### Celiac Disease HLA DQ Assoc.

**DQ2 (DQA1 0501/0505, DQB1 02XX)**
- **Result:** Negative
- **Code Translation:**
  - **AGUYF:** 24:02/24:06/24:07/24:09N/24:15/24:25/24:26
  - /24:90N/24:95
  - **BSRR:** 01/02/08/09/11
  - **AJKFD:** 06:04/06:34/06:36/06:39/06:52/06:58
  - /06:85/06:86/06:93/06:135/06:155/06:158N/06:160/06:164/06:171/06:180
  - **DB:** 03/10

The patient is not positive for any of the HLA DQ risk alleles. Celiac Disease risk from the HLA DQA/DQB genotype is approximately 1:2518 (<0.04%).

Allele interpretation for all loci based on IMGT/HLA database version 3.11

HLA Lab CLIA ID Number 34D0954530

Greater than 95% of celiac patients are positive for either DQ2 or DQ8 (Sollid and Thorsby, (1993) Gastroenterology 105:910-922). However, these antigens may also be present in patients who do not have Celiac disease.

**Comment:**
This test was performed using Polymerase Chain Reaction/(PCR) Sequence Specific Oligonucleotide Probes (SSOP) (Luminex) technique. Sequence Based Typing (SBT) and/or Sequence Specific Primers (SSP) may be used as supplemental methods when necessary. Please contact HLA Customer Service at 1-800-533-1037 if you have any questions.

Director of HLA Laboratory
Dr George C Maha, PhD
Celiac disease is a chronic immune-mediated inflammatory disorder with multi-systemic manifestations, both gastrointestinal and non-gastrointestinal. In genetically susceptible individuals, ingestion of gluten can cause inflammation and damage to the small intestine mucosa. Celiac disease has an incidence of 1:100 in the United States.

In order for celiac disease to develop, human leukocyte antigen (HLA) molecule DQ2 (encoded by alleles DQA1*0501 or *0505 plus DQB1*0201 or *0202), half of the DQ2 molecule, or DQ8 (encoded DQA*03 plus DQB1*0302) must be present. These molecules confer susceptibility to celiac disease by binding to gluten and interacting with intestinal T cells, leading to a pathologic immune response involving autoimmunity. The familial nature of susceptibility to celiac disease is shown by an 11-18% prevalence of this disorder in siblings of individuals with celiac disease and a 70% concordance rate between identical twins.

Among celiac disease patients, >90% carry DQ2, 5-10% carry DQ8, and the remaining carry half DQ2. The presence of DQ2, half DQ2, or DQ8 alone is not sufficient for a diagnosis of celiac disease. Clinical symptoms, positive test results for endomysial, tissue transglutaminase or deamidated gliadin peptide antibodies, or abnormal small bowel biopsy results all support a diagnosis of celiac disease. Most individuals with a positive genetic result do not develop celiac disease. The risk for developing celiac disease in individuals with a positive genetic result approaches 40% if there is a known first degree relative with celiac disease.

Table: Genetic Risk from HLA-DQA/DQB Genotypes

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>DQ2 + DQ8</td>
<td>1:7 (14.3%)</td>
</tr>
<tr>
<td>DQ2 + DQ2 OR DQ2 Homozygous *02</td>
<td>1:10 (10%)</td>
</tr>
<tr>
<td>DQ8 + DQ8</td>
<td>1:12 (8.4%)</td>
</tr>
<tr>
<td>DQ8 + DQB1*02</td>
<td>1:24 (4.2%)</td>
</tr>
<tr>
<td>Homozygous DQB*02</td>
<td>1:26 (3.8%)</td>
</tr>
<tr>
<td>DQ2 alone</td>
<td>1:35 (2.9%)</td>
</tr>
</tbody>
</table>
From Megiorni et al. 2009 for all genotypes except DQ8 + DQ8
DQ8 + DQ8 risk is from Pietzak et al. 2009

Other influences on risk for celiac disease
The overall risk for an individual to develop celiac disease is influenced not just by genetic risk from the HLA-DQA/DQB genotype, but by presence of symptoms of celiac disease, positive results for celiac antibody tests or intestinal biopsy, and having relatives with celiac disease. Celiac disease risk is also higher in individuals with IgA deficiency, Down syndrome, Turner syndrome, and the autoimmune disorders Type I diabetes mellitus, Sjogren syndrome, and thyroiditis. There are also additional genetic influences on the development of celiac disease in individuals predisposed to the disorder.

