



**GRAIN  
ZOOMER**

**Grain Zoomer**

Evaluate *grain sensitivity* when a gluten-free diet is not enough



1(866) 364-0963  
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Final Report Date:	01-06-2020 18:14	Specimen Collected:	01-05-2020 18:14
Accession ID:	2001060006	Specimen Received:	01-06-2020 12:14

LAST NAME	FIRST NAME	GENDER	DATE OF BIRTH	ACCESSION ID	DATE OF SERVICE
TEST	ERIC	MALE	1997-07-25	2001060006	01-05-2020 18:14

## PATIENT

Name: ERIC TEST  
 Date of Birth: 1997-07-25  
 Gender: Male  
 Age: 22  
 Fasting: FASTING

## PROVIDER

Practice Name: Demo Client, MD  
**Provider Name: Demo Client, MD (999994)**  
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 City: TEST  
 State: CA  
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 Fax #:

**Vibrant Wellness** is pleased to present to you, 'Grain Zoomer', to help you make healthy lifestyle, dietary and treatment choices in consultation with your healthcare provider. It is intended to be used as a tool to encourage a general state of health and well-being.

**The Vibrant Grain Zoomer** is a test to measure antibody levels to commonly consumed food antigens at the peptide level. The panel is designed to give a complete picture of an individual's levels of IgG (subclasses 1, 2, 3, 4) and IgA (subclasses 1, 2) antibodies to these antigens in serum.

**Interpretation of Report:** The report begins with the Grain Zoomer summary page which displays a summary score for each food which is a unified score calculated from IgA and IgG reactivity with higher weightage for IgA than IgG. The summary also lists all antigens against which the antibody levels are positive or moderate or negative in the reference range. Following the summary section is the complete list of the all antigens tested in a graphical format along with the levels of antibodies to enable a full overview along with the corresponding reference ranges. The classification of Positive (Red) to Moderate (Yellow) to Negative (Green) denotes the level of IgG and/or IgA antibodies detected. Additionally, the previous value is also indicated to help check for improvements every time the test is ordered. All contents provided are purely for informational purposes only and should not be considered medical advice. Any changes based on these choices are to be made in consultation with the clinical provider.

The Vibrant Wellness platform provides tools for you to track and analyze your general wellness profile. Testing for the Grain Zoomer panel is performed by Vibrant America, a CLIA certified lab CLIA#:05D2078809. Vibrant Wellness provides and makes available this report and any related services pursuant to the Terms of Use Agreement (the "Terms") on its website at [www.vibrant-wellness.com](http://www.vibrant-wellness.com). By accessing, browsing, or otherwise using the report or website or any services, you acknowledge that you have read, understood, and agree to be bound by these terms. If you do not agree to accept these terms, you shall not access, browse, or use the report or website. The statements in this report have not been evaluated by the Food and Drug Administration and are only meant to be lifestyle choices for potential risk mitigation. Please consult your physician for medication, treatment, diet, exercise or lifestyle management as appropriate. This product is not intended to diagnose, treat, or cure any disease or condition.

Please Note - It is important that you discuss any modifications to your diet, exercise and nutritional supplementation with your physician before making any changes.

To schedule an appointment with Vibrant Clinical Dietitians please call: Toll-Free 866-364-0963.

