## Who I am 🙂

- "Mum" to a rescue Husky named "Gambit"
- I love to cook (currently it's Italian)
- My favorite place to camp at/rent a cabin at is Kalaloch, at the Pacific Ocean
- I have traced many cousins who immigrated from Sweden to the US, and even met some on my mother's side at IKEA in Renton
- I have a background in basic science, was a "Saliva Fellow" at NIDCR when I first started at UW in 2005, and I am still intrigued by how the quality of saliva affects oral health







# Geriatric Oral Health Dentistry Beyond the Margins

- It's all in the "Spit"

Susanne Kölare Jeffrey DDS, PhD Clinical Assistant Professor Restorative Dentistry University of Washington



UNIVERSITY of WASHINGTON



- Altered prior saliva
   Altered buffer capacity of saliva
- Alveolar bone
  - Bisphosphonate treatment of Osteoporosis











## Caries

- Tooth decay
- Caused by "biofilm" layers of bacteria (Str. Mutans) that attach to your teeth
- Oral bacteria "feed on" sugar and produce lactic acid, which leads to a demineralization of enamel and dentin
- The demineralization can be halted and reversed
  - Less acidic diet
  - Exchange part of your sugar intake for a sugar alcohol (Xylitol)
  - Regular dental exams with cleanings
  - Use of fluoride at higher concentrations in toothpaste and varnish (Rx)
  - Homecare using an electric toothbrush and interdental cleaning tools (Waterpik 🕗)
  - Use of many medications (4+) will give you less saliva, which means that your homecare is even more important!







# What do you see here?











# **Minor Salivary Glands**



#### **Mucous**

- Palatine glands
- Posterior lingual glands

#### Serous

Glands of von Ebner

#### Mixed

- Anterior lingual glands
  Buccal glands
  Labial glands



## **Capillaries surround both acini and ducts**



# **Contents of saliva**



• 99.5% water and 0.5% dissolved substances:

#### Salivary proteins and glycoproteins

• Amylase, Cystatins, *Mucins*, Proline-rich proteins (PrPs), Lysozyme, slg's, Lactoferrin, Peroxidase, Statherin etc.

 Growth factors: NGF, EGF, and other regulatory peptides
 Antimicrobial: Lysozyme, Lactoferrin, Lactoperoxidase, Histatins, Defensins
 Digestion of starch and lipids: Amylase and Lipase

#### **Inorganic ions**

• Bicarbonate, potassium, calcium and phosphate ions

#### Gases

• Oxygen, carbon dioxide and nitrogen





Most Common Causes of Dry Mouth

## Medications

Therapeutic Radiation

Autoimmune disease

Sjogren's Syndrome







## Functions of Saliva

Lubrication -

Control of oral flora -

Remineralization -

Buffering -

Taste -

Speech, swallowing, mastication Mucins

**Resistance to caries, mucosal infection** Anti-microbial peptides. Ig

Protection of enamel integrity Calcium and Phosphate

Resistance to changes in pH Phosphate buffer, Bicarbonate buffer, Protein buffer

Delivery of tastants to receptors Water acts as a solvent

Most Common Causes of Dry Mouth

Medications

Therapeutic Radiation

Sjogren's Syndrome

## Salivary Dysfunction Caused by Head and Neck Radiation

### Presentation

- Frequency/Severity increases with RTx dose
- Serous Acini more sensitive than Mucus Acini
- Patients complain of lack of saliva or excessive, thick mucus & ropy saliva
- Direct Toxicity from Cancer Therapy
   Radiation: Dose to gland > 2000 cGy
   Chemotherapy

## Stage 4 Throat Cancer

• B received 6,600 Gy as total dose for his stage 4 throat cancer in 2007





*Hyperbaric O<sup>2</sup> treatment post radiation to prevent osteonecrosis during invasive procedures to radiated bone.* 



Most Common Causes of Dry Mouth

Medications

Therapeutic Radiation

Sjögren's Syndrome

Most Common Causes of Dry Mouth

Medications

Therapeutic Radiation

Sjögren's Syndrome

## Sjögren's Syndrome



Sjögren's syndrome (SS) as a systemic disease was described by Henrik Sjögren in 1933.

It is an autoimmune disease in which the salivary and lacrimal glands become infiltrated with lymphocytes resulting in glandular damage

- **Primary SS** is characterized by dry eyes and dry mouth alone.
- Secondary SS dry eyes and dry mouth present in connection with a connective tissue disorder, such as RA, scleroderma or SLE.

#### Epidemiology:

Peak incidence in the fourth and fifth decades of life

Female to male ratio 9:1.

Prevalence of approx 0.6% of the general population, which means 1,800,000 persons in the US alone (2007) .

