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INTEGSCI 3002A: Nutrition: Uncovering the Misconceptions of What We Consume

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Nutrition: Uncovering the Misconceptions of What We Consume

Integrated Science 3002A: Science in the Community

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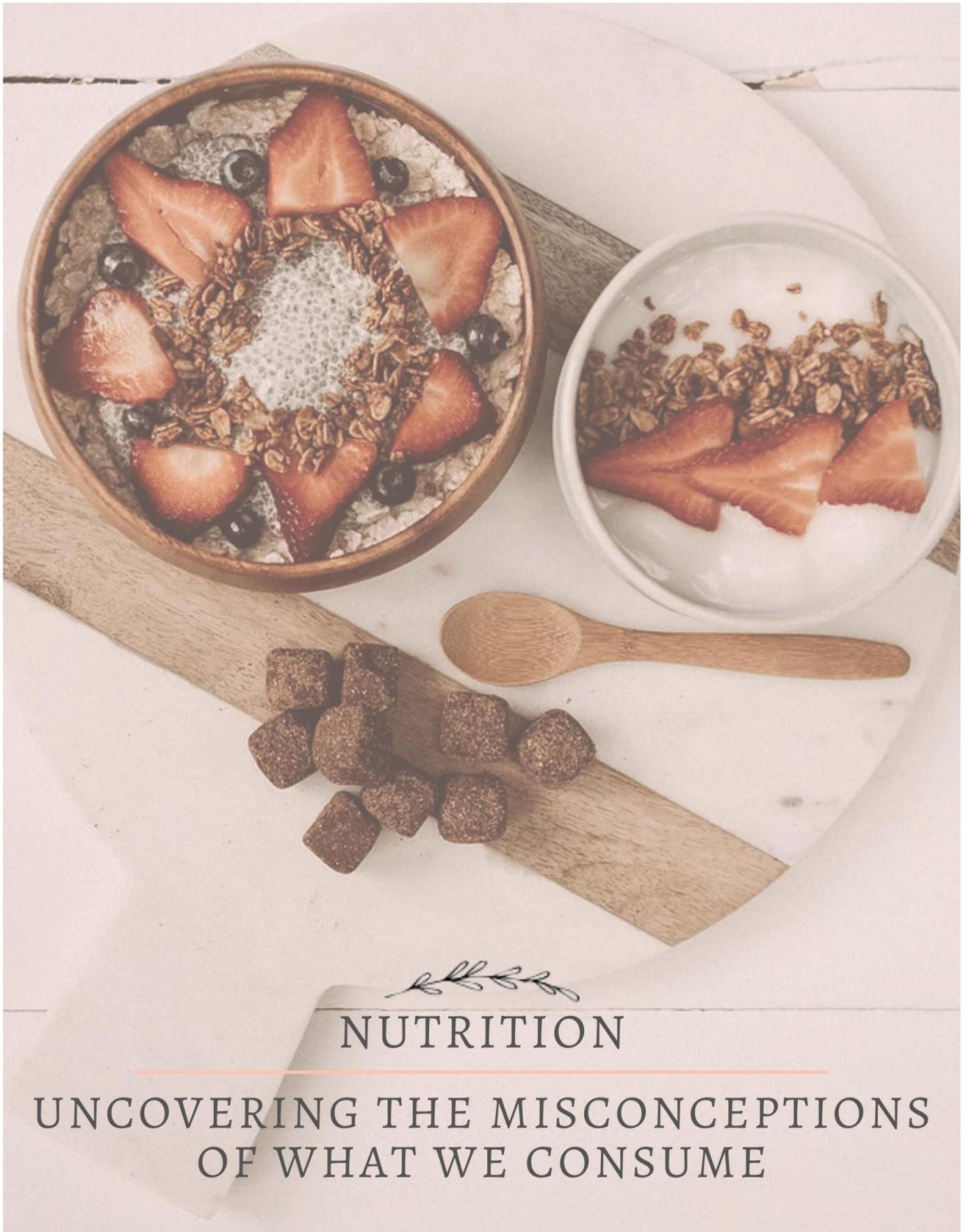
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Decorative flourish
NUTRITION

UNCOVERING THE MISCONCEPTIONS
OF WHAT WE CONSUME

Debunking Misconceptions in Your Everyday Nutrition

5 In today's digital age of bloggers, YouTubers, and celebrity influencers heavily promoting products and ideas, discerning accurate information as the average consumer is harder than ever. These ideas are not necessarily fact-based, and can mislead consumers into blindly following harmful trends, especially related to diets and nutrition.

