Calculating PDCAAS for %DV Protein
Genesis R&D®

Presented by ESHA Research

Wednesday, August 14, 2019
11:00 AM PDT | 1:00 PM CDT | 2:00 PM EDT
ESHA Research

ESHA Research was established in 1981 as one of the very first nutrition software solutions. Today, ESHA’s suite of nutritional software products, services, and databases are recognized as the industry’s top choice for food and supplement formulation, recipe development, labeling, nutritional analysis, and regulatory compliance.

**ESHA Solutions**
- Genesis R&D® Food Formulation
- Genesis R&D® Supplement Formulation
- Food Processor® Nutrition & Diet Analysis
- Consulting Services

Our mission is to help remove the complexity of product development and regulatory compliance for the food, beverage, and supplement industries through software, services, and nutritional databases.
Genesis R&D Foods

Genesis R&D® Foods, first released in 1991, is designed to help users manage processes, overcome industry challenges, and meet federal requirements. Industry professionals use Genesis R&D for quick and accurate nutrient evaluation, virtual product development, nutrition labeling, and regulatory compliance.

• Product Development
• Formulation Analysis
• Menu Analysis
• Reporting
• Regulatory Compliance
Upcoming Webinars

Top Genesis R&D User Q&A’s | September 25, 2019
Taken from user feedback, this session covers the most common questions we get from users about working with the software. In addition we will cover questions you ask during registration and during the live session.

Menu Labeling Practical Applications and Best Practices in Genesis R&D | October 23, 2019
Genesis R&D takes the hassle out of complying with the FDA’s menu labeling regulations. During this webinar, we will walk you through using the Menu Label Module to evaluate and display calories and nutrition content for your menu items. We will also discuss best practices for meeting the regulatory requirements.

To register or view archived webinars please visit: www.esha.com/news-events/webinars
Please Note!

✓ The webinar is being recorded
✓ All webinars available on our website
✓ Submit your questions in the GoToWebinar control panel
What we’ll cover today

• %DV Protein on Nutrition Facts Label
• U.S. Labeling Regulations for Protein
• Protein and Amino Acids
• Calculating PDCAAS
• How to Display %DV on Nutrition Facts Label in Genesis R&D
• Q&A
ATTENDEE POLL

What method do you *primarily* use to determine PDCAAS?
%DV Protein on U.S. Nutrition Facts Label

%DV for Protein mandatory in some cases, voluntary in others

An additional factor is required to calculate %DV
U.S. Labeling Regulations for Protein

U.S. labeling regulations

Per the CFR you must report %DV for Protein:

• On product labels for infants (age 0 – 12 months)
• On product labels for children (age 1 – 3 years)
• On products that make a claim about protein – includes adult labels (ages 4+)
Protein Daily Reference Value & %DV

• Protein Dietary Reference Value (DRV) for U.S. adults = 50g
• %DV is *not necessarily*: Protein g / DRV for protein
• The %DV for protein on the U.S. label factors in the digestibility of the protein
• Protein digestibility essentially means how our bodies access and use the protein provided by the foods we consume
PER vs PDCAAS

The CFR indicates that we use a PER or PDCAAS to report the %DV for Protein on the label

• PER (Protein Efficiency Ratio)
  • Lab determined value
  • Used for infant labels (age 0 – 12 months)
  • Value of 0 – 2.5

• PDCAAS (Protein Digestibility Corrected Amino Acid Score)
  • Lab determined value or can be calculated
  • Used for child (age 1 – 3 years) and adult (age 4+ years) labels
  • Value of 0 – 1

Protein

- Energy
- Necessary for creating, supporting, and maintaining structure within cells
- Necessary for building and repairing tissue
- Hormone production
- Enzymes
Sources of Protein

Protein comes from a variety of animal- and plant-based sources

• Meat, poultry, fish, eggs, milk, soybeans, quinoa
• Combinations of plant protein sources
Amino Acids

- Referred to as the “building blocks” of protein
- Our bodies can make/synthesize some amino acids
- Amino acids that our bodies cannot make must be obtained from outside sources, e.g. by eating food
  - Known as Essential Amino Acids aka indispensable
  - 9 essential amino acids
  - Cystine and Tyrosine also get special billing as complementary and considered necessary in some conditions and for some age groups
Complete vs. Incomplete Protein

