It’s Too Spicy: The Dynamics of How You Eat Heat

Scott Walnofer – Research Chef

I. Introduction – Background of Kerry Ingredients & Flavours
II. Introduction to Commercial Chili Peppers
   a. Sourcing
   b. Production
   c. Processing for commercial applications
III. Sensory Case Study
   a. Form and function of heat delivery in a sandwich build
   b. Descriptive analysis of heat perception
IV. Culinary Tasting Exercise
   a. Scoville Unit training
   b. Pepper tasting from mild to wild
Spices vs. Herbs

- **Herb** = Leaf

- **Spice** = Bud, Bark, Root, Berry, Seed

- **Multi-tasking plants** = Coriander, Dill
Shelf Life and Storage of Spices

• Stable in largest, un-processed form

• Flavor and Volatile Oil loss accelerated after grinding

• Kerry standard shelf life for seasonings is 6 months

• Seasoning blends do not improve with age

• Storage should be cool, dry, protected from light

• Long-term refrigerated or frozen storage
Spices and Chilies are natural, agricultural products grown and harvested in a variety of conditions, some of which are very primitive.

Open-air drying methods

Spice processor must have comprehensive HACCP plan

Tracking of lots is critical since spices and herbs are considered “high risk”

Audits by Kerry personnel or accredited third-party audit group

Primary steps of spice and herb processing:

- Receiving the Material
- Cleaning
- Microbiological reduction
- Grinding or sizing
- Metal detection
- Packaging
Processing of Spices and Chilies

Open-Air Drying of Peppercorns

Open-Air Drying of Chilies
Processing of Herbs and Spices

Black and White Pepper Process:
Cleaning, Sterilization, Packaging

Pepper received in bags from Farmers/Traders

Pre-cleaning, Stones, stems, mud balls

Steam sterilization - 120°C, 2.5 torr/hr, Time: 20-50 seconds, P=2 Bar. Salmonella kill: up to 8 log

Cooling & Drying - within 5°C of Ambient: 30°C

Grinder- roller crusher

Sieving

Magnets.

Hammermill - pulverizing

Hopper

Magnets.

Shaker

Finished product metal detector:
2.5 mm: Fe; 3 mm: Non-Fe; 4 mm: SS

Packaging

Flow-through metal detector:
1.8 mm: Fe; 2 mm: Non-Fe; 3 mm: SS

Hopper

Warehouse
Processing of Herbs and Spices

Hammer Mill
Roller Mill

- Sequential pairs of counter-rotating stainless rollers
- Since particles passes through each roller pair once, there is little regrinding of already ground material. This results in a very tight particle size distribution and minimum number of very small particles ("fines").
- The following factors influence the particle size reduction process:
  - Roller tooth size and shape
  - Relative roll speed - 1:1 ratio, 2:1 ratio, etc.
  - Gap distance between mating rollers
Processing of Herbs and Spices

Rotary Sifter
Processing of Herbs and Spices

Pressure Destoner

• Separates particles of the same size based upon density of the particles

• A tilted, canted vibrating screen with air flow from the bottom

• The screen moves in an eccentric manner

• Air flow is adjusted to float less dense particles to the bottom of the screen

• Denser particles stay in contact with the screen, thereby moving those particles (stones) uphill
Microbiological Reduction Methods

• Primary methods of microbiological reduction: Ethylene Oxide Treatment, Heat Processing (steam or dry), Irradiation

• Globally, the only universally accepted method is heat processing

• North America still accepts all three methods

• Finished micro level is dependent upon the micro load before processing

• A 6 log reduction in micro levels is typical
Peppercorns

- Tropical vines with densely packed spikes
- Major producers are Vietnam, India, Indonesia and Brazil
- Black peppercorns (Piper nigrum): picked green, then dried
- Volatile oils including piperine
- White pepper: same berry, nearly ripe, pericarp removed
- Wet or dry decorticated
- White pepper lacks some volatile oils, but contains piperine
- Pink peppercorns: fully ripe berries
- Green peppercorns: unripe berries
How do you want to spell it? Chilie?, Chili?, Chile?, Chillie?, Chilli?
Common species are Capsicum annum and Capsicum frutescens
Most defining characteristic is heat, spiciness from capsaicin
Scoville Heat Units (SHU)
The fruit (pod) consists of flesh, ribs, and seeds
Ribs and seeds contain most of the capsaicin

Cleaning, de-stoning and colour sorting.
Steam Sterilization (or Sterilization via other method)
Grinding & Crushing
Roasting
Customized Blending to achieve correct grade
Packing
Chili Peppers 101

