LOWER FO IN MODERN WOMEN:
CONTRADICTORY EVIDENCE

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INTRODUCTION

- The mystical “they” often say that average vocal fundamental frequency in women has lowered over the last century.
- This is mentioned at conferences, in presentations, and as a discussion topic among voice people
- The Spring 2015 Speech Science class decided to investigate if this was true.
- The investigation took three tracts
  - A review of past literature and other sources indicating factors that might lead to lowered Fo
  - A review of past literature in which vocal Fo was measured
  - An analysis of their own vocal Fo to obtain a class average

FACTORS THAT MIGHT LEAD TO LOWER FO

- Increased dietary fat
- Antibiotics in the food supply
- Hormones in the food chain
- Steroids in the food chain

- All of these are primarily found in meat or poultry
- Some, especially increased dietary fat, may be related to early puberty

EARLY PUBERTY THEORIES

Euling, et al (2008) indicate that puberty in females has shown a downward age trend between 1940 and 1994

Changes in the food supply
  - Increase in the consumption of:
    - Fats
    - Antibiotics
    - Steroids
    - Hormones
  - Eter via a general increase in the consumption of naturally occurring sources or due to the addition of chemicals in agriculture and/or the rearing of livestock

These changes in the food supply and our relationship with the consumption of the food supply have also lead to dramatic increases in obesity

EARLY FOOD GUIDANCE

First USDA published food guidance in 1894 (USDA, 1999)

- First guides for children in 1916 gave “fats and fatty foods” as a group
- Guidelines for the Great Depression focusing on cost rather than on food groups came out in the 1930s (USDA, 1999)
**Dietary Guidance: 1940s-1970s**

The 1943 Basic Seven Food Guide had little guidance on fats (USDA, 1999; 2011; 2013).

- This was not changed with 1946 update following WWII.

The 1956 Basic Four Food Guide also did little to address fats (USDA, 1999; 2011; 2013).

**Dietary Guidance: 1970s-1990s**

Recommended “Dietary Goals for the American People” first established by US Senate Select Committee on Nutrition and Human needs in 1977 (USDA, 1999; 2013).

- Recommendations included:
  - Increased the consumption of complex carbohydrates and naturally occurring sugars
  - Reduced consumption of refined and processed sugars, total fat, saturated fat, cholesterol, sodium

In 1979, USDA addressed fat’s role in the risks surrounding chronic disease (USDA, 1999; 2013).

1993’s Dietary Guidelines highlighted fats in the “using sparingly” group.

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**The Food Guide Pyramid and Nutrition Facts Labels**


- Onceagain, recommended consuming fats sparingly.

1994 saw the addition of the Nutrition Facts label to foods, outlining their nutritional contents (USDA, 1999; 2013).

**MyPyramid**


- Removed mentions of fat other than low-fat meat and dairy options.

**Today: MyPlate**

2011 introduced the current MyPlate (USDA, 2011).

- Does not address “fat” separately.

Overall, we know that the USDA and dietary guidelines have warned against excessive fat consumption to the point of not mentioning fat.

**Fats**

Between 1997 and 2000, per capita consumption of added fats rose 17% (USDA, 2001).

- From 64 to 74.5 pounds annually.

- Thought to be a backlash against the perceived lack of flavor in many low-fat and fat-free options released in the 1990s as a result of the addition of the Nutrition Facts label.

1950s → added fats contributed to 41% of the fat in the food supply.

By 1999 → 53%.

- Likely due to higher consumption of fried foods, high-fat snack foods, and increased use of added dressing (USDA, 2001).

- Margarine, salad dressings, mayonnaise, baked goods, and oils continually appear in the top 10 foods for fat contribution (USDA, 2001).

- Indicates ongoing prevalence of fat consumption in discretionary fats in American diet.
OBESITY FIGURES

In 1990, 15% of the US population was obese (Harvard University)

As of 2012, more than 33% of American adults and 17% of American children are obese (Ogden, et al.)

69% of adults are obese or overweight (Harvard University)

This figure has remained stable since 2003-2004 (Ogden, et al.)

Obesity rates are approximately 10% lower among young adults than middle aged adults (CDC)

Research shows that childhood obesity may lead to early puberty in girls (Burt Solomon & McCartney)


ANTIBIOTICS IN THE FOOD SUPPLY

The FDA has approved the use of antibiotics in animals for:

- Disease treatment, control, and prevention
- Growth promotion and increased feed efficiency

Shelf life is extended for meat, poultry, eggs, and dairy products treated with antibiotics due to resistance to bacteria that cause these foods to go bad

Several federal agencies are responsible for regulating antibiotic use (including approval of antibiotics and allowable levels of antibiotic residues in food products) (USGA)

- FDA
- EPA
- CDC
- USDA

Debate over human health risks vs. economic benefit for consumers (USGA)


HOW OFTEN ARE ANTIBIOTICS USED?