10 Local holistic nutritionist and business-owner, Nicole VanQuaethem of Simply Nic Nutrition, helps consumers sift through these misconceptions in the media. She reaches a wide audience through her blog, where she writes credible articles on improving one's health and lifestyle.

A team of six students from Western University have investigated several popular misconceptions about nutrition to help Nicole separate fact from fiction for her readers.

15 The scientific information they have collected is important for helping consumers avoid harmful and misleading trends. For example, supplements are heavily promoted in the media, but using them excessively with normal dietary habits can lead to health deterioration.

20 Protein powders are also a major trend, but individuals who choose it over animal protein often lose out on other essential nutrients. Kombucha is another major trend, but contrary to supplements and protein powders, it has positive health effects for its consumers.

25 Their research also indicated how education about certain foods can positively impact health. For those who face barriers in obtaining fresh fruits and vegetables, it is important to know that frozen ones are a comparable source of nutrition. It is also often claimed that bottled water mineral content is higher, however research indicates that mineral content is similar in bottled water and municipal water systems.

30 And for those who are diabetic, the team's research found that consuming plant-based protein rather than animal-based protein plays an important role in maintaining healthy blood-glucose levels.

Title: Nutrition: Uncovering the Misconceptions of What We Consume

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Abstract: Nutrition misconceptions are widespread and can be harmful to consumers. It is necessary to address and research them to avoid the propagation of misinformation. This investigation revealed the truth behind some commonly debated nutrition topics: frozen produce are equal in nutrition to fresh; protein powders are not a sufficient diet alone because they lack essential nutrients; kombucha has genuine positive health impacts; bottled water is not healthier than tap water; supplements can cause health deterioration over time; and diabetics can manage their condition through diet choices. The information gathered here will provide more power to the consumer to make informed, beneficial choices about their diet and health.

One Sentence Summary: Many nutritional trends seen in social media are not well understood; these concepts are broken down and explained here.

Main Text:

Despite food consumption being a daily activity for everyone, many concepts of nutrition are not well understood by the general public, and misinformation can easily propagate. Nutrition misconceptions are important to address in order to maximize the general consumer's benefit from food, their ability to make informed, healthy decisions, and to help them avoid potentially harmful nutrition trends. Here we address misconceptions regarding frozen produce, kombucha, supplements, protein powders, diabetes, and water quality.

Frozen Fruits/Vegetables Are Not as Nutritious as Fresh

A popular nutrition misconception is that frozen fruits and vegetables are not as nutritious as their fresh counterparts. This contributes to overall low consumption of fruits and vegetables, with only 28.6% of Canadians consuming the recommended 5 servings per day (1). Frozen produce can mitigate cost barriers because they are cost-effective, available year-round, and are largely equal in nutrition to fresh produce (3).

Ascorbic acid (Vitamin C) is often the nutrient measured, because it is unstable and reflects overall nutrient loss over time (2, 4). When typical storage length is considered, frozen produce were found to be equal to or higher in Vitamin C content than such fresh-stored produce (2). Frozen fruits and vegetables were also found to be comparable, and sometimes higher, in the nutrients folate, riboflavin, and alpha-tocopherol compared to fresh (4).

While frozen produce may initially lose some nutritional value during the freezing process (typically involving blanching), their value then remains largely constant over time (2, 5). Freezing preserves nutritional content by halting respiration, which prevents it from self-consuming nutrients as an energy source (6). Fresh produce, alternatively, begin to lose nutritional value after harvesting, and continue with increased storage time, eventually falling below that of frozen (Fig. 1) (5).

Freezing also prevents microbial growth and food spoilage and maintains food quality by preventing moisture loss making frozen produce an excellent alternative to fresh produce (6).