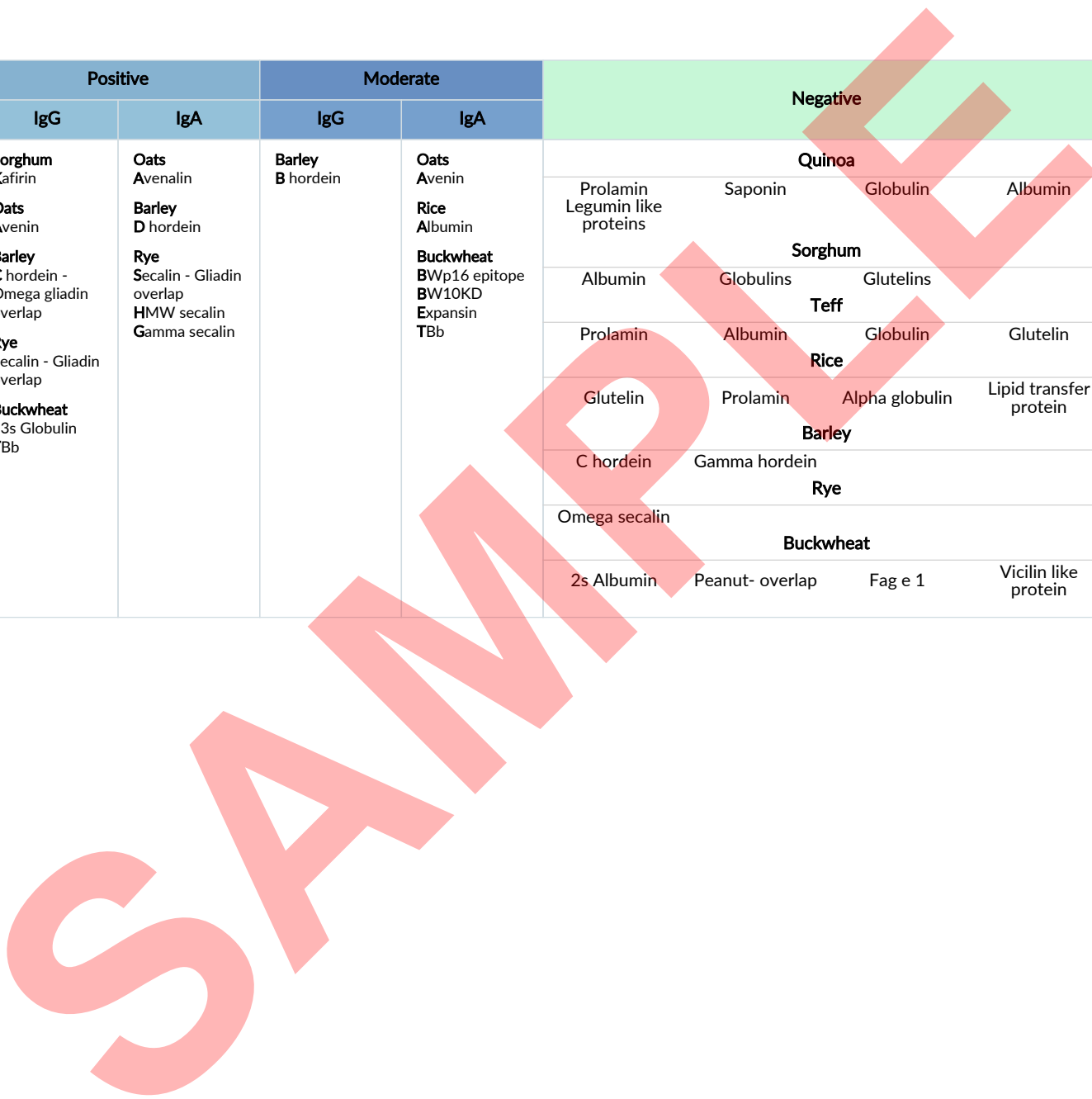
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**SUMMARY**



LAST NAME	FIRST NAME	GENDER	DATE OF BIRTH	ACCESSION ID	DATE OF SERVICE
TEST	ERIC	MALE	1997-07-25	2001060006	01-05-2020 18:14

Positive		Moderate		Negative			
IgG	IgA	IgG	IgA				
<b>Sorghum</b> Kafirin  <b>Oats</b> Avenin  <b>Barley</b> C hordein - Omega gliadin overlap  <b>Rye</b> Secalin - Gliadin overlap  <b>Buckwheat</b> 13s Globulin TBb	<b>Oats</b> Avenalin  <b>Barley</b> D hordein  <b>Rye</b> Secalin - Gliadin overlap HMW secalin Gamma secalin	<b>Barley</b> B hordein	<b>Oats</b> Avenin  <b>Rice</b> Albumin  <b>Buckwheat</b> BWp16 epitope BW10KD Expansin TBb	<b>Quinoa</b> Prolamin      Saponin      Globulin      Albumin Legumin like proteins  <b>Sorghum</b> Albumin      Globulins      Glutelins  <b>Teff</b> Prolamin      Albumin      Globulin      Glutelin  <b>Rice</b> Glutelin      Prolamin      Alpha globulin      Lipid transfer protein  <b>Barley</b> C hordein      Gamma hordein  <b>Rye</b> Omega secalin  <b>Buckwheat</b> 2s Albumin      Peanut- overlap      Fag e 1      Vicilin like protein			



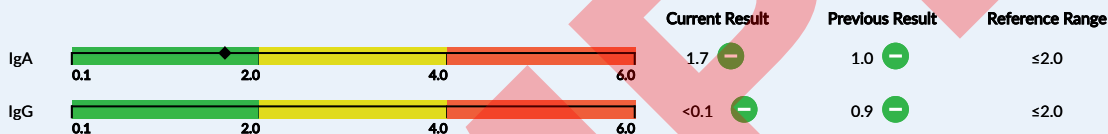
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## Quinoa

Quinoa is a flowering plant in the amaranth family. The quinoa seeds are rich in protein, dietary fiber, B vitamins, and dietary minerals in amounts greater than in many grains.