Antibiotics in small doses daily help animals gain up to 3% more weight than they would without antibiotics (PBS)

Theorized that the antibiotics kill flora in intestines, allowing the animals to digest foods more effectively

Estimates: 15-17 million pounds of antibiotics used in animals yearly


ANTIBIOTIC WORRIES

The biggest issue surrounding the use of antibiotics is the increasing amount of evidence that using antibiotics typically used to treat human illness in food production will make these bacteria in animals antibiotic resistant, leading to resistance to bacteria that cause these foods to go bad

- A 2001 study in the New England Journal of Medicine found...
- 2 million people become infected with bacteria that are resistant to antibiotics and at least 23,000 people die each year as a direct result of these infections (CDC)


WHY ARE HORMONES USED IN FOOD PRODUCTION?

Hormones make young animals gain weight faster (Ghandi & Snedeker)

- Reduce wait time to slaughter
- Reduce amount of feed needed per animal
- Increase milk production

Shelf life is extended for meat, poultry, eggs, and dairy products treated with antibiotics due to resistance to bacteria that cause these foods to go bad
WHY WORRY ABOUT HORMONES?

Certain synthetic steroidal hormones in pharmaceutical drugs have been found to affect cancer risk (Ghandi & Snedeker).

- In the 1960s, diethylstilbestrol (DES), a synthetic estrogen, increased the risk of vaginal cancers in the daughters of women who used the drug.
- Exposure to excess estrogen increases risk of breast cancer.
- It’s also a common belief that increased hormones in the food supply cause early puberty, which may affect the female voice (Ghandi & Snedeker).

HISTORY OF HORMONES IN FOOD PRODUCTION

Bovine growth hormone (bGH) was found to help cows produce more milk in the 1930s (Ghandi & Snedeker).

- Technology prevented this from being done outside research.
- In the 1980s, recombinant DNA technology allowed this to be done on a larger scale.
- The FDA approved the use of recombinant bovine growth hormone (rbGH) in dairy cattle.

The 1930s also lead to the discovery that estrogen affected growth rates in cattle and poultry (Ghandi & Snedeker).

- In the early 1950s, estrogen became synthetically produced and was used in large amounts for use in these animals.
- DES was used for the 1950s-1970s for this purpose until it was found to cause cancer and phased out.

HORMONES USED TODAY

FDA currently approves 6 hormones for use in food production (other than rbGH) (Ghandi & Snedeker).

- Estradiol – a natural female sex hormone.
- Progesterone – a natural female sex hormone.
- Testosterone – a natural male sex hormone.
- Zeranol – synthetic.
- Trebolone acetate – synthetic.
- Melengestrol acetate – synthetic.

DO HORMONES USED IN FOOD AFFECT PUBERTY?

Food hormones and steroids were suspected to cause early puberty in girls (Ghandi & Snedeker).

- Large enough epidemiological studies have not been done to see if there is a relationship.
- The CDC investigated meat samples from Puerto Rico in the 1980s due to an increase in causes of early puberty in girls (Ghandi & Snedeker).

- Some chicken samples had elevated estrogen levels.
- Some girls were found to have zeranol in their blood.
- Other laboratories did not replicate these results.
- When the USDA tested samples in the Puerto Rican food supply in 1985, these findings were not present.

SPEECH SCIENCE CLASS PROJECT

- Students were recorded saying the sentence “Keith, say CVC again.”
- Recorded on Kay’s Computerized Speech Lab.
- CVC was plosive /a/ /t/.
- Consistent mouth-to-microphone distance was maintained.
- “Natural” speaking style was required.
- The sentence was used for a variety of class assignments related to voice, F0, VOT and formants.
- The only male in the class participated in the project but his data was not used as part of it.
- For this project, the F0 was measured on the center portion of the /a/ and the /e/ and averaged.
- F0 was extracted using Real Time Pitch.

RULES WERE BROKEN

- Because this was a class project, all female students were used as subjects regardless of age, race, medications, or voice use history.
- The majority of students were white.
- Age range was 19-29, with an average of 20.63.
- The need to control factors such as these was stressed throughout the project.

- Some rules were made to be broken.

- www.firstcigarette.com
Ma9 JK: Should this slide go earlier in the hormone section?
Microsoft account, 4/4/2016
STATISTICAL SUMMARY OF THE TWO VOWELS SEPARATELY; MEAN FO IS IN CPS

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STATISTICAL SUMMARY OF THE TWO VOWELS COMBINED; MEAN FO IS IN CPS

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HISTORICAL DATA

Average Fo was obtained from a variety of past studies:
- Methodologies, subjects, and speech samples varied.
- Only used data from "young women" which varied from late teenagers to late 20s.
- Samples ranged from prolonged vowels to reading.
- The chart is arranged by Fo (in CPS) on the Y axis and year on the X axis.
- Following the chart of average Fo is the result of a statistical correlation (Pearson) between Fo and year.
- References are on the following page with the year indicated in yellow.
- Many were secondary sources.

Average Fo of Young Women: 1945-2015

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<td>1990</td>
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<td>2000</td>
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</table>

CHART DATA POINT REFERENCES BY YEAR (SOME ARE SECONDARY)

CONCLUSION

There does not appear to be a downward trend in vocal Fo in adult women. The data from the class fit quite well in the overall distribution. The correlation between year and Fo was .216. “They” may be wrong about the lowering of Fo.

REFERENCES


REFERENCES CONTINUED


Ma15 JK: remove hyperlink here and further down
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