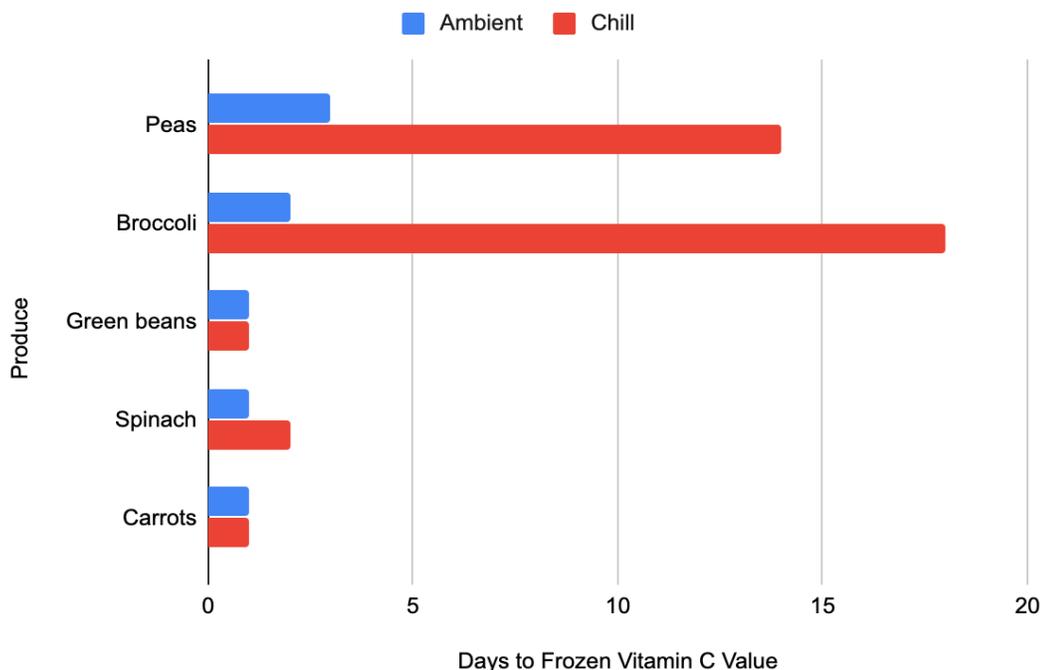


Fig. 1. Days for a variety of fresh produce stored in ambient (eg. countertop) and chill (eg. fridge) conditions to have a vitamin C content equal to that of their frozen counterparts. The majority of samples fell below the frozen value after less than 2 days in either ambient or chill conditions (5).

Kombucha

There are a lot of questions in regards to the health benefits and mechanisms of kombucha, and whether they are legitimate claims. It has recently risen to popularity, however, kombucha has been consumed for over a hundred years by many different cultures throughout history. Kombucha is a fermented beverage, prepared from either a black, green, or oolong tea base, with the addition of a SCOBY – a Symbiotic Culture of Bacteria and Yeast (7).

Both the tea and the products of fermentation work together to provide many health benefits to the consumer including antimicrobial properties, anti-tumor properties, and liver protection (8). A review article outlined various studies on the impact of kombucha on the liver

and determined that it does have a positive effect by reducing the physiological changes that are driven by liver toxins (9).

Tea polyphenols and their degradation products formed during fermentation from the beverage work in a variety of different ways to prevent cancer. These mechanisms include the inhibition of gene mutations, inhibition of cancer cell proliferation, induction of cancer cell apoptosis, and termination of cancer cell metastases.

The antibacterial properties of kombucha were studied and it was determined that the higher the concentration of the tea extract, the larger the zone of inhibition was with human pathogenic bacteria (Fig. 2). This means that higher concentrations from longer fermentation times were able to have an effect on the bacteria present and inhibit their growth (10).