• A complete protein contains all nine essential amino acids in the correct proportions our bodies need

• An incomplete protein does not have enough of one or more of the essential amino acids

• A food can contain complete protein (all amino acids meet or exceed their respective ratios), but due to digestibility factor(s), it can still have a PDCAAS of <1
Protein Digestibility Factors

• Referred to as a percent or as value: 79% = .79 factor
• For a plain ingredient use one protein digestibility factor
• When calculating PDCAAS for a combination food, must account for the various digestibility factors of the individual ingredients
Determining PDCAAS

• If all your protein comes from one ingredient or from one source (e.g. pea protein in multiple ingredients), and you have the PDCAAS for your protein, enter the PDCAAS in Genesis R&D.

• If your protein comes from multiple ingredients and multiple sources of protein, determine PDCAAS from:
  • Lab analysis
  • Calculation
Calculations Needed for PDCAAS

**PDCAAS** = (amino acid score X recipe protein digestibility)

**Recipe Protein Digestibility** = \[\left(\text{percent ingredient}1\text{ protein in recipe} \times \text{ingredient}1\text{ protein digestibility}\right) + \left(\text{percent ingredient}2\text{ protein in recipe} \times \text{ingredient}2\text{ protein digestibility}\right) + ...\]

Recipe Protein Digestibility: weighted protein digestibility, factoring in the contributions of each ingredient to the total protein and each ingredient’s individual protein digestibility
Calculate PDCAAS – Gather this Information

1. Amino acid data
2. Percent Protein for each ingredient
3. Protein Digestibility Factors
4. Amino Acid Score
5. Recipe Protein Digestibility
Amino Acids - View the Spreadsheet Report

- Need amino acid data for ingredients that contribute to the total protein of your Recipe
  - Request this from your suppliers or refer to items in the ESHA database that reference the USDA SR database.
  - You do not need amino acid data for ingredients that contain zero protein.
- Nutrients to View – Basic Protein and Amino Acids

<table>
<thead>
<tr>
<th>Item Name</th>
<th>Quantity</th>
<th>Measure</th>
<th>Weight (g)</th>
<th>Calories (kcal)</th>
<th>Protein (g)</th>
<th>Alanine (g)</th>
<th>Arginine (g)</th>
<th>Aspartate (g)</th>
<th>Cysteine (g)</th>
<th>Glutamate (g)</th>
<th>Glycine (g)</th>
<th>Histidine (g)</th>
<th>Isoleucine (g)</th>
<th>Leucine (g)</th>
<th>Lysine (g)</th>
<th>Methionine (g)</th>
<th>Phenylalanine (g)</th>
<th>Tyrosine (g)</th>
<th>Valine (g)</th>
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<tbody>
<tr>
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<td>15.95</td>
<td>62.65</td>
<td>2.69</td>
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<td>0.19</td>
<td>0.23</td>
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<td>0.59</td>
<td>0.13</td>
<td>0.06</td>
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<td>0.06</td>
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<td>0.18</td>
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<td>0.06</td>
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<td>0.23</td>
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<tr>
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<td>0.408998 Gram</td>
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<td>0.60</td>
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<td>--</td>
<td>--</td>
</tr>
<tr>
<td>brown rice syrup</td>
<td>2.04499</td>
<td>Gram</td>
<td>2.04</td>
<td>6.97</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>egg white, dried</td>
<td>2.45399</td>
<td>Gram</td>
<td>2.45</td>
<td>9.37</td>
<td>1.99</td>
<td>0.11</td>
<td>0.11</td>
<td>0.20</td>
<td>0.05</td>
<td>0.26</td>
<td>0.07</td>
<td>0.11</td>
<td>0.17</td>
<td>0.14</td>
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<td>0.07</td>
<td>0.12</td>
<td>0.08</td>
<td>0.14</td>
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<tr>
<td>water, distilled</td>
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<td>Gram</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
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<td>0.00</td>
</tr>
<tr>
<td>cinnamon, ground SPM</td>
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<td>Gram</td>
<td>0.33</td>
<td>1.16</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>almonds, slivered</td>
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<td>Gram</td>
<td>2.45</td>
<td>14.21</td>
<td>0.52</td>
<td>0.02</td>
<td>0.06</td>
<td>0.06</td>
<td>0.00</td>
<td>0.14</td>
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<td>0.01</td>
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<td>0.01</td>
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<tr>
<td>applesauce, unsweetened</td>
<td>7.38196</td>
<td>Gram</td>
<td>7.38</td>
<td>3.69</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1 Serving</strong></td>
<td><strong>40.60</strong></td>
<td><strong>113.51</strong></td>
<td><strong>9.54</strong></td>
<td><strong>0.45</strong></td>
<td><strong>0.68</strong></td>
<td><strong>0.99</strong></td>
<td><strong>0.17</strong></td>
<td><strong>1.86</strong></td>
<td><strong>0.41</strong></td>
<td><strong>0.23</strong></td>
<td><strong>0.45</strong></td>
<td><strong>0.45</strong></td>
<td><strong>0.74</strong></td>
<td><strong>0.52</strong></td>
<td><strong>0.18</strong></td>
<td><strong>0.51</strong></td>
<td><strong>0.49</strong></td>
<td><strong>0.50</strong></td>
</tr>
</tbody>
</table>