### Prolamin

Prolamins are plant proteins that have a high proline content which makes them difficult to fully digest. Quinoa contains prolamins that were, in some strains, able to stimulate the immune system in biopsied tissue from celiac disease (CD) patients.<sup>1</sup> Gliadin, a prolamin of gluten, is found in wheat and can induce celiac disease. It has been suggested that the quinoa prolamins could cause duodenal mucosal lesions in some patients with celiac disease, but this requires further investigation. This is similar to the presence of gliadin-stimulated T cell responses in celiac disease patients and supports the evidence that the adaptive immune response to gliadin is directly responsible for the inflammatory mucosal lesion.



### Saponin

Saponins are a naturally occurring phytochemical that give unwashed quinoa a bitter taste. During growth, saponins act as the quinoa plant's natural protection from pests, however, the bitter flavor they produce is also a mild digestive irritant and is a deterrent for human consumption when not properly removed. While some research shows that saponins have a high antioxidant capacity, currently purchasers seek quinoa varieties with low saponins amounts (low to no bitterness).<sup>2</sup>



### Globulin



Globulin is a major seed storage protein of quinoa. It is NaCl-soluble protein. Recently the quinoa 11S globulin gene has been suggested to belong to a multigene family as in other species. These proteins are related to each other based on their primary structures, with homologies reaching 63% between soybean proA1aB1b and pea prolegumin.<sup>3</sup>



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## Albumin

Albumin is a major seed storage protein of quinoa. The predominance of albumins in quinoa is technologically significant because they are highly soluble in water and dilute salt solutions, which can be an advantage for food formulation purposes, in particular for the production of plant-based beverages.<sup>4</sup>

	Current Result	Previous Result	Reference Range
IgA	0.4 	0.9 	≤2.0
IgG	0.3 	2.0 	≤2.0

## Legumin like proteins

Legumin, or vegetable casein, is a protein substance analogous to the casein of milk, obtained from quinoa seeds. Legumin-like 11S globulins are a storage protein of quinoa.<sup>5</sup>




	Current Result	Previous Result	Reference Range
IgA	0.1 	<0.1 	≤2.0
IgG	0.3 	0.5 	≤2.0

## Sorghum

Sorghum is a genus of flowering plants in the grass family Poaceae. One species, Sorghum bicolor, native to Africa with many cultivated forms now, is an important crop worldwide, used for food (as grain and in sorghum syrup or "sorghum molasses"), animal fodder, the production of alcoholic beverages, and biofuels.<sup>6</sup> Sorghum flour has been used as alternative to gluten-containing cereals for the celiac market and because of its neutral flavor and the use of hybrids with a white pericarp, which are able to produce flour similar to wheat flour in appearance and color.

## Albumin

Albumin is a water-soluble seed storage protein in sorghum. Studies on amino acid composition of the protein fractions showed that the sorghum albumin contains high amounts of lysine and tryptophan and in general were well balanced in their essential amino acid composition.<sup>7</sup>

	Current Result	Previous Result	Reference Range
IgA	1.0 	1.4 	≤2.0
IgG	1.4 	0.8 	≤2.0

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## Kafirin

Kafirin is a class of prolamin storage protein found in grain sorghum. Sorghum is a safe cereal grain for celiac patients because kafirins are so different in structure from the wheat gliadin and glutenin storage proteins. However, it has been considered to have antinutritive properties. Kafirins show high homology with the equivalent zein proteins in corn which may cause food sensitivity.<sup>8</sup>



Figure. Amino acid alignment between the sequence of β-kafirin and β-zein.



## Globulins

Globulin is a NaCl-soluble seed storage protein in sorghum. Studies on amino acid composition of the protein fractions showed that the sorghum globulins contain high amounts of lysine and tryptophan and in general were well balanced in their essential amino acid composition.<sup>9</sup>



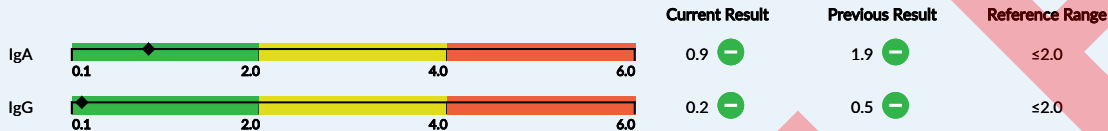
## Teff

Teff, also known as Eragrostis tef, Williams' lovegrass, is an annual grass, a species of lovegrass native to the Horn of Africa, belonging to the family of Poaceae. Teff is a rich source of protein, dietary fiber, and manganese, and contains moderate amounts of thiamin, phosphorus, iron, magnesium, and zinc. The fiber content in teff is also higher than in most other cereals.<sup>11</sup>