References:
<table>
<thead>
<tr>
<th>Account Number</th>
<th>Patient ID</th>
<th>Control Number</th>
<th>Date and Time Collected</th>
<th>Date Reported</th>
<th>Sex</th>
<th>Age(Y/M/D)</th>
<th>Date of Birth</th>
</tr>
</thead>
<tbody>
<tr>
<td>90000999</td>
<td></td>
<td></td>
<td>08/25/16 00:00</td>
<td></td>
<td>F</td>
<td>36/07/15</td>
<td>01/10/80</td>
</tr>
</tbody>
</table>

©2004−16 Laboratory Corporation of America ® Holdings
All Rights Reserved

For inquiries, the physician may contact Branch: 800−222−7566  Lab: 336−222−7566

08/31/16 11:35 ET  DUPLICATE FINAL REPORT

This document contains private and confidential health information protected by state and federal law.
If you have received this document in error, please call 800−222−7566
Celiac Disease HLA DQA/DQB Association

Result: NEGATIVE for celiac-associated allele(s)

Genetic Risk: Extremely Low

1:2518

Extremely Low  Low  Moderate  Elevated

1:1000  1:100  1:10

HLA DQ alleles detected

DQA1*01:BSRR, 01:DB
DQB1*06:AGUYF, 06:AKJD

DQ2

DQA1*05:01/05:05
DQB1*02:01/02:02
NEGATIVE
NEGATIVE
NEGATIVE for DQ2

DQ8

DQA1*03:XX
DQB1*03:02
NEGATIVE
NEGATIVE
NEGATIVE for DQ8

HLA allele interpretation based on IMGT/HLA database version 3.21

The patient is not positive for any of the HLA DQ risk alleles. Celiac Disease risk from the HLA DQA/DQB genotype is approximately 1:2518 (<0.04%).

Code/G Group Translation

AJKFD  06:04/06:34/06:36/06:38/06:39/06:52/06:58/06:85/06:86/06:93/06:135/06:155/06:158N/06:160/06:164
       /06:171/06:180
BSRR   01/02/08/09/11
DB     03/10

The range of genetic risk for individuals with a celiac disease-associated genotype is 1:1842 (0.05%) to 1:7 (14.3%). See table "Genetic Risk for HLA-DQA/DQB Genotypes" on page 2.

The ACTUAL risk for this individual to have celiac disease may be significantly higher if there are symptoms of celiac disease, positive results from celiac antibody tests, positive intestinal biopsy, or family members with celiac disease.

Greater than 90% of celiac patients are positive for DQ2, 5-10% carry DQ8, and the remaining carry half of the DQ molecules (Green and Cellier, 2007). However, the majority of individuals positive for celiac-associated HLA alleles do not develop celiac disease, and detection of these alleles alone is not sufficient for a diagnosis of celiac disease. Relatives of individuals positive for one or more celiac-associated HLA alleles are also at risk for being positive.

This test was performed using a Polymerase Chain Reaction (PCR) Sequence Specific Oligonucleotide Probes (SSOP) technique on the Luminelex platform. This test has been cleared by the U.S. Food and Drug Administration. Analytic sensitivity and specificity are >99.9%. Sequence-based Typing (SBT) and/or Sequence Specific Primers (SSP) may be used as supplemental methods when necessary. This test evaluates HLA-DQA and DQB genotypes and cannot detect abnormalities elsewhere in the genome. It should be realized that there are many possible sources of diagnostic error including sample misidentification, rare technical errors, trace contamination of PCR reactions, and rare genetic variants that interfere with analysis.

©2014 Laboratory Corporation of America® Holdings
All Rights Reserved
INFORMATION ABOUT CELIAC DISEASE GENETICS

Celiac disease is a chronic immune-mediated inflammatory disorder with multi-systemic manifestations, both gastrointestinal and non-gastrointestinal. In genetically susceptible individuals, ingestion of gluten can cause inflammation and damage to the small intestine mucosa. Celiac disease has an incidence of 1:100 in the United States.

In order for celiac disease to develop, human leukocyte antigen (HLA) molecule DQ2 (encoded by alleles DQA1*0501 or *0505 plus DQB1*0201 or *0202), half of the DQ2 molecule, or DQ8 (encoded DQA*03 plus DQB1*0302) must be present. These molecules confer susceptibility to celiac disease by binding to gluten and interacting with intestinal T cells, leading to a pathologic immune response involving autoimmunity. The familial nature of susceptibility to celiac disease is shown by an 11-18% prevalence of this disorder in siblings of individuals with celiac disease and a 70% concordance rate between identical twins.