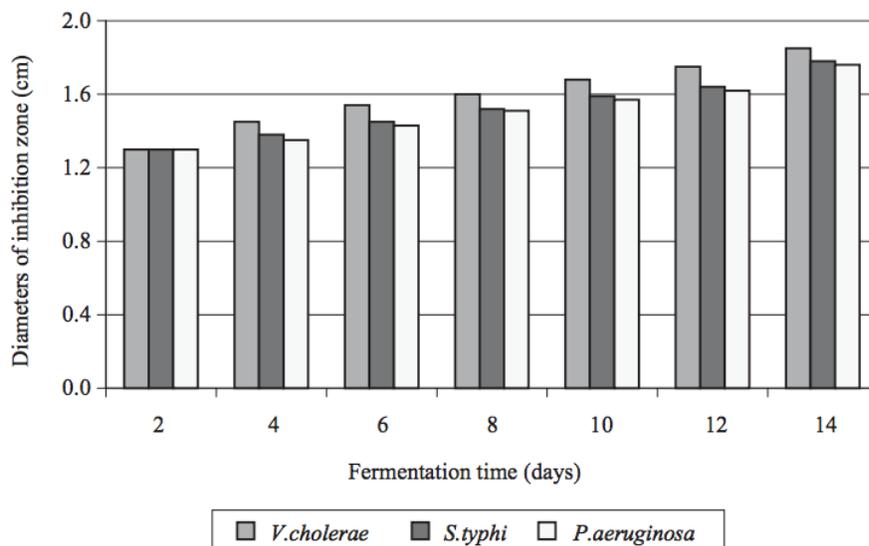


Fig.2. Kombucha fermentation time as it relates to the area in which its antibacterial properties are successful. As fermentation time increases, the area in which bacteria are unable to survive increases for three human pathogenic bacteria. Longer fermentation times correspond to stronger antibacterial properties.

Regardless of the health benefits from kombucha, some precautions should still be noted. There have been some instances where kombucha has been implicated in case reports of illness, however it has never been confirmed. Kombucha contains small amounts of alcohol due to the fermentation process so it is advised that it should not be consumed by pregnant women or people with liver, pulmonary, or renal disease (8).

There has been extensive testing from government departments, finding it was safe for human consumption. A study done in rats showed no toxic effects from kombucha after consumption over a 90-day period (11). Overall, kombucha is not considered harmful and provides many health benefits to consumers.

Supplements

Supplement pills are seen as the superior alternative for filling the gaps of nutrient deficiencies within our daily diets. Supplements provide an easy alternative for individuals to get vital minerals and vitamins into their bodies without the need to worry about maintaining a balanced diet. However, the effectiveness of these pills, especially when taken with normal dietary habits, is another misconception that should be addressed.

Vitamin D, which is a common supplement pill, is vital in the body as it absorbs calcium to help with bone health (11). Vitamin D helps your muscles, nerves, and immune system work properly. The official tolerable upper limit of Vitamin D intake is 50 micrograms per day for adults (12). Vitamin D is most commonly associated with exposure to sunlight as this is enough to increase the body's production of Vitamin D to proper levels (13). However, if you live at higher latitudes which receive less sunlight, then sunlight is not a viable source of Vitamin D. In addition to this, if foods that have high Vitamin D concentrations are not available for a routine diet, then supplementation of Vitamin D through pills is a good alternative (Fig. 3.).

However, you should only take Vitamin D supplements if the reasons above apply to you; a long-term excess of Vitamin D has been associated with increased calcium concentration within the blood and urine which can cause weakened bone strength and the creation of kidney stones (12). This indicates that taking supplements is not always healthy, despite popular conceptions.

FOOD	VITAMIN D (MICROGRAM PER 100G)	FOOD	VITAMIN D (MICROGRAM PER 100G)
EEL	25.6	SALMON	12.4
PIKE-PERCH	24.6	EGG YOLK	7.8
HERRING	15.4	TUNA	7.2

Fig. 3. The concentration of Vitamin D (measured in micrograms of Vitamin D per 100 grams of food source) within commonly obtainable food sources (12).

Whole Foods vs Protein Powders

Another popular misconception is that protein powders provide more protein than whole foods, and are a healthy alternative. Table 1 outlines comparisons between whole foods and protein powders. This misconception can influence consumer habits and cause individuals to consume powders more often instead of whole foods.