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## Prolamin

Prolamin is the major seed storage protein in teff, here called eragrostins. Teff has  $\gamma$ - and  $\delta$ -prolamins but has no  $\beta$ -prolamins. Teff contains high amounts of prolamin, which has a particular amino acid composition that is different from gluteins, therefore more suited for celiac disease patients.<sup>12</sup>



## Albumin

Albumin is a water-soluble seed storage protein in teff. The teff albumin fraction is particularly rich in lysine, which essentially makes the protein's digestibility high.<sup>13</sup>



## Globulin

Globulin is a NaCl-soluble seed storage protein in teff. A study shows that  $\alpha$ -globulins play an important role in protein aggregation and germplasm divergence for teff.<sup>14</sup>



## Glutelin

Glutelin is a water-insoluble assembly in teff. Glutelin is the most prominent seed storage protein in teff followed by albumins and globulin (or prolamins). The higher proportion of glutelin in white teff may have a big influence on functional properties including baking performance and dough rheology.<sup>15</sup>





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## Oats

Oats are a species of cereal grain grown for its seed. While oats are suitable for human consumption as oatmeal and rolled oats, one of the most common uses is as livestock feed. Oats are a nutrient-rich food associated with lower blood cholesterol when consumed regularly. Oat products are frequently contaminated by other gluten-containing grains, mainly wheat and barley, through grain harvesting, transport, storage or processing.

## Avenin

Avenins present in oats (proteins similar to gliadin from wheat) are thought to exacerbate celiac disease in a small portion of people. The minor protein of oat is a prolamin, avenin. Oat prolamins, named avenins, are similar to gliadins found in wheat, hordeins in barley, and secalins in rye, which are collectively named gluten. Avenins toxicity in celiac patients depends on the oat cultivar consumed because of prolamin genes, protein amino acid sequences, and the immunoreactivities of toxic prolamins, which vary among oat varieties.<sup>17</sup>



## Avenalin

Oats are the only cereal containing a legume-like protein, avenalin, as the major (80%) storage protein. Globulins are characterized by solubility in dilute saline as opposed to the more typical cereal proteins, such as gluten and zein, the prolamines.<sup>18</sup>



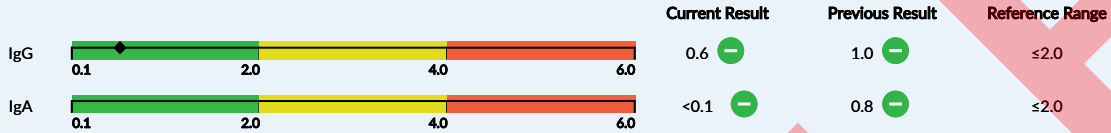
## Rice

Rice, as a cereal grain, is the most widely consumed staple food for a large part of the world's human population, especially in Asia. Depending on the type, rice is an excellent source of B vitamins, thiamin, niacin, riboflavin, fiber, iron, manganese, and magnesium. In recent years, an increase in the number of individuals sensitized to rice components with or without clinical symptoms has been reported.

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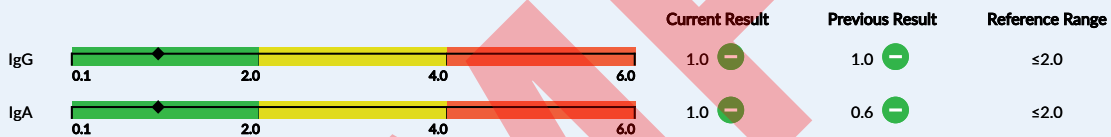
## Glutelin

Glutelins are the primary form (80-90%) of energy storage in the endosperm of rice grains. Glutelin C precursor, which is a major glutelin subunit in the Asian japonica rice subspecies, has been identified as a new potential rice antigen.<sup>20</sup>



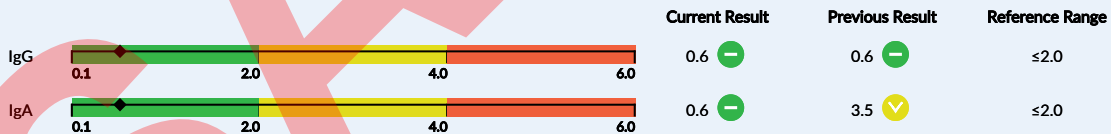
## Prolamin

Rice prolamins account for 5-10% of the total seed proteins. Prolamins are stable in response to thermal processing and enzyme proteolysis as they are rich in cysteine. Several members of the rice prolamin superfamily including LTP types 1 and 2, RA14, are well-recognized food antigens.<sup>21</sup>