Among celiac disease patients, >90% carry DQ2, 5-10% carry DQ8, and the remaining carry half DQ2. The presence of DQ2, half DQ2, or DQ8 alone is not sufficient for a diagnosis of celiac disease. Clinical symptoms, positive test results for endomysial, tissue transglutaminase or deamidated gliadin peptide antibodies, or abnormal small bowel biopsy results all support a diagnosis of celiac disease. Most individuals with a positive genetic result do not develop celiac disease. The risk for developing celiac disease in individuals with a positive genetic result approaches 40% if there is a known first degree relative with celiac disease.

Genetic Risk from HLA-DQA/DQB Genotypes

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>DQ2 + DQ8</td>
<td>1:7 (14.3%)</td>
</tr>
<tr>
<td>DQ2 + DQ2 OR DQ2 Homozygous *02</td>
<td>1:10 (10%)</td>
</tr>
<tr>
<td>DQ8 + DQ8</td>
<td>1:12 (8.4%)</td>
</tr>
<tr>
<td>DQ8 + DQ81*02</td>
<td>1:24 (4.2%)</td>
</tr>
<tr>
<td>Homozygous DQ8*02</td>
<td>1:26 (3.8%)</td>
</tr>
<tr>
<td>DQ2 alone</td>
<td>1:35 (2.9%)</td>
</tr>
<tr>
<td>DQ8 alone</td>
<td>1:89 (1.1%)</td>
</tr>
<tr>
<td>Population risk (genotype unknown)</td>
<td>1:100 (1%)</td>
</tr>
<tr>
<td>1/2 DQ2: DQ81*02</td>
<td>1:210 (0.5%)</td>
</tr>
<tr>
<td>1/2 DQ2: DQA1*05</td>
<td>1:184 (0.05%)</td>
</tr>
<tr>
<td>No HLA-DQA/DQ8 susceptibility alleles</td>
<td>1:2518 (&lt;0.04%)</td>
</tr>
</tbody>
</table>

From Megiorni et al. 2009 for all genotypes except DQ8+DQ8
DQ8+DQ8 risk is from Pietzak et al. 2009

Other influences on risk for celiac disease

The overall risk for an individual to develop celiac disease is influenced not just by genetic risk from the HLA-DQA/DQB genotype, but by presence of symptoms of celiac disease, positive results for celiac antibody tests or intestinal biopsy, and having relatives with celiac disease. Celiac disease risk is also higher in individuals with IgA deficiency, Down syndrome, Turner syndrome, and the autoimmune disorders Type I diabetes mellitus, Sjogren syndrome, and thyroiditis. There are also additional genetic influences on the development of celiac disease in individuals predisposed to the disorder.

REFERENCES

### Celiac Disease HLA DQ Assoc.

**DQ2** (DQA1 0501/0505, DQB1 02XX)
- **Flag:** Negative
  - **Result:** 01

**DQ8** (DQA1 03XX, DQB1 0302)
- **Flag:** Positive
  - **Result:** 01

**Final Results:**
- DQA1*02:01,03:MN
- DQB1*02:YE,03:AJGCV

**Code Translation:**
- YE: 02/12
- AJGCV: 03:02/03:85/03:90N/03:190
- MN: 01/02/03

The patient is positive for DQ8 and DQB1*02. Celiac disease risk from the HLA DQA/DQB genotype is approximately 1:24 (4.2%).

**Allele interpretation for all loci based on IMGT/HLA database version 3.11**
- HLA Lab CLIA ID Number 34D0954530
- Greater than 95% of celiac patients are positive for either DQ2 or DQ8 (Sollid and Thorsby, (1993) Gastroenterology 105:910-922). However, these antigens may also be present in patients who do not have Celiac disease.

**Comment:**
- This test was performed using Polymerase Chain Reaction/(PCR) Sequence Specific Oligonucleotide Probes (SSOP) (Luminex) technique.
- Sequence Based Typing (SBT) and/or Sequence Specific Primers (SSP) may be used as supplemental methods when necessary. Please contact HLA Customer Service at 1-800-533-1037 if you have any questions.

**Additional Information:**
- Celiac disease is a chronic immune-mediated inflammatory disorder with multi-systemic manifestations, both gastrointestinal and non-gastrointestinal. In genetically susceptible individuals, ingestion of gluten can cause inflammation and damage to the small intestine.
mucosa. Celiac disease has an incidence of 1:100 in the United States.