% Recommendation (US Label Adult (2016))

20
Percent Protein from Each Ingredient

- View the **Single Nutrient report** in Genesis R&D set to Protein to identify the % protein that each ingredient contributes to the total protein.
- Some ingredients will contribute zero.
Protein Digestibility Factors

- If protein digestibility is not reported by ingredient supplier, then request from the supplier.
- If supplier cannot provide protein digestibility, then your organization needs to determine the protocol for filling in blanks.
- Obtain general protein digestibility factors from reputable sources and specific research articles:
  - FAO/WHO references
  - ESHA maintains a list
- If encountering different factors for one ingredient, consider the form of your ingredient and the source that best supports your ingredients.

A list of PDCAAS and protein digestibility citations is available at [www.esha.com/pdcaas-protein-digestibility-list](http://www.esha.com/pdcaas-protein-digestibility-list)
Amino Acid Score - Protein Quality Report

• Essential (indispensable) Amino Acids
• Score – shows a score for each amino acid
  • The amino acid reporting the lowest score, gives us the amino acid score for the Recipe
  • If there is an amino acid showing <100%, this indicates an incomplete protein
• Actual Ratio
  • Each Amino Acid (mg) per Protein (g)
• Ideal Ratio (for U.S. labeling purposes)
  • 1985 FAO/WHO/UNU suggested pattern of amino acid requirements of a 2- to 5-year-old child
Recipe Protein Digestibility

Recipe Protein Digestibility =
   (percent ingredient1 protein in recipe X ingredient1 protein digestibility)
   + (percent ingredient2 protein in recipe X ingredient2 protein digestibility)
   + (percent ingredient3 protein in recipe X ingredient3 protein digestibility)
   and so on...

For each ingredient:

• **Percent ingredient protein in recipe**: from the Single Nutrient report
• **Ingredient protein digestibility**: from a protein digestibility reference
## Example Recipe