Chili Field Ready For Harvest
Chili Peppers 101

Chili Harvesting
Chili Peppers 101

Grading Table Tunnel Dryers
Chili Peppers 101

Storage
# Chili Peppers 101

<table>
<thead>
<tr>
<th>Scoville rating</th>
<th>Type of pepper</th>
</tr>
</thead>
<tbody>
<tr>
<td>15,000,000–16,000,000</td>
<td>Pure capsaicin[^4]</td>
</tr>
<tr>
<td>9,100,000</td>
<td>Nordihydrocapsaicin</td>
</tr>
<tr>
<td>2,000,000–5,300,000</td>
<td>Standard US Grade pepper spray[^5]</td>
</tr>
<tr>
<td>855,000–1,041,427</td>
<td>Naga Jolokia[^6][^7][^8][^9]</td>
</tr>
<tr>
<td>876,000–970,000</td>
<td>Dorset Naga[^10][^5]</td>
</tr>
<tr>
<td>350,000–577,000</td>
<td>Red Savina Habanero[^11]</td>
</tr>
<tr>
<td>100,000–350,000</td>
<td>Habanero Chile[^12]</td>
</tr>
<tr>
<td>100,000–350,000</td>
<td>Scotch Bonnet[^12]</td>
</tr>
<tr>
<td>100,000–200,000</td>
<td>Jamaican Hot Pepper[^5]</td>
</tr>
<tr>
<td>50,000–100,000</td>
<td>Thai Pepper, Malagueta Pepper, Chiltepin Pepper</td>
</tr>
<tr>
<td>30,000–50,000</td>
<td>Cayenne Pepper, Ají pepper[^12], Tabasco pepper</td>
</tr>
<tr>
<td>10,000–23,000</td>
<td>Serrano Pepper</td>
</tr>
<tr>
<td>7,000–8,000</td>
<td>Tabasco Sauce (Habanero)[^13]</td>
</tr>
<tr>
<td>5,000–10,000</td>
<td>Wax Pepper</td>
</tr>
<tr>
<td>2,500–8,000</td>
<td>Jalapeño Pepper</td>
</tr>
<tr>
<td>2,500–5,000</td>
<td>Tabasco Sauce (Tabasco pepper)[^13]</td>
</tr>
<tr>
<td>1,500–2,500</td>
<td>Rocotillo Pepper</td>
</tr>
<tr>
<td>1,000–1,500</td>
<td>Poblano Pepper</td>
</tr>
<tr>
<td>600–800</td>
<td>Tabasco Sauce (Green Pepper)[^13]</td>
</tr>
<tr>
<td>500–1000</td>
<td>Anaheim pepper</td>
</tr>
<tr>
<td>100–500</td>
<td>Pimento[^5], Pepperoncini</td>
</tr>
<tr>
<td>0</td>
<td>No heat, Bell pepper[^5]</td>
</tr>
</tbody>
</table>
Spice Warehouse

• Kerry is establishing centralized raw material hubs in locations all around the globe

• Tentative plans for 6-8 hubs

• North American hub is in the Chicago area

• Centralized receipt, testing, and distribution

• Global raw material testing protocol

• Testing parameters determined by critical attributes
With inspiration now drawn from across the globe, bold spices and intricate combinations are the trend of today with consumers more comfortable with the idea of spicier, hotter, zestier, and more varied items.
Consumers in markets which lack a traditional culture of spicy foods are looking to turn up the heat...

“The 1st Annual New York City Hot Sauce Expo will be a celebration of the city’s culturally diverse love of all things spicy and hot. We are really excited about what might become the biggest hot sauce show on the East Coast.”
Hot n’ Spicy Analysis

…but the issue comes down to what do consumers define as ‘hot’ or ‘spicy’?

**Hot Peppers** …

  e.g. chili peppers, chipotle peppers

**Ethnic flavors** …

  e.g. Elements of heat and spice in Mexican, Indian, Thai cuisine

**Common spices** …

  e.g. Ginger and Nutmeg

**Traditional ingredients** …

  e.g. Garlic

Source: Various Industry Sources
Spices and heat play leading roles in the flavor profiles on US restaurant menus…

According to Mintel Menu Insights…

- **Top Spicy Menu Dishes** – Buffalo wings, Sushi, Seafood and Chicken (wraps and fingers)
- **Top Spicy Ingredient** – Mustard, Chicken, Buffalo sauce, Garlic sauce and BBQ sauce
- **Top Cuisines that feature Spicy Ingredients** – Traditional American, Italian, Mexican, Tex-Mex, and Asian cuisines (Chinese, Pan-Asian and Japanese)
- **Top Branded Sauces showing up in Spicy Menu Dishes** – Tapatio, Sweet Baby Ray’s and French’s Cattlemen's BBQ
According to Mintel Menu Insights, the most menued flavors across all menu sections are traditional tastes, such as “garlic,” “spicy,” “seasoned” and “sweet”.