## Diagnosis of Autoimmune Disease-related Salivary Gland Disease

- History of autoimmune disease
- Serum antibody tests: ANA, SSA, SSB
- Labial gland biopsy
- Salivary flow rate measurement
- Tear flow rate measurement
- Symptom assessment







Salivary hypofunction to 2<sup>nd</sup> Sjogren's

Palatal candidiasis

Root caries

CE





## Saliva-Check BUFFER



## Saliva Testing

#### TEST 1: Saliva-Check Buffer

#### HYDRATION (minor salivary glands, 15% of resting saliva)

1. Visual inspection of hydration

## UNSTIMULATED SALIVA (minor and major salivary glands) for 5 mins

- 1. Flow (mL/min)
- 2. Consistency
- 3. pH (may also measure buffer capacity)

## STIMULATED SALIVA (minor and major salivary glands) for 5 mins

- 1. Flow (mL/min)
- 2. pH
- 3. Buffer capacity









Test results for "Pam" High Caries Risk	Minor salivary glands Hydration X Low Greater than 60 sec Normal Less than 60 second	conds Is
	Resting salivary secretion	
	Flow (mL/min) X VeryLow Less than 0.1 ml/mi	n -
	Low 0.1 - 0.25 mL/min	-
	Normal Above 0.25 mL/min	
Contraction of the second	Consistency Sticky, frothy: Increased viscosi	ty
	Frothy, bubbly: Increased viscos	sity
	X Watery, clear: Normal viscosity	617 C
	pH 5.0 - 5.8 Highly Acidic	
	X 6.0 - 6.6 Moderately Acidic	
	6.8 - 7.8 Healthy pH	
	Stimulated salivary secretion	
	Flow (mL/min) X Very Low Less than 0.7 mL/m	in
	Low 0.7 - 1.0 mL/min	
	Normal Above 1.0 mL/min	
	pH X 5.0 - 5.8 Highly Acidic	
	6.0 - 6.6 Moderately Acidic	
	6.8 - 7.8 Healthy pH	
	Buffer capacity 0 - 5 Very Low	
	X 6-9 Low	
	10-12 Normal/High	



No new caries in 3 years (includes incipient lesions)	<ul> <li>1 - 2 new caries in 3 years</li> <li>Exposed root surfaces</li> <li>No fluoride in drinking water</li> <li>4+ medications</li> <li>Low pH unstimulated saliva</li> <li>Flow &lt;0.16 mL/min unstimulated</li> <li>Visible plaque</li> <li>Interproximal restorations</li> <li>Drug/Alcohol abuse</li> </ul>	3 new caries in 3 y • Teeth missing du • Chemo/Radiation • Severe dry mout	years le to caries in past 3 years n therapy h (<0.1 mL/min)
Low risk REMINERALISATION Professional Care: • 1x yearly exam Home Care: • Brush 2x daily with NaF toothpaste ~ 1,100 ppm • If exposed root surfaces use ACP containing tooth paste • Supplement with a daily Rx 0.2% NaF rinse (OTC is 0.05%)	Moderate risk REMINERALISATION Professional Care: • 2x yearly exam • NaF varnish (22,500 ppm) • SDF (55,600 ppm) Home Care: • Use 5,000 ppm paste as only toothpaste • If low flow - ACP/TCP products (incl. in ClinPro/Prevident Booster Plus) ANTI-BACTERIAL • 5-10 g of Xylitol each day (root caries prevention)	High REMINERALISATION Professional Care: • 2-4x yearly exam • NaF varnish • SDF Home Care: • Use 5,000 ppm paste (ClinPro or Prevident Booster Plus) • Use Calcium containing MI paste as indicated • Baking soda rinse	risk ANTI-BACTERIAL Rx: • Rinse with 0.12% Chx Home care: • 5-10 g of Xylitol each day (root caries prevention) • Diet modifications: Fermentable carbs, frequency and pH of foods















