Product development considerations of flaxseed (*Linum usitatissimum*) supplementation for the aging population: A pilot study

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Background

An Aging Society

- Between 2014-2060, the U.S. population is projected to increase from 319 million to 417 million; 1 in 5 Americans expected to be 65 years old or over by 2030
- The baby boomer cohort, individuals born post-World War II between 1946-1964, is largely responsible for this growth in the older population

Inflammaging

- During the aging process, immune system shifts to a state of low-grade chronic inflammation and declines in reliability and efficiency
- This dysregulation of the immune system (immunosenescence) may make it difficult to cope with and adapt to stressors
- May lead to increased susceptibility to diseases and has been associated with obesity, cardiovascular disease, some cancers, frailty, and mortality

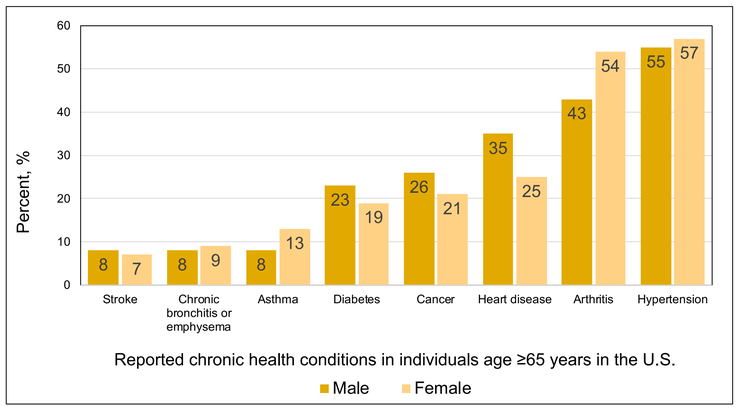

FIGURE 1. Percentage of people age 65 and over in the United States who reported having chronic health conditions, by sex, 2013–2014. Adapted from the Federal Interagency Forum on Aging-Related Statistics (2016).

Flaxseed (*Linum usitatissimum*)

- Contains biologically active components (α-linolenic acid, lignans, and soluble and insoluble fiber)
- Shown to reduce blood pressure, improve lipid abnormalities, increase anti-inflammatory mediators, and decrease chronic inflammation markers
- Little is known regarding the acceptance among baby boomers in relation to food products with flaxseed

Objectives

To evaluate the acceptability of a food product formulated with flaxseed among baby boomers or individuals 50 years and older.

Hypotheses

$H_0$1: There is no significant difference in the likability of the flaxseed bagel compared to control (0% flaxseed).

$H_0$2: There is no significant difference in the preference of the flaxseed bagel compared to control bagel.

$H_0$3: There is no significant difference in the intended frequency of eating the flaxseed bagel compared to control bagel.

Methods

Recruitment

Flyers were placed around Osher Lifelong Learning Institute (OLLI), LifeFit Center, and the Department of Family and Consumer Sciences (FCS) at CSULB two weeks prior to the sensory evaluation.

Product Development

FIGURE 2. Ingredients of bagels

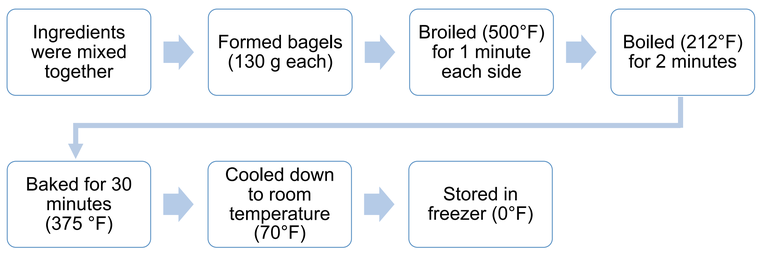

FIGURE 3. Bagel formulation

FIGURE 4. Control bagel with 0% flaxseed (left) and 23% flaxseed bagel (right).

Sensory Evaluation

- Occurred under controlled conditions at the sensory evaluation laboratory in CSULB FCS Department
- Panelists were provided with two coded bagels in a random order
- Tools used:
  - **9-point Hedonic scale:** Measures food likeability using sensory attributes
  - **Paired Preference test:** Measures overall preference between products
  - **Food Action (FACT) rating scale:** Measures food acceptance by frequency consumption
- Water was supplied to cleanse the palate between samples

Results

Sample Characteristics (N = 20)

- 25% (N = 5) were male and 75% (N = 15) were female
- Age range: 54 to 76 years old (Mean ± SD = 69.0 ± 6.33)
- All participants were non-Hispanic whites

9-point Hedonic scale: There was no significant difference in all sensory attributes between both bagels

TABLE 1. Paired Samples *t*-Test Results Comparing Sensory Attributes Scores of Bagels

Sensory attributes	Control Mean ± SD	Flaxseed Mean ± SD	*p*
Appearance[a]	6.95 ± 1.050	6.65 ± 1.725	0.453
Color[a]	7.00 ± 1.026	6.55 ± 1.820	0.324
Flavor[a]	6.75 ± 1.251	5.90 ± 1.971	0.105
Aroma[a]	6.70 ± 1.525	6.35 ± 1.981	0.439
Texture[a]	6.45 ± 1.605	6.45 ± 1.504	1.000
Overall acceptability[a]	7.00 ± 1.026	6.05 ± 2.038	0.078

[a]9-point hedonics was measured on a scale from 1 to 9, with 7 = like moderately; 6 = like slightly; 5 = neither like nor dislike. Significance at $p \leq .05$.

Paired Preference test: 50% of participants preferred flaxseed bagel while 50% preferred control bagel

FACT rating scale: There was no significant difference in the frequency of consuming both bagels

TABLE 2. Paired Samples *t*-Test Results Comparing FACT Rating Scores of Bagels

Factor	Control Mean ± SD	Flaxseed Mean ± SD	*p*
FACT rating[a]	5.20 ± 1.281	4.90 ± 2.075	0.527

[a]FACT rating was measured on a scale from 1 to 9, with 5 = I would eat this if available but would not go out of my way; 4 = I do not like this but would eat it on an occasion. Significance at $p \leq .05$.

Correlation of sensory attributes to overall acceptability of bagels: For flaxseed bagel, appearance was most strongly correlated to overall acceptability, which was then followed by flavor, color, and texture

TABLE 3. Spearman's Rho Correlation Coefficient Results of Sensory Attributes to Overall Acceptability of Bagels

	Overall acceptability	
Sensory attributes	Control	Flaxseed
Appearance	0.778**	0.785**
Color	0.704**	0.754**
Flavor	0.907**	0.758**
Aroma	0.599**	0.413
Texture	0.787**	0.749**
FACT rating	0.761**	0.887**

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Conclusion

- Flaxseed can be successfully incorporated into a cinnamon raisin bagel as there were no significant differences between the two bagels with respect to sensory attributes, overall acceptability, preferences, and FACT ratings
- Enhancing appearance, flavor, color, and texture may improve consumer acceptability for bagels among older adults
- Small sample; further consumer evaluations among a large sample may be required to verify the acceptance of bagels containing flaxseed