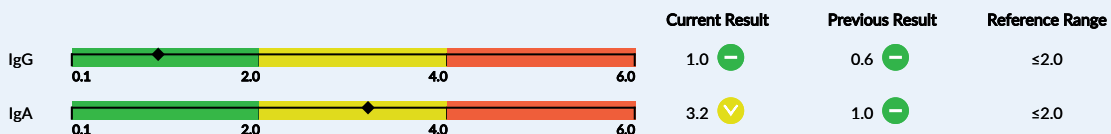
## Alpha globulin

Globulin is a NaCl-soluble protein fraction in the seed. Together with albumin, it accounts for 4-10% of the total rice seed proteins. Alpha globulin (26 kDa, α-Glb) in the embryonic bud of rice has been proven to be one of the major rice antigens. The allergenicity of rice alpha globulin can survive heat and enzymatic treatment.<sup>22</sup>



## Albumin

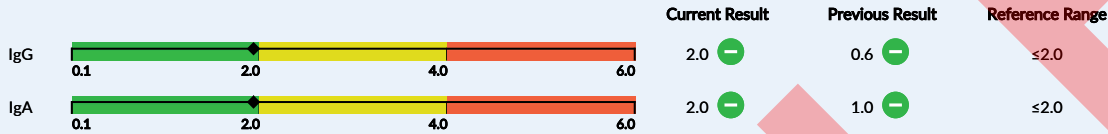
Albumin is a NaCl-soluble protein fraction in the seed. Together with globulin, it accounts for 4-10% of the total rice seed proteins. Albumin is a major rice antigen. There are six homologous proteins with molecular masses of 14-16 kDa in the albumin fraction which have reacted with antibodies from allergic patients.<sup>23</sup> The antigenicity of rice albumin can survive heat and enzymatic treatment.



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## Lipid transfer protein (LTP)

LTPs are a class of proteins with antimicrobial activities. Rice LTP is a largely cross-reacting antigen, especially with peach and apple.<sup>24</sup> LTP is also pepsin resistant and heat stable, therefore especially harmful for patients who are sensitized to LTPs. A 9kDa LTP, which is highly homologous to Pru p 3, was identified as a major rice antigen and elicited a positive response in a cohort of peach-allergic patients.<sup>25</sup>



## Barley

Barley is the world's oldest cultivated cereal and an important staple in many cuisines. Sprouted barley naturally contains a high level of maltose (a sweetener). Fermented barley is commonly used as an ingredient in beer and other alcoholic beverages. Hordeins are the major storage proteins in barley. They are alcohol-soluble prolamins and rich in glutamine and proline residues, but poor in charge amino acids. Depending on the molecular mass and amino acid composition, there are A, B, γ, C and D hordeins.

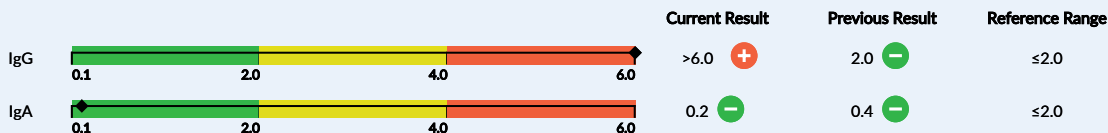
## C hordein

C hordein, together with B hordein, account for over 95% of barley seed storage proteins. C hordein is a group of homologous proteins (50 kDa) that are rich in glutamine, proline and phenylalanine residues. They are homologous to wheat ω-gliadin and contributes to 5% of patients with celiac disease.<sup>26</sup>



## C hordein - ω-gliadin overlap

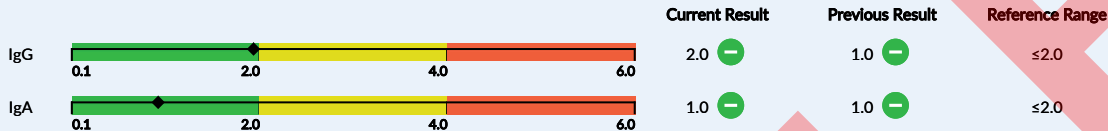
ω-gliadin/C-barley hordein peptide (QFPFQPEQFPFW) exhibits immunodominance in gluten-sensitive T-cell clones from peripheral blood mononuclear cells after wheat and barley challenge.<sup>27</sup> This peptide is comprised of two overlapping celiac disease relevant T-cell epitopes known as DQ2.5-glia-ω1 and DQ2.5-glia-ω2. Individuals who react with this peptide would be sensitive to both barley and wheat.<sup>17</sup>