When protein is from the translucent liquid part of milk and comes in different forms (15). Whey powder is often used as food additives in foods such as smoothies and oatmeal. Whey concentrate is used in many protein powders and supplements and is made by removing

the water, lactose, ash and some minerals from whey (15). Whey isolate is even more pure in its protein content because all the lactose and fat are removed. Whey protein is very attractive because it has a lot of the amino acid cysteine, which the body uses to help fight off diseases (15-16). However, whey protein is never meant to be used as a replacement for protein sources from whole foods - it is meant to be a supplement for when your regular diet is not providing you with enough protein (17-18)

Casein is found in bovine or ox milk. Casein spontaneously makes micelles, which are circular balls of protein that stay in the stomach and allow the slow release of amino acids (15). The ball exterior interacts with water whereas the inside does not. Casein protein forms these structures and slowly releases amino acids as it breaks down making it a very efficient nutrient supply (15).

Vegetable proteins can be combined to supply essential amino acids (15). Soy is a very common vegetable protein and a decent alternative to animal protein. In particular, soy isolates are the most refined soy protein product which is why it is often seen in sports and health drinks (15).

Overall, expert consensus is that whole foods should be prioritized over protein powders or supplements, because while such supplements contain adequate protein, they do not contain other essential vitamins and minerals required for a healthy diet.

Table 1. Comparison of different sources of protein in animal protein and various protein powders.

Protein source	Quality	Common form or source	Additional information
Animal	Very high (15)	Meat, egg whites, milk, fish	Provides body with all essential amino acids and additional nutrients such as B vitamins, vitamin E, iron, zinc and magnesium (18)
Whey	High, particularly in cysteine (15)	Whey powder, concentrate, isolate	Whey protein promotes the feeling of satisfaction after a meal which promotes weight loss (16)
Casein	High	Bovine milk	Slow release of amino acids from micelles (15)
Vegetable	Low individually	Soy and soy isolates	Can decrease the saturated fat and cholesterol from animal protein (15)

Type 2 Diabetes: The Sugar Disease and Plant-Based Protein

Diabetes is commonly known as the sugar disease. Type 2 diabetes is a condition in which insulin, a hormone necessary for sugar metabolism, is not properly produced (Fig. 4.) (19). It is a popular misconception that in order to maintain healthy blood-sugar levels, diabetics must abstain from sugar (19). Contrary to this belief, sugar consumption is not the only factor involved in maintaining healthy blood-glucose levels. Research indicates that consuming plant-based protein rather than animal-based protein can play an important role in maintaining healthy blood-glucose levels (19).

When Type 2 diabetic patients followed a high-carb, high plant fibre diet, or a low-fat vegan diet, results demonstrated that patients decreased their use and dosage of insulin therapy (20, 21). These results indicate that a plant-based protein diet may be a feasible alternative treatment for Type 2 diabetics, as it can improve glycemic control and metabolism.

Animal-based protein can be harmful to diabetics for several reasons. Animal meat contains heme-derived iron that can promote oxidative stress by increasing the formation of hydroxyl radicals following ingestion (22). Radicals cause damage to the pancreatic beta cells and reduce insulin synthesis and secretion (22). Processed meats also contain nitrites and nitrates that are converted to nitrosamines through the interaction with amino compounds either in the stomach or the food product itself (22). Nitrosamines are toxic to pancreatic beta cells and can also interfere with their ability to produce insulin (22). Diabetics need to secrete and use as much insulin as possible. Animal-based protein can inhibit natural insulin production and will not help alleviate the symptoms of this condition. Plant-based protein does not produce these same harmful chemicals, and can therefore play an important role in maintaining healthy blood-glucose levels.