**Spicy is the second-leading flavor mentioned on menus and it’s one with plenty of room for growth.**

According to Mintel’s consumer survey: More than half of respondents (52%) agree that spicier food has more appeal to them now than when they were younger.

Of the men surveyed, 46% regularly add spicy flavors, like pepper sauce, to restaurant food.

Vegetarian food is considered too bland by 48% of men, so menu innovation in the realm of spicy cuisine likely will be noticed.

<table>
<thead>
<tr>
<th>Top Flavors – All Menu Sections</th>
<th>Q4 2009 #</th>
<th>Q4 2010 #</th>
<th>Q4 2011 #</th>
<th>Q4 2012 #</th>
<th>% Change Over Time, Q4 2009 – Q4 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Garlic</td>
<td>2,872</td>
<td>3,092</td>
<td>2,913</td>
<td>3,057</td>
<td>6</td>
</tr>
<tr>
<td>2. Spicy</td>
<td>2,049</td>
<td>2,199</td>
<td>2,267</td>
<td>2,241</td>
<td>9</td>
</tr>
<tr>
<td>3. Seasoned</td>
<td>1,851</td>
<td>2,070</td>
<td>2,200</td>
<td>2,251</td>
<td>22</td>
</tr>
<tr>
<td>4. Chicken</td>
<td>1,450</td>
<td>1,508</td>
<td>1,517</td>
<td>1,587</td>
<td>9</td>
</tr>
<tr>
<td>5. Smoked</td>
<td>1,057</td>
<td>1,226</td>
<td>1,245</td>
<td>1,177</td>
<td>11</td>
</tr>
<tr>
<td>6. Sweet</td>
<td>964</td>
<td>1,104</td>
<td>1,112</td>
<td>1,101</td>
<td>14</td>
</tr>
<tr>
<td>7. Honey</td>
<td>924</td>
<td>953</td>
<td>1,014</td>
<td>1,042</td>
<td>13</td>
</tr>
<tr>
<td>8. Vanilla</td>
<td>689</td>
<td>827</td>
<td>947</td>
<td>938</td>
<td>36</td>
</tr>
<tr>
<td>9. Chipotle Pepper</td>
<td>550</td>
<td>709</td>
<td>793</td>
<td>776</td>
<td>41</td>
</tr>
<tr>
<td>10. Lemon</td>
<td>609</td>
<td>711</td>
<td>710</td>
<td>790</td>
<td>30</td>
</tr>
<tr>
<td>11. Tomato</td>
<td>635</td>
<td>753</td>
<td>680</td>
<td>727</td>
<td>14</td>
</tr>
<tr>
<td>12. Parmesan Cheese</td>
<td>620</td>
<td>719</td>
<td>755</td>
<td>685</td>
<td>10</td>
</tr>
<tr>
<td>13. Herb</td>
<td>631</td>
<td>749</td>
<td>705</td>
<td>669</td>
<td>6</td>
</tr>
<tr>
<td>14. Chocolate</td>
<td>585</td>
<td>700</td>
<td>731</td>
<td>705</td>
<td>21</td>
</tr>
<tr>
<td>15. BBQ</td>
<td>601</td>
<td>679</td>
<td>688</td>
<td>725</td>
<td>21</td>
</tr>
</tbody>
</table>

Flavors showing the most growth are descriptive and bold:
- “Chipotle pepper,” up 41%
**Top Appetizer Flavors**

