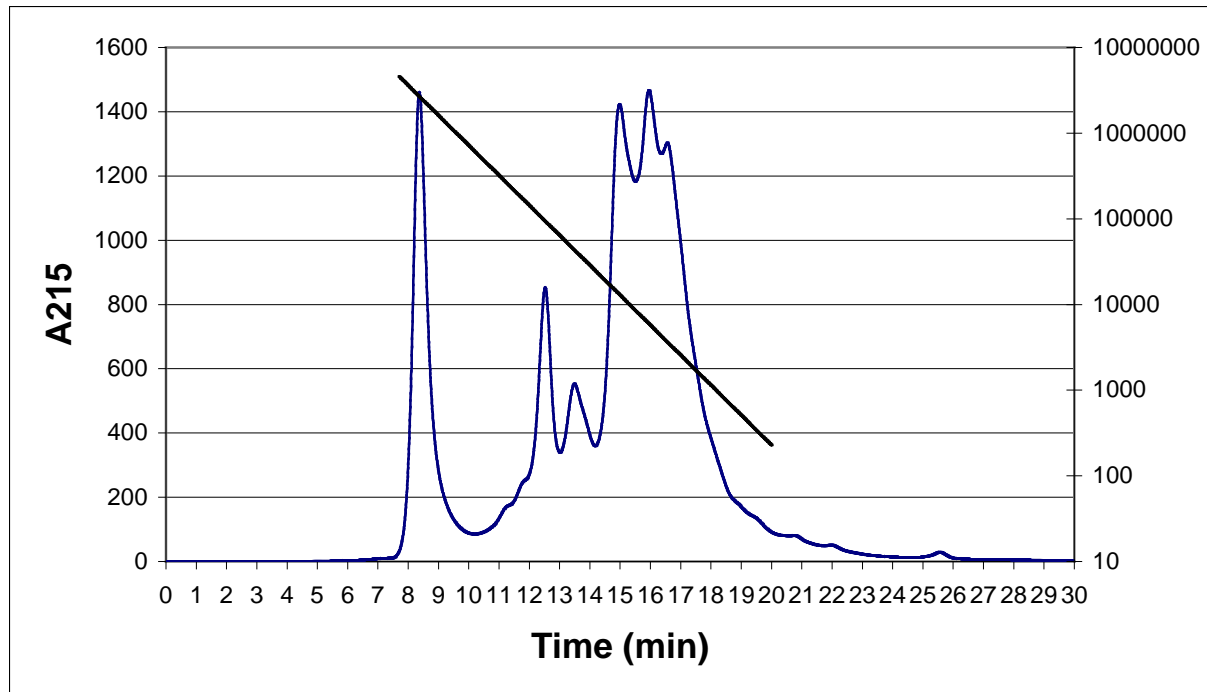
In vitro digestion of soy hydrolysate does not destroy CCK inducing bioactivity



CCK release induced by <10K fraction of control hydrolysate



CCK-releasing hydrolysates contain substantial amts of <10 kDa peptides



MW range	Retent time	AUC	Area %
>20 kDa	7.7-14.44	371867	37.53%
10-20 kDa	14.44-15.3	144766.9	14.61%
5-10 kDa	15.3-16.17	168930.5	17.05%
2-5 kDa	16.17-17.3	191685.6	19.34%
1-2 kDa	17.3-18.17	65223.69	6.58%
<1kDa	18.17-20	48470.9	4.89%



Summary

- Obesity is a significant global issue that needs to be addressed.
- Weight management strategies that include protein are most likely to be successful
- Soy is an excellent source of nutritionally-complete protein.
- Enzymatic processing of soy protein:
 - can improve functionality, thus making it easier to incorporate soy into different food forms
 - Releases bioactive peptides that may be useful in, e.g., maintenance of lean body mass, or inducing satiety
- Bioactive peptides derived via hydrolysis of soy can release CCK from enteroendocrine cells in a dose-dependent fashion, and a significant portion of the bioactive portion survives digestion.
- The majority of this bioactivity is found in the <10 kDa fraction.
- Future work will focus on determining whether the bioactive peptides exert an enhanced satiating effect *in vivo*

Path Forward

- Fractionate bioactive hydrolysate(s) to identify peptide(s) responsible for CCK release.
- Look at the effect of soy peptides on the release of other satiety hormones.

Thank you!

Questions?



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