	Abalone	6.10 - 6.50	Artichokes, Jerusalem, cooked	5.93 - 6.00
	Abalone mushroom	5.00 -	Asparagus	6.00 - 6.70
pH of Foods	Ackees	5.5	Asparagus Buds	6.7
	Aloe vera	6.1	Asparagus Stalks	6.1
	Aloe Juice	6.00 - 6.80	Asparagus, cooked	6.03 - 6.16
	Anchovies	6.5	Asparagus, canned	5.00 - 6.00
	Antipesto	5.60 -	Asparagus, frozen, cooked	6.35 - 6.48
	Apple, baked with sugar	3.20 - 3.55	Asparagus, green, canned	5.20 - 5.32
	Apple, eating	3.30 - 4.00	Asparagus, strained	4.80 - 5.09
	Apples, Delicious	3.9	Avocados	6.27 - 6.58
	Apples, Golden Delicious	3.6	Baby corn	5.20 -
	Apples, Jonathan	3.33	Baby Food Soup, unstrained	5.95 - 6.05
	Apples, McIntosh	3.34	Bamboo Shoots +	5.10 - 6.20
	Apple Juice	3.35 - 4.00	Bamboo Shoots, preserved	3.50 - 4.60
	Applesauce	3.10 - 3.60	Bananas	4.50 - 5.20
	Apples, Winesap	3.47	Bananas, red	4.58 - 4.75
	Apricots	3.30 - 4.80	Banana, yellow	5.00 - 5.29
	Apricots, Canned	3.40 - 3.78	Barley, cooked	5.19 - 5.32
	Apricots, Dried, stewed	3.30 - 3.51	Basil pesto	4.9
	Apricots, Nectar	3.78	Bass, sea, broiled	6.58 - 6.78
	Apricots, Pureed,	3.42 - 3.83	Bass, striped, broiled	6.50 - 6.70
	Apricots, Strained	3.72 - 3.95	Beans	5.60 - 6.50
	Arrowroot Crackers	6.63 - 6.80	Beans, Black	5.78 - 6.02
	Arrowroot Cruel	6.37 - 6.87	Beans, Boston style	5.05 - 5.42
	Artichokes	5.50 - 6.00	Beans, Kidney	5.40 - 6.00
	Artichokes, canned, acidified	4.30 - 4.60	Beans, Lima	6.5
pyright: SmithGlaxoKline:	Artichokes, French, cooked	5.60 - 6.00	Soy beans	6.00 - 6.60







## Salagen Tablets (Pilocarpine Hydrochloride)

## Indication:

For the treatment of symptoms of xerostomia from salivary gland hypofunction caused by radiotherapy for cancer of the head and neck and by Sjogren's syndrome.





## Sara's journey

- This is a story of medical/dental separation and dysfunction that shouldn't be, in this extremely rich, highly technically advanced country.
- Thirteen years ago, at the age of 64, I was healthy and fit. I danced 30 hours a week, taking class with people 1/3 my age and managing my own dance business, teaching adults of all ages.
- I had all my teeth including all my wisdom teeth and they were healthy.
- Then I was diagnosed with squamous cell carcinoma of the tonsil.

• Doctors at UW Medical Center and Fred Hutchinson saved my life and I am forever grateful. It was a fight — against the disease and to preserve my life and manner of living afterward.

• I was told that my head & neck treatment was the most rigorous cancer treatment there was, outside of bone marrow transplant — and even after refusing surgery for what was termed a necessary JPEG, I still came through treatment in the top few percent of patient survivors — thanks to my husband and the excellent care of world-class doctors and medical personnel.

• With their help, I survived some the worst that cancer could throw at me.

• What I have nearly not survived — is the less than adequate transition of care from the medical world to the dental world. Two separate worlds which should not exist in that form.

• Transition of my care should have been a smooth transfer from critically urgent, short term treatment to eliminate cancer — to critically important long term care of radiation damaged teeth and tissue — by an extended team of healthcare providers who understood enough about each other's specialties to be able to work smoothly and efficiently together to assist me — their patient — in making the transition to life after cancer.

• What I got was a huge, sudden, gap in knowledge that led me to lose trust and feel suddenly cast adrift to find my own way in a changed world.

• A medical resident who clearly knew very little about dentistry or post cancer oral medicine, made his ignorance and arrogance clear in his useless remarks, lack of useful information and questionable advice.

• By inference, if not directly, he disparaged the UW School of Dentistry — part of his own medical center — and left me feeling that I had nowhere to turn for the care of my mouth and teeth.

• As a result, I wandered in the dental wilderness for 9 years — getting inadequate care from dentists who did not know how to treat me or my mouth — while I literally ate my teeth.

• Finally, in desperation, I did go to the UW School of Dentistry in late 2019 and connected with Dr. Jefferey in March of 2020 — a week before the COVID shutdown...

• Now, after 2 years of heroic care under her guidance — and — I'm guessing, with about another year to go, I am finally feeling hopeful for the future of my teeth. I know they will always be susceptible to decay, but now I have more knowledge, effective tools, and a dentist I know and trust to be able to care for my particular needs.

- But it shouldn't have been this hard.
- My teeth shouldn't have gotten this bad.
- I shouldn't need such extensive treatment.
- And my family and I shouldn't have been put at such financial risk.

I experienced 2 failures of care during transition from cancer treatment to survival and life AC (after cancer).

- 1. My doctors didn't now enough about dentistry to give me good information, advice and guidance.
- 2. The dentists I sought out didn't know enough about post cancer oral medicine to effectively care for my teeth and advise me.

And I'm the one who lost.

• A more functional health care system would have prevented what happened to me and happens to millions of Americans.

500 years is long enough to continue an archaic and no longer useful belief system around health care.

• Doctors and dentists must come together and work together for the health of their patients.