### Apple Cinnamon Protein Bars

**Number of Servings:** 12.22 (40 g per serving)

**Weight:** 489.00 g

<table>
<thead>
<tr>
<th>Item Name</th>
<th>Quantity</th>
<th>Measure</th>
<th>ESHA Code</th>
<th>% Weight</th>
<th>Gov. Code</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>oats, rolled, dry</td>
<td>195 Gram</td>
<td></td>
<td></td>
<td>39.88</td>
<td>AmGrains</td>
<td></td>
</tr>
<tr>
<td>applesauce, unsweetened</td>
<td>90 Gram</td>
<td></td>
<td>7517</td>
<td>18.40</td>
<td>LFG</td>
<td></td>
</tr>
<tr>
<td>protein isolate, soy</td>
<td>60 Gram</td>
<td></td>
<td>90073</td>
<td>12.27</td>
<td>16122 USDA</td>
<td></td>
</tr>
<tr>
<td>water, distilled</td>
<td>50 Gram</td>
<td></td>
<td>19609</td>
<td>6.13</td>
<td>1173 USDA</td>
<td></td>
</tr>
<tr>
<td>egg white, dried</td>
<td>30 Gram</td>
<td></td>
<td>4503</td>
<td>6.13</td>
<td>12061 USDA</td>
<td></td>
</tr>
<tr>
<td>almonds, slivered</td>
<td>30 Gram</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>brown rice syrup</td>
<td>25 Gram</td>
<td></td>
<td></td>
<td>5.11</td>
<td></td>
<td>Sweet Stuff</td>
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<tr>
<td>baking powder, double acting, straight phosphate</td>
<td>5 Gram</td>
<td></td>
<td>28046</td>
<td>1.02</td>
<td>18370 USDA</td>
<td></td>
</tr>
<tr>
<td>cinnamon, ground SPM</td>
<td>4 Gram</td>
<td></td>
<td></td>
<td>0.82</td>
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<td></td>
</tr>
</tbody>
</table>
Example Recipe – Spreadsheet: Amino Acids

- Nutrients to View – Basic Protein and Amino Acids
- Review the Spreadsheet to ensure no dashes in essential amino acids
Example Recipe - Percent Protein

- View the **Single Nutrient report** in Genesis R&D set to Protein to identify the % protein that each ingredient contributes to the total protein.
- Some ingredients contribute zero percent protein by nature or because the ingredients occur in minimal amounts per serving.
## Protein Digestibility Factors

<table>
<thead>
<tr>
<th>Food</th>
<th>PDCAAS</th>
<th>Protein Digestibility</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>oats, sugared flakes</td>
<td>0.67</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>oat, flakes</td>
<td>0.7</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>oat, extruded oat/wheat</td>
<td>0.76</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>oat cereal</td>
<td>0.89</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>oats, quick</td>
<td>0.82</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>oats, oatmeal</td>
<td>0.9</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>oats, rolled</td>
<td>0.57</td>
<td>0.91</td>
<td>3</td>
</tr>
<tr>
<td>pea flour</td>
<td>0.69</td>
<td>0.88</td>
<td>3</td>
</tr>
<tr>
<td>pea protein concentrate</td>
<td>0.73</td>
<td>0.92</td>
<td>3</td>
</tr>
<tr>
<td>peanut</td>
<td>0.693</td>
<td>0.9114</td>
<td>5</td>
</tr>
<tr>
<td>peanut butter</td>
<td></td>
<td>0.98</td>
<td>3</td>
</tr>
<tr>
<td>peanut flour</td>
<td></td>
<td>0.93</td>
<td>27</td>
</tr>
<tr>
<td>peanut meal</td>
<td>0.52</td>
<td>0.94</td>
<td>3</td>
</tr>
<tr>
<td>peas</td>
<td>0.69</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>
Example Recipe - Record Percent Total Protein and Digestibility Factors

Identify the percent that each ingredient contributes to the total protein (Single Nutrient report) and the Protein Digestibility factor for each ingredient that contributes to total protein (from a reliable source)

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percent Protein</th>
<th>Digestibility Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soy Protein Isolate</td>
<td>45.44</td>
<td>.98</td>
</tr>
<tr>
<td>Oats</td>
<td>28.24</td>
<td>.91</td>
</tr>
<tr>
<td>Egg White</td>
<td>20.86</td>
<td>1</td>
</tr>
<tr>
<td>Almonds</td>
<td>5.44</td>
<td>.88</td>
</tr>
</tbody>
</table>
Let’s Do Some Math!!!
Example Recipe - Recipe Protein Digestibility

- **Recipe Protein Digestibility**
  Multiply each ingredient’s % total protein X its respective digestibility factor

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percent Protein expressed as decimal</th>
<th>Digestibility Factor</th>
<th>Ingredient Digestibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soy Protein Isolate</td>
<td>.4544</td>
<td>X .98</td>
<td>= .4453</td>
</tr>
<tr>
<td>Oats</td>
<td>.2824</td>
<td>X .91</td>
<td>= .2570</td>
</tr>
<tr>
<td>Egg Whites</td>
<td>.2086</td>
<td>X 1</td>
<td>= .2086</td>
</tr>
<tr>
<td>Almonds</td>
<td>.0544</td>
<td>X .88</td>
<td>= .0479</td>
</tr>
</tbody>
</table>