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## Gamma hordein

$\gamma$ -hordein is homologous to  $\gamma$ -gliadin of wheat.  $\gamma$ -hordein is presented in  $\gamma$ 1-,  $\gamma$ 2-,  $\gamma$ 3-types. Analysis of primary sequences revealed a distant relation between  $\gamma$ 3-hordein to  $\gamma$ 2- and B hordein, while  $\gamma$ 2-hordein is very close to  $\gamma$ -gliadin and  $\gamma$ -secalin in wheat.<sup>28</sup> Individuals who react with this peptide would be sensitive to both barley and wheat.



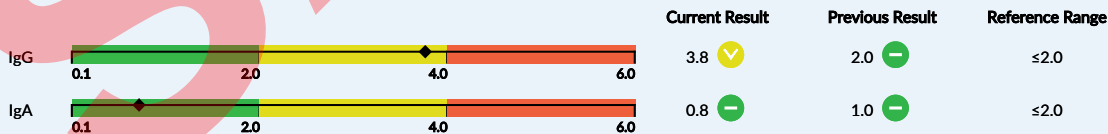
## D hordein

D hordein is homologous to HMW glutenin of wheat.<sup>29</sup> They have been studied in detail due to their importance in the quality and strength of dough. D hordein possesses a similar amino acid composition as HMW glutenin subunits of wheat. It has repeat units such as tripeptides (GQQ), hexapeptides (PGQQQQ), and nonapeptides (GYPTSLQQ). D hordein differs from HMW glutenin subunits in terms of the number and distribution of cysteine residues. Individuals who react with this peptide would be sensitive to both barley and wheat.



## B hordein

B hordeins are the orthologous prolamins family to wheat LMW glutenin subunit group.<sup>30</sup> Most of the B hordein are present in monomeric form or as single polypeptide subunits within the globules of low electron density of endosperm cells along with C,  $\gamma$  1-,  $\gamma$  2- and possibly  $\gamma$  3-hordein polypeptides. Individuals who react with this peptide would be sensitive to both barley and wheat.



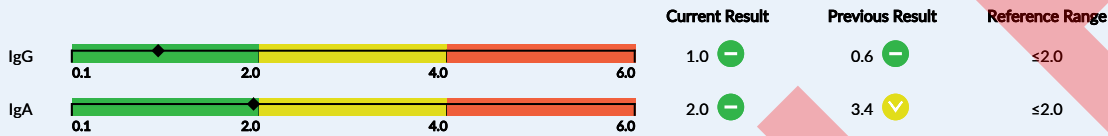
## Rye

Rye is an edible grain that is mainly used to make rye bread and rye whiskey. Because it is difficult to separate the germ and bran from the endosperm, rye flour is generally from its whole grain form and may retain a large quantity of nutrients, in contrast to refined wheat flour. It is rich in carbohydrates and dietary fibre and provides small quantities of protein, potassium, and B vitamins.

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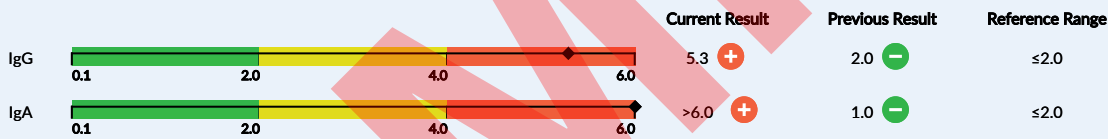
## Omega secalin

Rye prolamins are secalins, which amount to about 50% of total seed proteins in rye.  $\omega$ -secalins are related to S-poor group of prolamins. The repetitive region of  $\omega$ -secalin has an unusual supersecondary structure, similar to that in C hordein of barley. Sec-1 locus is a gene region of  $\omega$ -secalins, which is linked to some dough quality defects such as marked stickiness, reduced strength, and intolerance to overmixing.<sup>31</sup>



## Secalin Gliadin Overlap

Rye-derived peptide (QFPQPQQPIPQ) is an immunodominant peptide that stimulates T-cell clones of PBMCs in celiac disease affected individuals.<sup>32</sup> This peptide lies in epitopes of sec- $\alpha$ -2 /DQ2.5-sec-2 and sec- $\alpha$ -9 /DQ2.5-sec-1 that are recognized by CD4+ T cells.<sup>33</sup> Secalin was shown to elicit toxic reactions in intestinal Caco-2 epithelial cells similarly to gliadin by inducing epithelial cell layer permeability, tight junctional protein occludin and ZO-1 distortion, and actin reorganization.<sup>34</sup>



## HMW Secalin

Rye HMW secalin subunits are homologous to wheat HMW glutenin subunits.<sup>35</sup> Repetitive domain of HMW Secalin subunits contains tripeptides (GQQ), hexapeptides (PGQGQQ), and nonapeptides (GYPTSLQQ), which are also the repetitive central region in wheat HMW glutenin subunits. Individuals who react with this peptide would be sensitive to both rye and wheat.



