

# Energy Bar Hardness Analysis

Hardness and fracturability testing of energy bars are essential to ensure texture consistency, which affects consumer satisfaction and suitability for various uses, such as workout or meal replacement snacks. These tests measure the firmness and brittleness of different energy bar types, providing insights into their chewability and quality.

## Background:

- Energy bars are formulated to provide high protein, carbohydrates, and calories, with varied textures based on ingredients and intended uses. The test measures hardness (peak load), work done (energy to shear the bar), and fracturability (indicating crunchiness).

## Equipment:

- CTX Texture Analyzer with a 10kg load cell
- Components: Shear Blade Assembly (TA-SBA) with Fixture Base Table and Bottom Plate
- Software: Texture Pro for setting test parameters and recording results

## Settings:

- Test Type: Compression
- Target Type: Distance
- Target Value: 23 mm
- Trigger Load: 100 g
- Pre-Test Speed: 1 mm/s
- Test Speed: 1 mm/s

## Sample Preparation:

1. Store each energy bar sample overnight at room temperature in its original packaging.
2. Remove each sample from packaging just before testing.

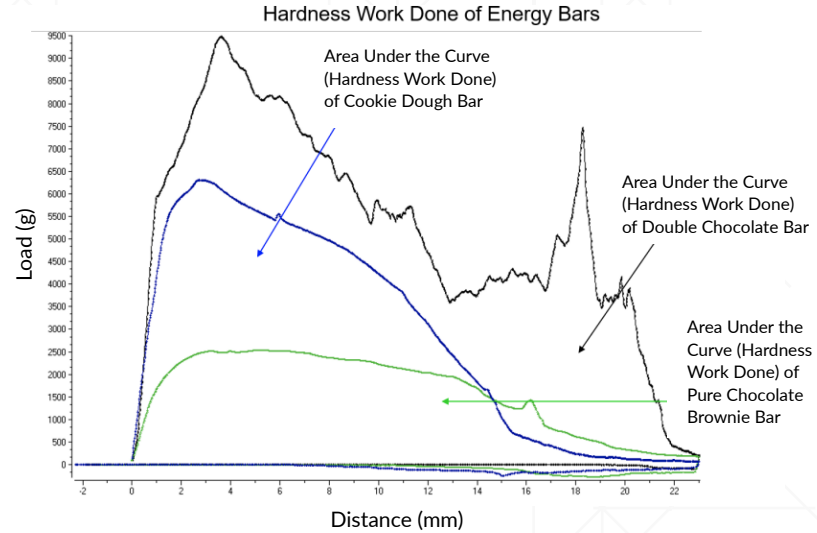
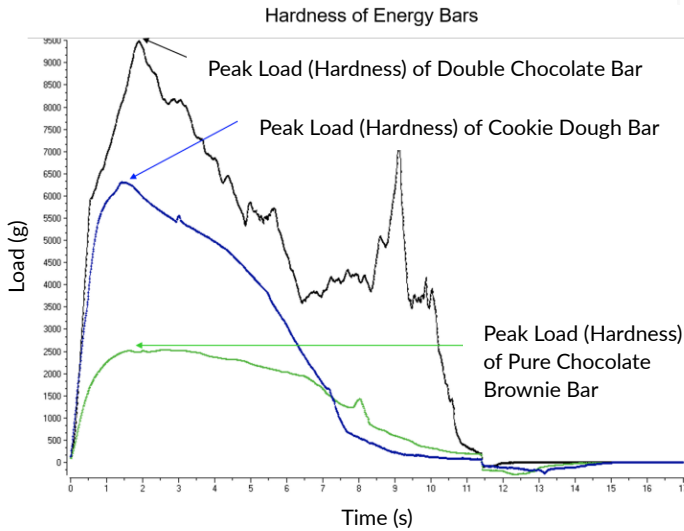
## Procedure:

1. Attach the shear blade and set up the Fixture Base Table on the analyzer.
2. Ensure alignment by lowering the blade through the slot in the bottom plate.
3. Center each sample on the base plate beneath the blade.
4. Position the blade approximately 10 mm above the sample.
5. Set test parameters in Texture Pro software and initiate the test.
6. Repeat for each sample type to ensure accuracy.



**Observations:**

- Load vs. Time Graph: Indicates sample hardness, with peak load representing the maximum force required.
- Load vs. Distance Graph: Reflects work done to shear each sample and shows fracturability points as sharp decreases in load.



**Results:**

- Sample Data:
  - Double Chocolate Protein Bar: Firmest with peak load of 9,487 g and highest work done (1,170.3 mJ), indicating high hardness and fracturability.
  - Cookie Dough Protein Bar: Medium firmness with peak load of 6,308 g and work done of 655.6 mJ.
  - Pure Chocolate Brownie Bar: Least firm with peak load of 2,550 g and work done of 362.5 mJ.

#	Sample Description Product Name	Batch Name	Results Hardness Cycle 1 (g)	Hardness Work Cycle 1 (mJ)	Fracturability
1	Energy Bar	Double Chocolate Protein Bar	9487.00	1170.30	9487.00
2	Energy Bar	Cookie Dough Protein Bar	6308.00	655.60	6302.00
3	Energy Bar	Pure Chocolate Brownie Bar	2550.00	362.50	2522.00

**Discussion:**

Peak load indicates hardness, with higher values reflecting a firmer texture, while work done reflects chewability by measuring energy required to shear the bar. Fracturability, shown by a sharp drop in load, indicates brittleness or crunchiness. Consistent preparation and setup ensure reproducible results, helping manufacturers optimize texture for consumer satisfaction.