Don't wait for politicians to "fix" our healthcare mess. Don't wait for guilds or associations to bless each other. Talk to each other — directly. Learn from each other. Your patients deserve nothing less.



# Take Home Messages

• Older adults are at risk for coronal and root caries

• *Risk assessment* and *early detection* are key to successful prevention and treatment

• Fluoride: titrate the strength and frequency to the caries risk

Effective daily care and *healthy eating* are critical





# Summary: Caring beyond the restorative margin

*Including Saliva assessment, Caries Risk assessment, Nutritional counseling and Preventive Care* 

- > Appropriate dental treatment plans with better outcomes
- > Nutritional aspects
  - Tooth friendly diet 🎯
  - Salivary pH and pH of different foods
- > Personalized Preventive Care Programs
- Increased Quality of Care

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# Assisted living/Nursing home dentistry

May need assistance with tooth brushing Use of Rx toothpaste and 0.12% Chlorhexidine rinse (rinse can also be used to swab mouth) Regular cleanings as available Use of SDF to prevent/arrest decay





## Aspiration Pneumonia



 Plaque accumulation may be due to: Stroke - Less control of muscular activity/Less muscular activity (Facial muscles) Difficulty swallowing (Dysphagia) Loss of sensitivity (Sensory neuropathy) Unable to brush teeth (Inability to perform ADL)

- > Association between poor oral hygiene and respiratory disease, such as aspiration pneumonia
- > Aspiration pneumonia occur when oropharyngeal secretions are directed into the trachea and subsequently into the lungs. Results in either bi- or unilateral pneumonia.

Aspiration Pneumonia is the leading cause of death in Nursing home residents. 10% of deaths may be prevented by increased oral hygiene

Early			Early Middle
	<ul> <li>Not remembering appointments</li> </ul>		Loosing fine motor skills (buttoning a shirt)
Make customized	<ul> <li>Not recognizing familiar faces</li> </ul>		<ul> <li>Not recognizing objects for what they are</li> <li>Being unable to understand written words</li> </ul>
treatment plan	Losing track of time		
	Not storing recent information     Getting lost		Middle Middle
	Having difficulties finding words		Repetitious speech and action
	Misplacing needed items		Having hallucinations and delusions
Middle	arly		Altered visual perception
Wildule I	Being unable to make decisions		Frequent changes of emotions     Minimal attention span
	<ul> <li>Finding it hard to concentrate</li> </ul>		Overreacting, having outbursts
	Acting paranoid		Assistance with all ADL
	<ul> <li>Being unable to separate fact from fiction</li> </ul>		
	Being unable to translate thoughts into actions	•	Late Middle
	<ul> <li>Misunderstanding what is being said</li> </ul>		Incontinent
	<ul> <li>Making mistakes in judgment</li> </ul>		Unable to separate or recognize sounds
Late Ear	ly	٠	Late or Final
	Withdrawing, being frustrated and/or angry		Losing all language
	Losing ability to sequence tasks		Losing gross motor skills (sitting, waiking)     Having swallowing difficulties
	Speaking in rampling sentences     Misusing familiar words		Needing total care
Increasingly more	Having difficulty writing		
in a dental chair	Requiring supervision for ADL		
	Reacting less quickly		

# Lisa (F76)

- S: Lisa and her husband David presents for a problem-focused exam. *A previous dentist has recommended full mouth extraction*. L has fractured restorations, but L seems not to be in obvious pain. Last cleaning 3 yrs ago.
- O: Medical
  - Diabetes
  - BP well controlled
  - AD was diagnosed in late 2005, about 10 yrs ago. Advanced AD: nonresponsive, non-verbal
  - Drug allergy: Sulfa, Opiates/Codeine

# Lisa (F76)

- P: Limited exam, problem-focused. I was able to open L's mouth and to brush her teeth with 0.12% Chx without any difficulties. She has been to the dentist frequently in the past, and her motor reflexes are still intact. She reacts well to movements in her mouth, and opening reflexes are functioning.
- Discussed the need for extractions with her husband. A full mouth extraction at this point seems to be doing more harm than good. L is still eating and chewing, and a full mouth extraction would put her into a situation that she has not known in the past, which would not serve her well in terms of reflexes and cooping with the extractions. I could not notice that any probing that I did was painful for her.
- NV: Regular cleanings with Dr. Jeffrey
- Rx: 0.12% Chx solution for antimicrobial cleaning of gums and teeth 1-2x daily.

Epilogue: Lisa passed away 2 months after her visit in my dental office.