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## Gamma secalin

The structures of rye  $\gamma$ -secalin are analogues to the  $\gamma$ -type prolamins in wheat (alpha- and gamma-gliadins, B- and C-type LMW glutenin subunits) and barley (B-hordein, gamma-hordein). They have been suggested to elicit symptoms in patients with wheat-dependent, exercise-induced anaphylaxis.<sup>36</sup> It amounts to about 50% of total seed proteins in rye and is sometimes separated from other secalins into distinct types.

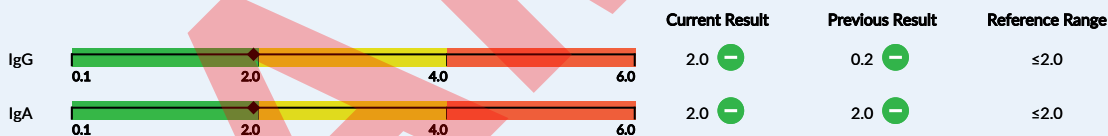


## Buckwheat

Buckwheat is actually a fruit seed but is usually served as an alternative to rice or made into porridge. It is widely used as a grain for people who are sensitive to wheat or other grains that contain protein glutes. It is processed into tea, groats, flour, and noodles. Buckwheat may also improve blood sugar control based on its high mineral and antioxidant content.

## 2s Albumin

Fag e 2 (16 kDa) belongs to the 2S albumin family, a buckwheat seed storage protein. Fag e 2 is a major buckwheat allergen based on the character of the antibody reaction in patients' sera. It has also shown superior diagnostic precision compared to buckwheat extracts with high sensitivity as well as high specificity.<sup>37</sup>



## 13s Globulin

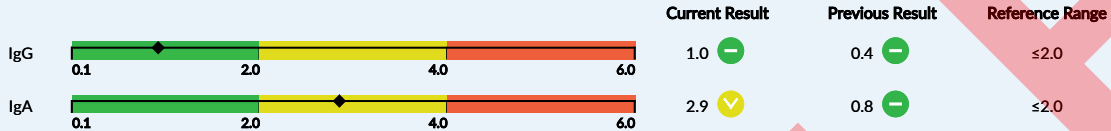
13S globulin, which accounts for 43% of total seed proteins, belongs to the 11S globulin superfamily. Several epitope peptides at its molecular surface remain unaltered in a core structure protected against hydrolysis by digestive proteases and are thus assumed to promote the allergenicity of the 13S globulin. Moreover, overlapped epitopes were observed in soybean 11S globulins, which could account for the cross-reactions between soybean and buckwheat.<sup>38</sup>



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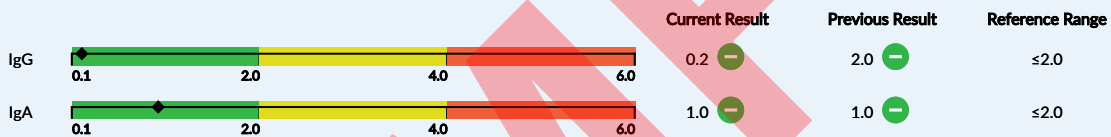
## BWp16 Epitope

Peptide (EGVRDLKE) has been identified as a strong candidate for the linear antibody-binding epitope of BWp16, which is a recognized allergen for buckwheat.<sup>39</sup>



## Peanut-Buckwheat Overlap

Peptide (SDQTRTGY) is an epitope of the peanut allergen oleosin that cross-reacts with buckwheat.<sup>40</sup> Synthetic SDQTRTGY was found to bind with antibodies in the sera of peanut-allergic patients. Individuals who react with this peptide should avoid all plant foods containing oleosin which may induce anaphylactic cross-reactions.