**Appetizers are an outlet for chefs and developers to take chances with bold ingredients and flavors.**

<table>
<thead>
<tr>
<th>Top Appetizer Flavors</th>
<th>Q4 2009 #</th>
<th>Q4 2010 #</th>
<th>Q4 2011 #</th>
<th>Q4 2012 #</th>
<th>% Change Over Time, Q4 2009 – Q4 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Spicy</td>
<td>356</td>
<td>395</td>
<td>464</td>
<td>417</td>
<td>17</td>
</tr>
<tr>
<td>2. Garlic</td>
<td>336</td>
<td>349</td>
<td>377</td>
<td>403</td>
<td>20</td>
</tr>
<tr>
<td>3. Seasoned</td>
<td>178</td>
<td>206</td>
<td>216</td>
<td>194</td>
<td>9</td>
</tr>
<tr>
<td>4. Sweet</td>
<td>137</td>
<td>164</td>
<td>176</td>
<td>163</td>
<td>19</td>
</tr>
<tr>
<td>5. Smoked</td>
<td>124</td>
<td>139</td>
<td>135</td>
<td>139</td>
<td>12</td>
</tr>
<tr>
<td>6. Tomato</td>
<td>95</td>
<td>135</td>
<td>138</td>
<td>126</td>
<td>33</td>
</tr>
<tr>
<td>7. Hot</td>
<td>109</td>
<td>104</td>
<td>110</td>
<td>110</td>
<td>1</td>
</tr>
<tr>
<td>8. BBQ</td>
<td>83</td>
<td>91</td>
<td>95</td>
<td>84</td>
<td>1</td>
</tr>
<tr>
<td>9. Lemon</td>
<td>70</td>
<td>83</td>
<td>90</td>
<td>91</td>
<td>30</td>
</tr>
<tr>
<td>10. Chipotle Pepper</td>
<td>58</td>
<td>78</td>
<td>83</td>
<td>80</td>
<td>38</td>
</tr>
<tr>
<td>11. Mild</td>
<td>66</td>
<td>78</td>
<td>71</td>
<td>73</td>
<td>11</td>
</tr>
<tr>
<td>12. Honey</td>
<td>67</td>
<td>71</td>
<td>77</td>
<td>67</td>
<td>0</td>
</tr>
<tr>
<td>13. Tangy</td>
<td>59</td>
<td>59</td>
<td>73</td>
<td>61</td>
<td>3</td>
</tr>
<tr>
<td>14. Parmesan Cheese</td>
<td>50</td>
<td>58</td>
<td>54</td>
<td>54</td>
<td>8</td>
</tr>
<tr>
<td>15. Zesty</td>
<td>60</td>
<td>52</td>
<td>54</td>
<td>49</td>
<td>-18</td>
</tr>
</tbody>
</table>

**Hot flavors are hot!**

Spicy, Garlic and Chipotle Pepper flavors rank high on the list of most menued appetizer flavors. They also show a substantial growth rate over the last 3 years.

**Which descriptors have moved the most?**

The word “zesty” has dropped the most in appetizer usage, -18% over the period 2009-2012.

The word “tangy” has grown. Indicating popularity of bold tastes from citrus, fruit or vinegars.
Hot n’ Spicy Analysis

Warning: Take a thoughtful approach to using heat…

The use of the chili pepper is delicate, as chefs recommend a “judicious” use of the pepper… no “shock” treatment…

In addition, the push for “interesting heat” is expected to gain steam and expand across multiple markets. As consumers grow more comfortable with spice, the demand has grown for new and varied combinations. Key word: Fusion!

Balance is the key…Homer takes a mysterious voyage as a result of the Merciless Pepper of Quetzalacatenango (The Guatemalan Insanity Pepper)…

Source: THE SIMPSONS, SEASON 8, EPISODE 14 "El Viaje Misterioso de Nuestro Jomer"
A menu analysis reveals that “hot n’ spicy” is tackled from a number of different angles with two clear paths… Peppers and Ethnic sauces or influences…

Jalapeno is king…

Between the Chipotle, a smoke dried jalapeno, and the conventional jalapeno pepper, this popular pepper makes up more than a third of the chili references in Mintel Menu Insights.

**Pepper Route**

- Chipotle
- Red and Green Chilies
- Habanero
- Jalapeno
- Guajillo
- Thai Chili
- Ancho
Ethnic sauces & cultural influence are also common ways to convey spicy heat...

**Peri-Peri** – This sauce is a mix of bird’s eye chili, garlic, herbs, and lemon and is used in a vast number of Portuguese dishes.

**Gochujang** – This fiery sweet and sour thick paste is traditionally made from red pepper powder, glutinous rice powder, fermented soybeans, and salt.

**Harissa** – This North African sauce also contains the Bird’s Eye chili

**Masala** – utilizes the long pepper in Garam Masala, but is largely a mixture of many spices. Garam = spice intensity

**Chimichurri** – utilizing red pepper flakes…

Source: Mintel, Fiery-Foods, Various Industry Sources
Consumers have a frame of reference around hot sauce, based on what they see and use...amongst the best-sellers and most recognizable:

Source: ACNielsen, Bloomberg Business Week: Sriracha Hot Sauce Catches Fire, Yet 'There's Only One Rooster', 2/2013
Customization is Key

Consumers want to feel that they are contributing to their dish. The availability of hot sauce gives the consumer the flexibility to give a personal touch…

Today’s restaurants are meeting consumer’s demand for variety not just by menu diversification but some are also providing customers with greater selections of condiments. This is allowing guests to customize their own meal.