Abalone	6.10 - 6.50	Artichokes, Jerusalem, cooked	5.93 - 6.00
Abalone mushroom	5.00 -	Asparagus	6.00 - 6.70
Ackees	5.5	Asparagus Buds	6.7
Aloe vera	6.1	Asparagus Stalks	6.1
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Artichokes	5.50 - 6.00	Beans, Kidney	5.40 - 6.00
Artichokes, canned, acidified	4.30 - 4.60	Beans, Lima	6.5
Artichokes, French, cooked Oral Health (Kolare Jeffrey), NW GWE	5.60 - 6.00 Winter 2024	Soy beans	6.00 - 6.60

Beans, Stringbeans	5.6	Broccoli, canned	5.20 - 6.00
Beans, Wax	5.30 - 5.70	Brussels sprout	6.00 - 6.30
Beans, pork & tomato sauce, canned	5.10 - 5.80	Buttermilk	4.41 - 4.83
Beans, refried	5.9	Cabbage	5.20 - 6.80
Beans, veg., tomato sauce, canned	5.32	Cabbage, Green	5.50 - 6.75
Beets	5.30 - 6.60	Cabbage, Red	5.60 - 6.00
Beets, cooked	5.23 - 6.50	Cabbage, Savoy	6.3
Beets, canned, acidified	4.30 - 4.60	Cabbage, White	6.2
Beets, canned	4.90 - 5.80	Cactus	4.7
Beets, chopped	5.32 - 5.56	Calamary (Squid)	5.8
Beets, strained	5.32 - 5.56	Cantaloupe	6.13 - 6.58
Bird's nest soup	7.20 - 7.60	Capers	6
Blackberries, Washington	3.85 - 4.50	Carp	6
Blueberries, Maine	3.12 - 3.33	Carrots	5.88 - 6.40
Blueberries, frozen	3.11 - 3.22	Carrots, canned	5.18 - 5.22
Bluefish, Boston, filet, broiled	6.09 - 6.50	Carrots, chopped	5.30 - 5.56
Bran Flakes	5.45 - 5.67	Carrots, cooked	5.58 - 6.03
Bran - All Bran	5.59 - 6.19	Carrots, pureed	4.55 - 5.80
Bread, white	5.00 - 6.20	Carrots, strained	5.10 - 5.10
Bread, Boston, brown	6.53	Cauliflower	5.6
Bread, Cracked wheat	5.43 - 5.50	Cauliflower, cooked	6.45 - 6.80
Bread, pumpernickel	5.40 -	Caviar, American	5.70 - 6.00
Bread, Rye	5.20 - 5.90	Celery	5.70 - 6.00
Bread, whole wheat	5.47 - 5.85	Celery, cooked	5.37 - 5.92
Breadfruit, cooked	5.33	Celery Knob, cooked	5.71 - 5.85
Broccoli, cooked	6.30 - 6.52	Cereal, strained	6.44 - 6.45
Broccoli, frozen, cooked	6.30 - 6.85	Chayote (mirliton), cooked	6.00 - 6.30

Oral Health (Kolare Jeffrey), NW GWE Winter 2024

Cheese, American, mild	4.98	Codfish, boiled	5.30 - 6.10
Cheese, Camembert	7.44	Cod liver	6.2
Cheese, Cheddar	5.9	Conch	7.52 - 8.40
Cheese, Cottage	4.75 - 5.02	Congee	6.4
Cheese, Cream, Philadelphia	4.10 - 4.79	Corn	5.90 - 7.30
Cheese Dip	5.8	Corn, canned	5.90 - 6.50
Cheese, Edem	5.4	Corn Flakes	4.90 - 5.38
Cheese, Old English	6.15	Corn, frozen, cooked	7.33 - 7.68
Cheese, Roquefort	5.10 - 5.98	Corn, cooked on cob	6.22 - 7.04
Cheese, Parmesan	5.20 - 5.30	Crab meat	6.50 - 7.00
Cheese, Snippy	5.18 - 5.2l	Crabapple Jelly, corn	2.93 - 3.02
Cheese, Stilton	5.7	Cranberry Juice, canned	2.30 - 2.52
Cheese, Swiss Gruyere	5.68 - 6.62	Crabmeat, cooked	6.62 - 6.98
Cherries, California	4.01 - 4.54	Cream, 20 per cent	6.50 - 6.68
Cherries, frozen	3.32 - 3.37	Cream, 40 per cent	6.44 - 6.80
Cherries, black, canned	3.82 - 3.93	Cream of Asparagus	6.1
Cherries, Maraschino	3.47 - 3.52	Cream of Coconut, canned	5.51 - 5.87
Cherries, red, Water pack	3.25 - 3.82	Cream of Potato soup	6
Cherries, Royal Ann	3.80 - 3.83	Cream of Wheat, cooked	6.06 - 6.16
Chicory	5.90 - 6.05	Chrysanthemum drink	6.5
Chili Sauce, acidified	2.77 - 3.70	Cucumbers	5.12 - 5.78
Chives	5.20 - 6.31	Cucumbers, Dill pickles	3.20 - 3.70
Clams	6.00 - 7.10	Cucumbers, pickled	4.20 - 4.60
Clam Chowder, New England	6.4	Curry sauce	6
Coconut, fresh	5.50 - 7.80	Curry Paste, acidified	4.60 - 4.80
Coconut milk	6.10 - 7.00	Cuttlefish	6.3
Coconut preserves	3.80 - 7.00	Dates, canned	6.20 - 6.40

