TEST OBJECTIVE
Comparison of firmness, hardness work done, adhesiveness, and adhesive force of cooked hamburger patties by compression with a 9mm small shear blade.

BACKGROUND
Hamburgers are a staple of American cuisine, and are commonly eaten at restaurants, sporting events and parties. Hamburgers are generally round, served as a patty. The hamburgers tested in this experiment are beef, but turkey, black bean, veggie and tofu burgers are also common.

This test compresses the hamburger patties to a set distance, and measures the amount of force required to penetrate the patty. The TA52 blade simulates the amount of force needed for human teeth to bite and cut a hamburger.

METHOD

EQUIPMENT:
- Texture Analyzer with 10kg load cell
- Fixture Base Table (TA-BT-KIT)
- Small Shear Blade (TA52)
- TexturePro Software

SETTINGS:
- Test Type: Compression
- Target Type: Distance
- Target Value: 10mm
- Trigger Load: 30g
- Pre-Test Speed: 1mm/s
- Test Speed: 1mm/s

SAMPLE PREPARATION
1. Sample is stored overnight in refrigerator before testing, and fully cooked just prior to testing.
2. Samples were tested within 10 minutes of being cooked.
3. All patties were cut to equal shape and size.

Note: Due to inherent differences between individual patties, both cooking and cutting will not be entirely exact between patties.

PROCEDURE
1. Attach the TA52 shear blade to the Texture Analyzer
2. Insert two table bolts into the slots on the instrument base.
3. Place the Fixture Base Table on the Texture Analyzer and lightly screw in the bolt nuts.
4. Adjust the table so the probe is centered on the base table.
5. Once alignment is complete, secure the base table by tightening the bolt nuts.
6. Place the hamburger sample on the table. Align the sample under the probe as centrally as possible.
7. Position the probe to about 3mm above the sample.
8. Set the Test Parameters using the TexturePro Software.
9. Commence the test.
10. Wipe the probe with a dry cloth after each test.
11. Repeat steps 1 - 11 for all samples.

Note: Three tests were conducted on each patty. Each test was equidistant away from the edges and center of the patty.

**OBSERVATION**
When a trigger load of 30g is detected at the sample surface, the shear blade penetrates the hamburger patty at a test speed of 1mm/s over a specified distance of 10mm. Once the 10mm distance is met, the probe returns to the starting position. The following graph displays the peak load (firmness) for the cooked hamburger patty tested.

**DISCUSSION**
The maximum force value is the peak load. It is a measure of sample firmness; the higher the value, the harder the sample. The higher the peak load, the more work required to break down the sample. Hardness work done is a measure of how much work is required to overcome the strength of bonds within a food, and is represented by the area enclosed under the Load vs. Distance graph (not shown in this example). Hardness work done peaks during the first bite of a cooked hamburger.

**DATA REPORT**
The TexturePro Software is used to program and control the Texture Analyzer during experimental tests. It automatically calculates peak load values (hardness) and hardness work done. Multiple samples can be run if desired, and calculated values for standard deviation can be reported.

<table>
<thead>
<tr>
<th>#</th>
<th>Sample Description</th>
<th>Batch Name</th>
<th>Results</th>
<th>Hardness Work Cycle 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hardness Cycle 1 (g)</td>
<td>(mJ)</td>
</tr>
<tr>
<td>1</td>
<td>Hamburger, Cooked</td>
<td>Patty TA52</td>
<td>724.00</td>
<td>39.40</td>
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<tr>
<td>2</td>
<td>Hamburger, Cooked</td>
<td>Patty TA52</td>
<td>607.00</td>
<td>40.90</td>
</tr>
<tr>
<td>3</td>
<td>Hamburger, Cooked</td>
<td>Patty TA52</td>
<td>687.00</td>
<td>43.90</td>
</tr>
</tbody>
</table>

Minimum: 607.00 39.40  
Maximum: 724.00 43.90  
Average: 673.00 41.40  
Standard Deviation: 60.00 2.30  

**CONCLUSION**
The test results can be used to determine the ideal hardness of cooked hamburgers. Test procedure, sample preparation, and equipment setup must be adhered to for reproducible and repeatable test results.