...of respondents who purchase ethnic food agree they would like to see more versions of ethnic food that could be customized in spiciness by the individual eater.

- 1,550 internet users 18+ who purchase ethnic foods at the grocery store

Mintel Oxygen: Ethnic Foods Jan 2013, QSR Magazine: Sauce is the Boss Mar 2013
New Hot n’ Spicy Launches

Launches of Hot & Spicy items over the last year span many pepper types and ethnic influences…

**Archer Farms Spicy Salsa Roja** is an extra hot picante-style salsa made with jalapeño peppers, garlic and lime juice.

**Pesto Diavolo Fiery Dip & Spread**

**Korean Hot Sauce**

**T.G.I. Friday’s Limited Edition Hot & Spicy Chicken Wings** breaded chicken wing sections, accompanied with a packet of hot and spicy sauce.

**Spicy Hot Tomato Oil Sauce**
A "put-on-anything" sauce with just a little heat, mellowed by a sweet tomato finish.

**Barcel Churritos**
Fuego Hot Chili Pepper & Lime Flavoured Corn Snack Sticks

**Claussen Hot & Spicy Spears**

**El Diablo Hot & Spicy Habanero Mustard**

**Ziyad Hummos Tahini** is a hot spicy chick pea dip.

**Spicy Nothings Spicy & Tangy Curry Simmer Sauce**

**Best Foods Spicy Buffalo Mayonnaise** with Frank’s RedHot.

**Hot Yaki BBQ Sauce**

**Spicy Hot n’ Tangy Curry Sauce**

**Jamaican Style Spicy Beef Patties**

**Best Foods Spicy Buffalo Mayonnaise**

Mintel GNPD, previous 12 months with period ending 3/18/2013.
Hot n’ Spicy Menu Launches

Popular Food Service chains are cashing into the Hot & Spicy craze…

**McDonalds**
- **Spicy Chicken McBites** - Pieces of chicken breast with the perfect balance of heat and flavor.
- **Hot ’n Spicy McChicken** – Crispy chicken seasoned with a bold mix of spices, topped with iceberg lettuce, mayonnaise and served on a toasted bun.

**Panda Express**
- **SweetFire Chicken Breast** - Crispy, white-meat chicken bites tossed in the wok with red bell peppers, diced onions and juicy pineapple with a zesty, sweet chili sauce.
- **Kung Pao Chicken** - A spicy stir-fry dish inspired by the Sichuan Province in Central China. It is prepared with marinated diced chicken, crunchy peanuts, diced red bell peppers and sliced zucchini, all tossed in the wok with fresh green onions.

**Burger King**
- **Spicy Chick’N Crisp** - Loaded with chopped lettuce, a layer of original firecracker sauce and served to you freshly prepared on a perfectly toasted sesame seed bun.
- **Chipotle Whopper** - Topped with thick-cut bacon, pepper jack cheese, spicy chipotle mayo, fresh-cut lettuce, ripe tomatoes and sweet caramelized style onions.
- **Angry Whopper** - 1/4 lb of savory fire-grilled beef, topped with thick-cut smoked bacon, melted habanero cheese, iceberg lettuce, spicy onion petals, ripe tomatoes, spicy jalapenos, smothered with a spicy angry sauce, on a sesame seed bun.

**Chill’s Bar & Grill**
- **Spicy Southwest Chicken and Sausage Soup** - Tender white beans, chicken, sausage, garden veggies with garlic and chicken broth. Topped with tortilla strips.
- **Chipotle Salmon** - Seared Cajun-spiced salmon with a smoky chipotle-garlic pesto cream sauce.
- **Jalapeno Smokehouse Burger** - With applewood smoked bacon, smoked cheddar, tortilla strips, red onion, mayo, jalapenos and ranch dressing.

Mintel Menu Insights; Various Industry Sources
Independent establishments are pushing the envelope and serving items that would make even the toughest eater sweat…

Mission Chinese
New York City & San Francisco, Ca
Two flames denote the spiciest dishes on the menu but regulars suggest multiplying each flame by five to approximate the true heat. Among the menu’s hottest: Mapo Tofu; Kung Pao Pastrami with explosive chiles; and the Thrice Cooked Bacon with rice cakes.