Oral Health (Kolare Jeffrey), NW GWE Winter 2024

Dates, Dromedary	4.14 - 4.88	Grapes, Niagara	2.80 - 3.27
Eggplant	5.50 - 6.50	Grapes, Ribier	3.70 - 3.80
Eggs, new-laid, whole	6.58	Grapes, Seedless	2.90 - 3.82
Egg White	7.96	Grapes, Tokyo	3.50 - 3.84
Egg Yolk	6.1	Grapefruit	3.00 - 3.75
Eel	6.2	Grapefruit, canned	3.08 - 3.32
Escarolle	5.70 - 6.00	Grapefruit Juice, canned	2.90 - 3.25
Enchalada sauce	4.40 - 4.70	Grass jelly	5.80 - 7.20
Fennel (Anise)	5.48 - 5.88	Greens, Mixed, chopped	5.05 - 5.22
Fennel, cooked	5.80 - 6.02	Greens, Mixed, strained	5.22 - 5.30
Figs, Calamyrna	5.05 - 5.98	Grenadine Syrup	2.31
Figs, canned	4.92 - 5.00	Guava nectar	5.5
Flounder, boiled	6.10 - 6.90	Guava, canned	3.37 - 4. 10
Flounder, fi1et, broiled	6.39 - 6.89	Guava Jelly	3.73
Four bean salad	5.6	Haddock, Filet, broiled	6.17 - 6.82
Fruit cocktail	3.60 - 4.00	Hearts of Palm	5.7
Garlic	5.8	Herring	6.1
Gelatin Dessert	2.6	Hominy, cooked	6.00 - 7.50
Gelatin, plain jell	6.08	Honey	3.70 - 4.20
Ginger	5.60 - 5.90	Honey Aloe	4.7
Ginseng , Korean drink	6.00 - 6.50	Horseradish, freshly ground	5.35
Gooseberries	2.80 - 3.10	Huckleberries, cooked with sugar	3.38 - 3.43
Graham Crackers	7.10 - 7.92	Jackfruit	4.80 - 6.80
Grapes, canned	3.50 - 4.50	Jam, fruit	3.50 - 4.50
Grapes, Concord	2.80 - 3.00	Jellies, fruit	3.00 - 3.50
Grapes, Lady Finger	3.51 - 3.58	Jujube	5.20 -
Grapes, Malaga Oral Health (Kolare Jeffrey), NW GV	3.71 - 3.78 VE Winter 2024	Kale, cooked	6.36 - 6.80

Ketchup	3.89 - 3.92	Mangoes, green	5.80 - 6.00
Kippered, Herring, Marshall	5.75 - 6.20	Mangostine	4.50 - 5.00
Herring, Pickled	4.50 - 5.00	Maple syrup	5.15
Kelp	6.3	Maple syrup, light (Acidified)	4.6
Kumquat, Florida	3.64 - 4.25	Matzos	5.7
Leeks	5.50 - 6.17	Mayhaw	3.27 - 3.86
Leeks, cooked	5.49 - 6.10	Melba Toast	5.08 - 5.30
Lemon Juice	2.00 - 2.60	Melon, Casaba	5.78 - 6.00
Lentils, cooked	6.30 - 6.83	Melons, Honey dew	6.00 - 6.67
Lentil Soup	5.8	Melons, Persian	5.90 - 6.38
Lettuce	5.80 - 6.15	Milk, cow	6.40 - 6.80
Lettuce, Boston	5.89 - 6.05	Milk, Acidophilus	4.09 - 4.25
Lettuce, Iceberg	5.70 - 6.13	Milk, condensed	6.33
Lime Juice	2.00 - 2.35	Milk, evaporated	5.90 - 6.30
Lime	2.00 - 2.80	Milk, Goat's	6.48
Lobster bisque	6.90 -	Milk, peptonized	7.1
Lobster soup	5.7	Milk, Sour, fine curd	4.70 - 5.65
Lobster, cooked	7.10 - 7.43	Milkfish	5.3
Loganberries	2.70 - 3.50	Mint Jelly	3.01
Loquat (May be acidified to pH 3.8)	5.1	Molasses	4.90 - 5.40
Lotus Root	6.90 -	Muscadine (A variety of grape)	3.20 - 3.40
Lychee	4.70 - 5.01	Mushrooms	6.00 - 6.70
Macaroni, cooked	5.10 - 6.41	Mushrooms, cooked	6.00 - 6.22
Mackerel, King, boiled	6.26 - 6.50	Mushroom Soup, Cream of, canned	5.95 - 6.40
Mackerel, Spanish, broiled	6.07 - 6.36	Mussels	6.00 - 6.85
Mackerel, canned	5.90 - 6.40	Mustard	3.55 - 6.00
Mangoes, ripe	3.40 - 4.80	Nata De Coco	5