• **Add the ingredient digestibilities:**
  .4453 + .2570 + .2086 + .0479 = .9588
  Recipe Protein Digestibility = .9588

Recipe Protein Digestibility can be >1
Example Recipe - Amino Acid Score

• Limiting amino acid (from Protein Quality report) for this recipe is Lysine at 93% or .93
Example Recipe - Calculating PDCAAS

- PDCAAS = Amino Acid Score \times \text{Recipe Protein Digestibility}

- Amino Acid Score = .93 from Lysine
  - From Protein Quality report
- Recipe Protein Digestibility = .9588

\[ .93 \times .9588 = \]

- PDCAAS = .93 \times .9588 = .8917
  - Enter this is Genesis R&D
  - If PDCAAS calculates to >1, enter 1
How to Display %DV on Label in Genesis R&D

- Open Recipe
- View Label
- Edit Label
  - Nutrient Options
    - Protein
    - Enter PDCAAS
    - Show Percent DV Protein
Label with %DV Protein

- View Label
- %DV calculates using the unrounded Protein g
- \((\text{Protein g} \times \text{PDCAAS}) / 50 \text{ g}\)

<table>
<thead>
<tr>
<th>Nutrition Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>6 servings per container</strong></td>
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<tr>
<td><strong>Serving size</strong></td>
</tr>
<tr>
<td><strong>Amount per serving</strong></td>
</tr>
<tr>
<td><strong>Calories</strong></td>
</tr>
<tr>
<td><strong>% Daily Value</strong>*</td>
</tr>
<tr>
<td><strong>Total Fat</strong></td>
</tr>
<tr>
<td><strong>Saturated Fat</strong></td>
</tr>
<tr>
<td><strong>Trans Fat</strong></td>
</tr>
<tr>
<td><strong>Cholesterol</strong></td>
</tr>
<tr>
<td><strong>Sodium</strong></td>
</tr>
<tr>
<td><strong>Total Carbohydrate</strong></td>
</tr>
<tr>
<td><strong>Dietary Fiber</strong></td>
</tr>
<tr>
<td><strong>Total Sugars</strong></td>
</tr>
<tr>
<td><strong>Includes 1g Added Sugars</strong></td>
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<tr>
<td><strong>Protein</strong></td>
</tr>
<tr>
<td><strong>Vitamin D</strong></td>
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<td><strong>Calcium</strong></td>
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<tr>
<td><strong>Iron</strong></td>
</tr>
<tr>
<td><strong>Potassium</strong></td>
</tr>
</tbody>
</table>

*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.
Genesis R&D Training

Genesis R&D Training | August 20-22, 2019 | Oak Brook, IL
Professional and/or Advanced training session. The first two days cover the fundamentals of the Genesis R&D Food program: creating ingredients, building recipes/formulas, nutrition analysis and reporting, labeling, and best practices. In addition, you can attend a third day of Advanced instruction, or just attend the Advanced session as a single day. Advanced training presents more complex scenarios and more comprehensive regulatory issues.

Genesis R&D Training | October 8-10, 2019 | Oak Brook, IL
Professional, and/or Advanced training session. See description above.

Genesis R&D Training | November 5-7, 2019 | Oak Brook, IL
Professional, and/or Advanced training session. See description above.

Genesis R&D Training: Professional + Menu Label | December 4-5, 2019 | MicroTek, Miami, FL
Instruction covers the fundamentals of the Genesis R&D Food program: creating ingredients, building recipes/formulas, nutrition analysis and reporting, labeling, and best practices. In addition, the class includes direction and discussion on the 2018 Menu Labeling requirements and Menu Label features in Genesis R&D.

See the Full Schedule: https://www.esha.com/news-events/training-schedule/
CONTACT US

Phone: 503-585-6242

Sales: sales@esha.com

Support: support@esha.com

Consulting Services: cs@esha.com

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