Lucy’s Fried Chicken
Austin, Texas
The spiciest dish in Austin, according to Chowhound.com is Lucy’s Diablo Oysters, a half-dozen wood-fire-grilled oysters topped with two chiles - habanero-infused butter and jalapeño - as well as Parmesan and bacon.

Hell Pizza will put two drops of the super-ultra spicy ghost pepper sauce onto only one slice of your pizza, but they won’t tell you which.

Pizza Roulette, Hell's Pizza Super Spicy Pizza Game
Monday, March 12, 2012, by Paula Forbes
New Zealand pizza chain Hell Pizza is living up to its name by introducing Pizza Roulette this week. What is Pizza Roulette? It seems the pizzeria will put two drops of the super-ultra spicy ghost pepper sauce onto only one slice of your pizza, but they won’t tell you which. So it’s like a game? That makes pizza taste awful for one lucky person in your party.
In any case, these cricket players from the Wellington Firebirds certainly seem to find it fun. Except for, you know, the guy who gets the ghost pepper slice. Below, find out why Pizza Roulette’s slogan is “It doesn’t cost, but someone pays.”
Quantitative Sensory Analysis
Due to the lack of clear definition of what consumers define as “hot” or “spicy”, when it comes to sauce, Kerry conducted an internal focus group to get a reference point...

Hot sauces from BW3, Quaker Steak and Lube and retail hot sauces were purchased... and six sauces were identified and presented in a focus group as a lightly smoked grilled chicken and coated with each of the sauces

**Sauces presented and evaluated:** Buffalo Wild Wings Mild Wing Sauce, Buffalo Wild Wings Spicy Garlic Wing Sauce, McIlhenny Company’s Tabasco® Sauce, Sriracha Hot Chili Sauce, Les Comptoirs Reunis Harissa, Soft Fine, Marrakech Preparation and Buffalo Wild Wings Blazin’ Sauce
Objectives – Phase I

To identify commercially available hot sauces which have broad appeal to consumers

To characterize and quantify differences in the sauces, when topically applied to marinated grilled chicken

To provide consumer insights which R&D can use to identify acceptable heat levels, flavor profiles, etc.

To understand how the sandwich build (bun, mayo and lettuce) impacts the sensory properties and “liking”
Caveat

These results should be used for directional purposes, only and to identify gross negatives.

A larger study (n=200+) with geographic representation is required to understand segmentation and to confirm these results.

The focus group consisted of employees from Beloit, WI who are males 18-25 years and like spicy foods. The results cannot be projected to the general population.
Hot n’ Spicy Analysis

Methodology

30+ sauces were screened and six sauces selected for further testing.

Descriptive analysis and focus groups were conducted on the sauces

Descriptive: To characterize and quantify differences in the samples

Focus Groups with males 18-30 years who like spicy foods were conducted to provide directional information and to identify gross negatives.

Sauces were baked onto marinated grilled chicken tenders (sauce, only) and as a complete sandwich (e.g., bun with mayo and lettuce)

Source: INTERNAL KERRY ANALYSIS
Hot n’ Spicy Analysis

Focus Group Executive Summary

Color, spicy aroma, heat and both spice/chili and grilled flavors are important attributes of a spicy fire grilled chicken product.

Product has to have a spicy aroma, dark red or reddish brownish color, and charcoal grill notes.

Flavor was very important and should be identifiable and not overpowered by the heat.

Heat level was segmented:

- Some consumers preferred “the higher heat the better” (fire-burning)
- Others wanted a balance between flavor and heat

Source: INTERNAL KERRY ANALYSIS
Focus Group Executive Summary

The panel wanted a spicy garlic sauce with hot to very hot heat

Preference results were as follows:

• 3 people wanted the flavor of BW3 Spicy Garlic with the heat of Tabasco and the color of BW3 Blazing Hot

• 2 people wanted the color, flavor and heat level of BW3 Blazing Hot but wanted additional mango or citrus flavor

• 4 people wanted the flavor of the BW3 Spicy Garlic and the heat of BW3 Blazing Hot

Source: INTERNAL KERRY ANALYSIS
Hot n’ Spicy Analysis

Key Attributes by Component (Listed in order of importance)

Component 1:
- Heat Hit Late
- Balance/Peaky
- Heat Hit Early
- Molasses
- Salt
- Color
- Vinegar
- Sour
- Heat Intensity
- BBQ

Component 2:
- Heat Hit Late
- Balance/Peaky
- Heat Hit Early
- Molasses
- Salt
- Color
- Vinegar
- Sour