Nectarines	3.92 - 4.18	Peaches	3.30 - 4.05
Noodles, boiled	6.08 - 6.50	Peaches, canned	3.70 - 4.20
<b>O</b> atmeal, cooked	6.20 - 6.60	Peaches, cooked with sugar	3.55 - 3.72
Octopus	6.00 - 6.50	Peaches, frozen	3.28 - 3.35
Okra, cooked	5.50 - 6.60	Peanut Butter	6.28
Olives, black	6.00 - 7.00	Peanut Soup	7.5
Olives, green, fermented	3.60 - 4.60	Pears, Bartlett	3.50 - 4.60
Olives, ripe	6.00 - 7.50	Pears, canned	4.00 - 4.07
Onions, pickled	3.70 - 4.60	Pears, Sickle cooked w/sugar	4.04 - 4.21
Onions, red	5.30 - 5.80	Pear Nectar	4.03
Onion white	5.37 - 5.85	Peas, canned	5.70 - 6.00
Onions, yellow	5.32 - 5.60	Peas, Chick, Garbanzo	6.48 - 6.80
Oranges, Florida	3.69 - 4.34	Peas, cooked	6.22 - 6.88
Oranges, Florida "color added"	3.60 - 3.90	Peas, dried (split green), cooked	6.45 - 6.80
Orange Juice, California	3.30 - 4.19	Peas, dried (split yellow), cooked	6.43 - 6.62
Orange, Juice Florida	3.30 - 4.15	Peas, frozen, cooked	6.40 - 6.70
Orange, Marmalade	3.00 - 3.33	Peas, pureed	4.90 - 5.85
Oysters	5.68 - 6.17	Pea Soup, Cream of, Canned	5.7
Oyster, smoked	6	Peas, strained	5.91 - 6.12
Oyster mushrooms	5.00 - 6.00	Peppers	4.65 - 5.45
Palm, heart of	6.7	Peppers, green	5.20 - 5.93
Рарауа	5.20 - 6.00	Persimmons	4.42 - 4.70
Papaya Marmalade	3.53 - 4.00	Pickles, fresh pack	5.10 - 5.40
Parsley	5.70 - 6.00	Pimiento	4.40 - 4.90
Parsnip	5.30 - 5.70	Pimento, canned, acidified	4.40 - 4.60
Parsnips, cooked	5.45 - 5.65	Pineapple	3.20 - 4.00
Pate	5.9	Pineapple, canned	3.35 - 4.10
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Pineapple Juice, canned	3.30 - 3.60	Quince Jelly	3.7
Plum Nectar	3.45	Radishes, red	5.85 - 6.05
Plums, Blue	2.80 - 3.40	Radishes, white	5.52 - 5.69
Plums, Damson	2.90 - 3.10	Raisins, seedless	3.80 - 4.10
Plums, Frozen	3.22 - 3.42	Rambutan (Thailand)	4.9
Plums, Green Gage	3.60 - 4.30	Raspberries	3.22 - 3.95
Plums, Green Gage, canned	3.22 - 3.32	Raspberries, frozen	3.18 - 3.26
Plums, Red	3.60 - 4.30	Raspberries, New Jersey	3.50 - 3.82
Plums, spiced	3.64	Raspberry Jam	2.87 - 3.17
Plums, Yellow	3.90 - 4.45	Razor Clams	6.2
Pollack, filet, broiled	6.72 - 6.82	Razor shell (sea asparagus)	6
Pomegranate	2.93 - 3.20	Rattan, Thailand	5.20 -
Porgy, broiled	6.40 - 6.49	Red Ginseng	5.5
Pork & Beans, rts.	5.7	Red Pepper Relish	3.10 - 3.62
Potatoes	5.40 - 5.90	Rhubarb, California, stewed	3.20 - 3.34
Potatoes, Mashed	5.1	Rhubarb	3.10 - 3.40
Prunes, dried, stewed	3.63 - 3.92	Rhubarb, Canned	3.4
Sweet Potatoes	5.30 - 5.60	Rice, Brown, cooked	6.20 - 6.80
Yams - Tubers	5.7	Rice Krispies	5.40 - 5.73
Potato Soup	5.9	Rice, White , cooked	6.00 - 6.70
Prune Juice	3.95 - 3.97	Rice, Wild, cooked	6.00 - 6.50
Prune, pureed	3.60 - 4.30	Bread Rolls, white	5.46 - 5.52
Prune, strained	3.58 - 3.83	Romaine lettuce	5.78 - 6.06
Puffed Rice	6.27 - 6.40	<b>S</b> almon, fresh, boiled	5.85 - 6.50
Puffed Wheat	5.26 - 5.77	Salmon, fresh, broiled	5.36 - 6.40
Pumpkin	4.90 - 5.50	Salmon, Red Alaska, canned	6.07 - 6.16
<b>Q</b> uince, fresh, stewed	3.12 - 3.40	Sardines	5.70 - 6.60