In order for celiac disease to develop, human leukocyte antigen (HLA) molecule DQ2 (encoded by alleles DQA1*0501 or *0505 plus DQB1*0201 or *0202), half of the DQ2 molecule, or DQ8 (encoded DQA*03 plus DQB1*0302) must be present. These molecules confer susceptibility to celiac disease by binding to gluten and interacting with intestinal T cells, leading to a pathologic immune response involving autoimmunity. The familial nature of susceptibility to celiac disease is shown by an 11−18% prevalence of this disorder in siblings of individuals with celiac disease and a 70% concordance rate between identical twins.

Among celiac disease patients, >90% carry DQ2, 5−10% carry DQ8, and the remaining carry half DQ2. The presence of DQ2, half DQ2, or DQ8 alone is not sufficient for a diagnosis of celiac disease. Clinical symptoms, positive test results for endomysial, tissue transglutaminase or deamidated gliadin peptide antibodies, or abnormal small bowel biopsy results all support a diagnosis of celiac disease. Most individuals with a positive genetic result do not develop celiac disease. The risk for developing celiac disease in individuals with a positive genetic result approaches 40% if there is a known first degree relative with celiac disease.

Table: Genetic Risk from HLA-DQA/DQB Genotypes

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>DQ2 + DQ8</td>
<td>1:7 (14.3%)</td>
</tr>
<tr>
<td>DQ2 + DQ2 OR DQ2 Homozygous *02</td>
<td>1:10 (10%)</td>
</tr>
<tr>
<td>DQ8 + DQ8</td>
<td>1:12 (8.4%)</td>
</tr>
<tr>
<td>DQ8 + DQB1*02</td>
<td>1:24 (4.2%)</td>
</tr>
<tr>
<td>Homozygous DQB*02</td>
<td>1:26 (3.8%)</td>
</tr>
<tr>
<td>DQ2 alone</td>
<td>1:35 (2.9%)</td>
</tr>
<tr>
<td>DQ8 alone</td>
<td>1:89 (1.1%)</td>
</tr>
<tr>
<td>Population risk (genotype unknown)</td>
<td>1:100 (1%)</td>
</tr>
<tr>
<td>1/2 DQ2:DQB1*02</td>
<td>1:210 (0.5%)</td>
</tr>
</tbody>
</table>
From Megiorni et al. 2009 for all genotypes except DQ8 + DQ8
DQ8 + DQ8 risk is from Pietzak et al. 2009

Other influences on risk for celiac disease
The overall risk for an individual to develop celiac disease is influenced not just by genetic risk from the HLA-DQA/DQB genotype, but by presence of symptoms of celiac disease, positive results for celiac antibody tests or intestinal biopsy, and having relatives with celiac disease. Celiac disease risk is also higher in individuals with IgA deficiency, Down syndrome, Turner syndrome, and the autoimmune disorders Type I diabetes mellitus, Sjogren syndrome, and thyroiditis. There are also additional genetic influences on the development of celiac disease in individuals predisposed to the disorder.

References:
Celiac Disease HLA DQA/DQB Association

Result: POSITIVE for celiac-associated allele(s)

Genetic Risk: Moderate

![1:24]

<table>
<thead>
<tr>
<th>HLA DQ alleles detected</th>
<th>DQA1*02:01, 03:MN</th>
<th>DQB1*02:YE, 03:AJGCV</th>
</tr>
</thead>
<tbody>
<tr>
<td>DQ2</td>
<td>DQA1*05:01/05:05</td>
<td>NEGATIVE</td>
</tr>
<tr>
<td></td>
<td>DQB1*02:01/02:02</td>
<td>POSITIVE, one copy</td>
</tr>
<tr>
<td>DQ8</td>
<td>DQA1*03:XX</td>
<td>POSITIVE, one copy</td>
</tr>
<tr>
<td></td>
<td>DQB1*03:02</td>
<td>POSITIVE, one copy</td>
</tr>
</tbody>
</table>

HLA allele interpretation based on IMGT/HLA database version 3.2.1

The patient is positive for DQ8 and DQB1*02. Celiac Disease risk from the HLA DQA/DQB genotype is approximately 1:24 (4.2%) 

Code/G Group Translation

AJGCV 03:02/03:85/03:90N/03:190
MN 01/02/03
YE 02/12

The range of genetic risk for individuals with a celiac disease-associated genotype is 1:1842 (0.05%) to 1:7 (14.3%). See table "Genetic Risk from HLA-DQA/DQB Genotypes" on page 2.

The ACTUAL risk for this individual to have celiac disease may be significantly higher if there are symptoms of celiac disease, positive results from celiac antibody tests, positive intestinal biopsy, or family members with celiac disease.