Source: INTERNAL KERRY ANALYSIS
Hot n’ Spicy Analysis

Partial Least Squares (PLS) Plot: Descriptive Results
Sauce Evaluation (on Grilled Chicken)

Correlations on axes t1 and t2

- DFR Appear
- DFR Flavor
- DFR Heat
- DFR Overall
- DFR Heat Hit early
- DFR Heat Hit late
- DFR Overall AR
- DFR Overall flavor intensity
- Fermented
- Black pepper
- Overall AR
- Overall flavor intensity
- Salt
- Peaky
- Grilled
- Lemon
- Spicy Garlic
- Franks
- Tabaasco
- Sraracha
- BW3 Blazin’
- BW3 Mild
- Sour
- BBQ
- AT Duration
- AT Intensity
- Chili
- Vinegar
- Molasses
- Salt
- BBQ
- AT Intensity
- Heat Hit early
- Heat Hit late
- Sour
- Molasses
- Color
- AT Duration
- Overall flavor intensity

Source: INTERNAL KERRY ANALYSIS
Will a sandwich build significantly change the flavor profile?

We hypothesized that Heat intensity and flavor (grilled, spicy) will decrease if served in a sandwich build (bun, lettuce, mayo).

Source: INTERNAL KERRY ANALYSIS
Hot n’ Spicy Analysis

Partial Least Squares (PLS) Plot: Descriptive Results
Sauce Evaluation (on Grilled Chicken) vs. Sandwich Build

Correlations on axes t1 and t2

DFR Appearance
DFR Flavor
DFR Heat
DFR Overall
Grilled
Salt
Garlic
Sour
Fermented

Heat Hit early
Heat Hit late
Overall AR
Overall Flavor Intensity
Peaky
Lemon
Black pepper
BBO

Chili
Fermented
Vinegar
BBQ
Salt
Sour

Franks
Sraracha Bun
BW3- Blazin’ Bun
Franks - Bun
Sraracha

BW3- Blazin’
Franks

-1 -0.75 -0.5 -0.25 0 0.25 0.5 0.75 1

t1 - Explains 72% of variation

Source: INTERNAL KERRY ANALYSIS
Partial Least Squares (PLS) Plot: Descriptive Results
Relationship of Sensory Attributes and Difference From Reference (DFR)*

Correlations on axes t1 and t2

Note: DFR: Samples were compared to Frank’s Hot Sauce
2nd Focus Group Results

These consumers (males 18-25 yrs) were excited about having a spicy chicken product in a fast food restaurant. Wendy’s spicy chicken was described as the only spicy chicken product on the market. Crispy chicken was preferred over grilled since “people on diets” consume grilled products. Wants: not messy, would pay more for higher heat levels, flavor complexity.

Segmentation: One group prefers high heat and flavor is less important, another likes hot and flavor, while the third prefer spicy flavor without extreme heat.

Source: INTERNAL KERRY ANALYSIS
2nd Focus Group Results

Heat: The majority wanted heat at least Tabasco Sauce intensity or else they would be disappointed. Many preferred BW3 Blazin’ heat. Everyone agreed the general population would not order this product nor could they tolerate the BW3 Blazin’ heat. When tested in a bun, everyone liked the BW3 Blazin’ heat the best but wanted more flavor complexity.

Flavor improvements: Increase the flavor complexity. Based on the descriptive results, flavor complexity could be achieved most easily with flavor layering (e.g., marinate, rub, topical sauce or dip).

Source: INTERNAL KERRY ANALYSIS
Next Steps

Conduct a larger consumer study (n=200+) with actual product users to confirm these results.

Investigate areas of opportunity found by the descriptive panel

Addition flavor profiles (e.g., fruit, cilantro, basil, lemongrass, etc.) which compliment heat

Investigate flavor layering (e.g., rubs, marinates, topical or dipping sauces)

Identify the target market prior to development to maximize development time

Source: INTERNAL KERRY ANALYSIS
I Dare You to Eat This!

- Tasting Science
- Pepper Identification
- Heat & Pepper Tasting
Heat vs. Flavor Exercise

1) Pinch and hold your nose.
2) Chew snack for 5 seconds.
3) Release your nose.
Human Brain receives messages via the Fifth Cranial Nerve (Trigeminal Nerve)

- $V_1$ – Ophthalmic Nerve
  - Eyes, Nasal Cavity, Lacrimal Gland

- $V_2$ – Maxillary Nerve
  - Nasal Cavity, Sinuses, Palate

- $V_3$ – Mandibular Nerve
  - Teeth, Gingivia, Motor Signals from Muscles
Human Responses to Heat