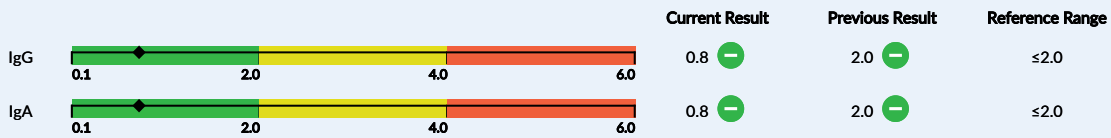
## BW10KD

BW10KD, a member of the 2S Albumin family, has been identified to react with IgE more strongly than with IgG and IgA in 57% of the allergic patients, but not with IgE in nonallergic individuals.<sup>41</sup>



## Fag e 1

Fag e 1 (VVGDEGRSVFDD) is the beta-subunit of the 13S globulin seed storage protein. Fag e 1 is a major antigenic protein of buckwheat, which may cause hypersensitivity reactions.<sup>42</sup> Fag e 1 has been identified as having 8 linear antibody-binding epitopes.<sup>43</sup>



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## Vicilin-like protein

Fag e 5 (55 kDa) is a member of the vicilin-like family of seed storage proteins. It has been identified to have antibody-binding properties, which is in line with previous studies where vicilins from other food sources such as peanut, walnut, and sesame were identified as important allergens.<sup>44</sup>



## Expansin

Expansins are a type of plant cell wall glycoproteins that catalyze cell wall loosening during cell growth and other developmental processes. Several groups of allergens are related to one or both expansin domains.<sup>45</sup> It is relatively resistant to heat and acid and may be the cause of symptoms and cross-reactivity between various plant foods.



## TBb

TBb is a major antigen in tartary buckwheat. The strongest antibody-binding peptides against patients' sera and the critical amino Arg(141) of TBb were revealed through epitope mapping and identification on a 3D model.<sup>46</sup>





## Key Terms/Glossary

### Amino acid

often referred to as the building blocks of proteins, are compounds that play many critical roles in your body.

### Celiac disease

an autoimmune disease that occurs in genetically predisposed individuals where ingestion of gluten damages the microvilli of the small intestines, leading to nutrient malabsorption and serious long term health complications.

### Cross reactivity

the reaction between an antibody and an antigen that differs from the immunogen which originally elicits the antibody production

### Epitope

The region of the antigen where the antibody attaches itself

### Gluten

a substance present in cereal grains, especially wheat, that is responsible for the elastic texture of dough. Gluten is composed of two proteins and may cause illness in people with celiac disease.

### Lysine

An essential amino acid that the human body cannot make and needs to obtain from food. As a medicine, lysine is used for preventing and treating cold sores (caused by the virus called herpes simplex labialis).

### Immune response

The Immune response is the body's response caused by its immune system being activated by antigens. The immune response can include immunity to pathogenic microorganisms and its products, allergies, graft rejections, as well as autoimmunity to self-antigens.

### Phytochemical

Phytochemicals are chemical compounds produced by plants, generally to help them thrive or thwart competitors, predators, or pathogens.

### Proline

Proline is a constituent of many proteins. Found in high concentrations in collagen, proline constitutes almost a third of the residues. Collagen is the main supportive protein of skin, tendons, bones, and connective tissue and promotes their health and healing.

### Seed storage protein

Seed storage proteins are proteins that accumulate significantly in the developing seed, whose main function is to act as a storage reserve for nitrogen, carbon, and sulfur.

## Key Terms/Glossary

### T cell

a type of lymphocyte which develops in the thymus gland and plays a central role in the immune response.

### Tryptophan

An essential amino acid that the human body cannot make and needs to obtain from food. Tryptophan is needed for normal growth in infants and for nitrogen balance in adults.

SAMPLE

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## Risk and Limitations

This test has been developed and its performance characteristics determined by Vibrant America Clinical Laboratory, a CLIA certified lab. These assays have not been cleared or approved by the U.S. Food and Drug Administration.

Vibrant Grain Zoomer panel does not demonstrate absolute positive and negative predictive values for any condition. Its clinical utility has not been fully established. Quantification of specific IgG and IgA antibodies is not an FDA-recognized diagnostic indicator of allergy. Clinical history and current symptoms of the individual must be considered by the healthcare provider prior to any interventions. Test results should be used as one component of a physician's clinical assessment.

Grain Zoomer testing is performed at Vibrant America, a CLIA certified laboratory and utilizes ISO-13485 developed technology. Vibrant America has effective procedures in place to protect against technical and operational problems. However, such problems may still occur. Examples include failure to obtain the result for a specific antibody due to circumstances beyond Vibrant's control. Vibrant may re-test a sample in order to obtain these results but upon re-testing the results may still not be obtained. As with all medical laboratory testing, there is a small chance that the laboratory could report incorrect results. A tested individual may wish to pursue further testing to verify any results.

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