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Sardine, Portuguese, in olive oil	5.42 - 5.93	Spinach, chopped	5.38 - 5.52
Satay sauce	5	Spinach, cooked	6.60 - 7.18
Sauce, Enchilada	5.50 -	Spinach, frozen, cooked	6.30 - 6.52
Sauce, Fish	4.93 - 5.02	Spinach, pureed	5.50 - 6.22
Sauce, Shrimp	7.01 - 7.27	Spinach, strained	5.63 - 5.79
Sauerkraut	3.30 - 3.60	Squash, acorn, cooked	5.18 - 6.49
Scallion	6.20 -	Squash, Kubbard, cooked	6.00 - 6.20
Scallop	6	Squash, white, cooked	5.52 - 5.80
Scotch Broth.	5.92	Squash, yellow, cooked	5.79 - 6.00
Sea Snail (Top shell)	6	Squid	6.00 - 6.50
Shad Roe, sauted	5.70 - 5.90	Sturgeon	6.2
Shallots, cooked	5.30 - 5.70	Strawberries	3.00 - 3.90
Sherbet, raspberry	3.69	Strawberries, California	3.32 - 3.50
Sherry-wine	3.37	Strawberries, frozen	3.21 - 3.32
Shredded Ralston	5.32 - 5.60	Strawberry Jam	3.00 - 3.40
Shredded Wheat	6.05 - 6.49	Straw mushroom	4.9
Shrimp	6.50 - 7.00	Sweet Potatoes	5.30 - 5.60
Shrimp Paste	5.00 - 6.77	Swiss Chard, cooked	6.17 - 6.78
Smelts, Sauted	6.67 - 6.90	Tamarind	3.00 -
Soda Crackers	5.65 - 7.32	Tangerine	3.32 - 4.48
Soup	5.4 - 6.2	Taro syrup	4.5
Soy infant formula	6.60 - 7.00	Теа	7.2
Soy Sauce	4.40 - 5.40	Three-Bean Salad	5.4
Soy bean curd (tofu)	7.2	Tofu (soybean Curd)	7.2
Soybean milk	7	Tomatillos	3.83
Spaghetti, cooked	5.97 - 6.40	Tomatoes	4.30 - 4.90
Spinach	5.50 - 6.80	Tomatoes, canned	3.50 - 4.70

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Tomatoes, Juice	4.10 - 4.60	Vermicelli, cooked	5.80 - 6.50
Tomatoes, Paste	3.50 - 4.70	Vinegar	2.40 - 3.40
Tomatoes, Puree	4.30 - 4.47	Vinegar, cider	3.1
Tomatoes, Strained	4.32 - 4.58	Walnuts, English	5.42
Tomatoes, Wine ripened	4.42 - 4.65	Wax gourd drink	7.2
Tomato Soup, Cream of, canned	4.62	Water Chestnut	6.00 - 6.20
Trout, Sea, sauted	6.20 - 6.33	Watercress	5.88 - 6.18
Truffle	5.30 - 6.50	Watermelon	5.18 - 5.60
Tuna Fish, canned	5.90 - 6.20	Wheat Krispice	4.99 - 5.62
Turnips	5.29 - 5.90	Wheatnena	5.85 - 6.08
Turnip, greens, cooked	5.40 - 6.20	Wheaties	5.00 - 5.12
Turnip, white, cooked	5.76 - 5.85	Worcestershire sauce	3.63 - 4.00
Turnip, yellow, cooked	5.57 - 5.82	Yams, cooked	5.50 - 6.81
Vegetable Juice	3.90 - 4.30	Yeast	5.65
Vegetable soup, canned	5.16	Yangsberries, frozen	3.00 - 3.70
Vegetable soup, chopped	4.98 - 5.02	<b>Z</b> ucchini, cooked	5.69 - 6.10
Vegetable soup, strained	4.99 - 5.00	Zwiebach	4.84 - 4.94

References: This list is from the U.S. FDA and the Center for Food Safety and Applied Nutrition.

- 1. Anon. 1962. pH values of food products. Food Eng. 34(3): 98-99.
- 2. Bridges, M. A., and Mattice, M.R. 1939. Over two thousand estimations of the pH of representative foods, American J. Digestive Diseases, 9:440-449.
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