- Initial Exposure – dislike, then hedonic shift occurs:
  - Exposure
    - Childhood
    - Repeated
  - Social reinforcement
  - Physiological

Perception via Exposure

Prescott, Stevenson (1995) Psychophysical Responses to Single and Multiple Presentations of the Oral Irritant Zingerone: Relationship to Frequency of Chili Consumption
## Types of Pungent Spices

<table>
<thead>
<tr>
<th>SPICE NAME</th>
<th>ACTIVE COMPOUNDS</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chili Peppers</td>
<td>Capsaicin, Other Capsaicinoids</td>
<td><img src="image1" alt="Structure" /></td>
</tr>
<tr>
<td>Ginger</td>
<td>Gingerols, Zingerones, Shogoals</td>
<td><img src="image2" alt="Structure" /></td>
</tr>
<tr>
<td>Mustard, Horseradish</td>
<td>Allyl Isothiocyanate</td>
<td><img src="image3" alt="Structure" /></td>
</tr>
<tr>
<td>Pepper</td>
<td>Piperine</td>
<td><img src="image4" alt="Structure" /></td>
</tr>
<tr>
<td>Szechuan</td>
<td>Hydroxy-alpha sanshool</td>
<td><img src="image5" alt="Structure" /></td>
</tr>
</tbody>
</table>
Perception by Spice

Perception by Spice

Chili Peppers

- Used for flavor and sensory sensation
  - Flavor
    - Jalapeno, Chipotle
    - Cayenne, Serrano
    - Habanero
  - Sensory Sensation
    - Capcaisinoids
    - Back of the throat heat, dissipates quickly
    - More forward heat available in extract form
Ginger

- Used for flavor and sensory sensation
  - Flavor
    - Fresh vs. Ground
  - Sensory Sensation
    - Zingerone, gingerol, shogoals
    - Back of the throat heat, slow building
    - Extract forms average approximately 50,000SHU
Horseradish, Mustard, Wasabi

• Used for flavor and sensory sensation
  – Flavor
    • Extracts don’t have the emulsifying property of ground mustard.
  – Sensory Sensation
    • Allyl, Isothiocyanate
    • Quick, intense nasal
    • Slight burn at the back of the throat
Pepper - Black and White

- Used for flavor and sensory sensation
  - Flavor
    - Black: Citrus, woody, terpenes
    - White: “Barnyard”
  - Sensory Sensation
    - Slow building, back of throat, lingering
    - Piperine – dissolved or suspended
    - 1% piperine = approximately 2000 SHU
Szechuan Pepper

- Used for flavor and sensory sensation
  - Flavor
    - Citrus, piney flavor popular in Asian Cuisines
    - Deodorized options exist in extract form
  - Sensory Sensation
    - Sanshool
    - Localized tingling on the tongue
    - Consider for evaporative cooling
Matrix Matters

- Perception of heat is influenced by the food matrix
  - Moisture and acidity accentuate perception
  - Fat content mutes perception
  - Understand the solubility characteristic of any extract being used and pair it with the food matrix

Multidimensional heat keeps a longer sustaining, lasting heat.
Pepper ID

1. Sweet Red Bell Pepper
   0 SHU

2. Anaheim Pepper
   500-2500 SHU

3. Poblano Pepper
   1000-1500 SHU
Pepper ID

4. Jalapeno Pepper
2500-8000 SHU

5. Chipotle Pepper
2500-8000 SHU

6. Serrano Pepper
10,000-23,000 SHU
7. Thai Bird Chili
50,000-100,000 SHU

8. Habanero Pepper
100,000-350,000 SHU

9. Police Grade Pepper Spray
5,300,000 SHU
Top 10 Hottest Chile Peppers (that the CPI has tested)

1. Trinidad Moruga Scorpion (2 Million SHU)
2. Chocolate 7 pot (1.8 Million SHU)
3. Trinidad Scorpion (1.5 Million SHU)
4. Bhut Jolokia (1 Million SHU)
5. Red 7 Pot (780,000 SHU)
6. Chocolate Habanero (700,000 SHU)
7. Red Savina Habanero (500,000 SHU)
8. Scotch Bonnet (350,000 SHU)
9. Orange Habanero (250,000 SHU)
10. Rocoto (175,000 SHU)

– Got a T-shirt!
Pepper ID – The Exotics for next time

NuMex Big Jim
Cajamarca
Chocolate Habanero
Jalmundo Jalapeño
Jamaican Hot Chocolate
Peruvian Aji
Red Savina Habanero
Trinidad Scorpion Butch T
Tabasco
Special Thanks To!

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Questions???