Greater than 90% of celiac patients are positive for DQ2, 5-10% carry DQ8, and the remaining carry half of the DQ molecules (Green and Cellier, 2007). However, the majority of individuals positive for celiac-associated HLA alleles do not develop celiac disease, and detection of these alleles alone is not sufficient for a diagnosis of celiac disease. Relatives of individuals positive for one or more celiac-associated HLA alleles are also at risk for being positive.

This test was performed using a Polymerase Chain Reaction (PCR) Sequence Specific Oligonucleotide Probes (SSOP) technique on the Luminex platform. This test has been cleared by the U.S. Food and Drug Administration. Analytic sensitivity and specificity are >99.9%. Sequence-based Typing (SBT) and/or Sequence Specific Primers (SSP) may be used as supplemental methods when necessary. This test evaluates HLA-DQA and DQB genotypes and cannot detect abnormalities elsewhere in the genome. It should be realized that there are many possible sources of diagnostic error including sample misidentification, rare technical errors, trace contamination of PCR reactions, and rare genetic variants that interfere with analysis.

©2014 Laboratory Corporation of America® Holdings
All Rights Reserved
INFORMATION ABOUT CELIAC DISEASE GENETICS
Celiac disease is a chronic immune-mediated inflammatory disorder with multi-systemic manifestations, both gastrointestinal and non-gastrointestinal. In genetically susceptible individuals, ingestion of gluten can cause inflammation and damage to the small intestine mucosa. Celiac disease has an incidence of 1:100 in the United States.

In order for celiac disease to develop, human leukocyte antigen (HLA) molecule DQ2 (encoded by alleles DQA1*0501 or *0505 plus DQB1*0201 or *0202), half of the DQ2 molecule, or DQ8 (encoded DQA*03 plus DQB1*0302) must be present. These molecules confer susceptibility to celiac disease by binding to gluten and interacting with intestinal T cells, leading to a pathologic immune response involving autoimmunity. The familial nature of susceptibility to celiac disease is shown by an 11-18% prevalence of this disorder in siblings of individuals with celiac disease and a 70% concordance rate between identical twins.

Among celiac disease patients, >90% carry DQ2, 5-10% carry DQ8, and the remaining carry half DQ2. The presence of DQ2, half DQ2, or DQ8 alone is not sufficient for a diagnosis of celiac disease. Clinical symptoms, positive test results for endomysial, tissue transglutaminase or deamidated gliadin peptide antibodies, or abnormal small bowel biopsy results all support a diagnosis of celiac disease. Most individuals with a positive genetic result do not develop celiac disease. The risk for developing celiac disease in individuals with a positive genetic result approaches 40% if there is a known first degree relative with celiac disease.

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>DQ2 + DQ8</td>
<td>1:7 (14.3%)</td>
</tr>
<tr>
<td>DQ2 + DQ2 OR DQ2 Homozygous *02</td>
<td>1:10 (10%)</td>
</tr>
<tr>
<td>DQ8 + DQ8</td>
<td>1:12 (8.4%)</td>
</tr>
<tr>
<td>DQ8 + DQB1*02</td>
<td>1:24 (4.2%)</td>
</tr>
<tr>
<td>Homozygous DQ8*02</td>
<td>1:26 (3.8%)</td>
</tr>
<tr>
<td>DQ2 alone</td>
<td>1:35 (2.9%)</td>
</tr>
<tr>
<td>DQ8 alone</td>
<td>1:89 (1.1%)</td>
</tr>
<tr>
<td>Population risk (genotype unknown)</td>
<td>1:100 (1%)</td>
</tr>
<tr>
<td>1/2 DQ2: DQB1*02</td>
<td>1:210 (0.5%)</td>
</tr>
<tr>
<td>1/2 DQ2: DQA1*05</td>
<td>1:1842 (0.05%)</td>
</tr>
<tr>
<td>No HLA-DQA/DQB susceptibility alleles</td>
<td>1:2518 (&lt;0.04%)</td>
</tr>
</tbody>
</table>

From Megiorni et al. 2009 for all genotypes except DQ8+DQ8
DQ8+DQ8 risk is from Pietzak et al. 2009

Other influences on risk for celiac disease
The overall risk for an individual to develop celiac disease is influenced not just by genetic risk from the HLA-DQA/DQB genotype, but by presence of symptoms of celiac disease, positive results for celiac antibody tests or intestinal biopsy, and having relatives with celiac disease. Celiac disease risk is also higher in individuals with IgA deficiency, Down syndrome, Turner syndrome, and the autoimmune disorders Type I diabetes mellitus, Sjogren syndrome, and thyroiditis. There are also additional genetic influences on the development of celiac disease in individuals predisposed to the disorder.

REFERENCES