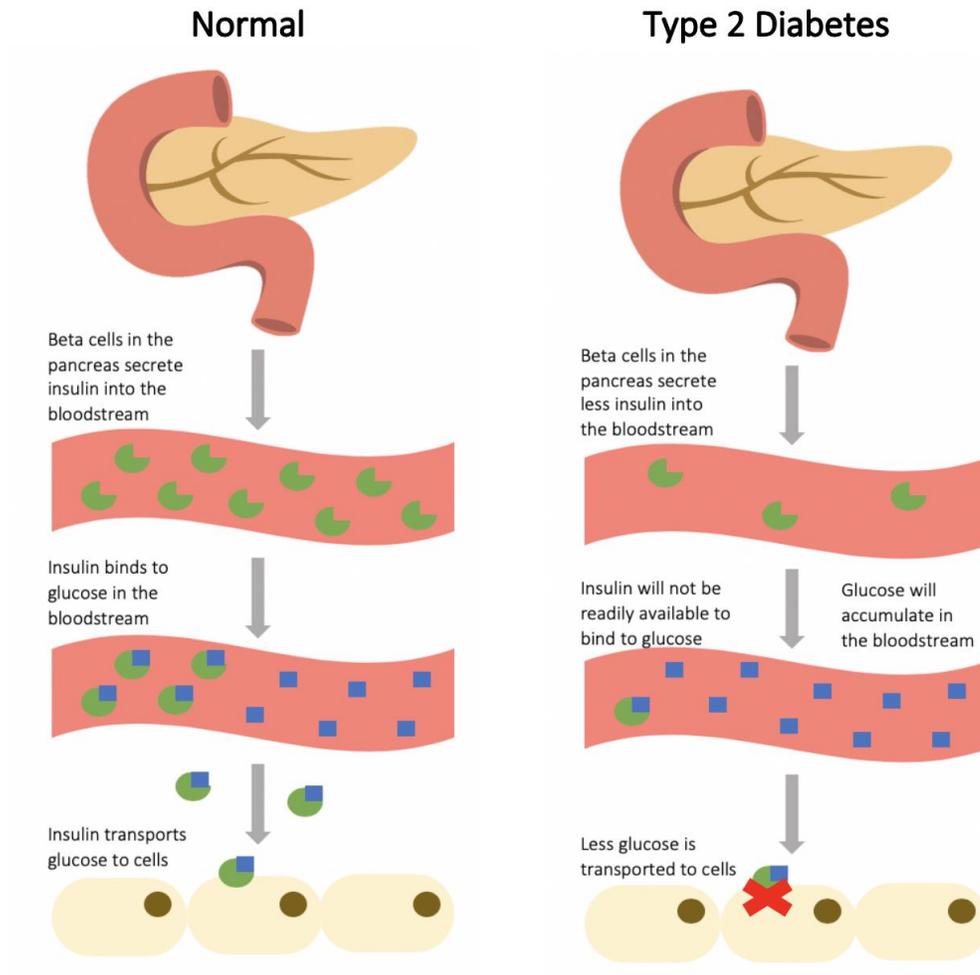


Fig. 4. Insulin hormone production and pathway in normal individuals and Type 2 diabetics.

Type 2 diabetics produce less insulin than normal individuals, leading to a decrease in glucose uptake by the cell and an accumulation of glucose in the bloodstream. The cells of Type 2

5 diabetics may also fail to respond to insulin when it delivers sugars to the insulin receptors on the plasma membrane.

Quality of Filtration Systems vs Bottled Water

The United Nations declared it a human right to have access to a consistent water source that is safe, sustainable, and affordable (23). The low level of technology, resource availability, and infrastructure in developing countries leads to the use of unsafe filtration systems. These filtration mechanisms improperly cleanse water, and detrimental contaminants are not identified and filtered out, whereas nutrients that are essential to the body are lost.

This also occurs in isolated aboriginal communities. These communities are susceptible to frugal drinking conditions due to cultural beliefs and limited knowledge regarding developments in drinking water. Segregated regions detached from municipal pipelines are heavily dependent on bottled water (24). This is viewed as a safer alternative, as bottled water is believed to be better regulated. However, with bottled water dominating the global market, manufacturers focus their efforts towards optimizing production rates which hinders health requirements (25).

One study determined that bottled water has similar traces of bacteria to municipal drinking water in Canada (26). Despite this, West Virginia university students exhibited a preference in bottled water over corporate filtration because it is perceived to be more reliable, safer, convenient, and healthier (27). Marketing strategies use the phrases pure, organic, natural and fresh which attract people towards bottled water and indirectly dissuade people from municipal water. It was determined that mineral quality of municipal, bottled mineral water, and bottled spring water is relatively equal (28). Calcium, magnesium, and sodium are apparent in all these water sources. This is beneficial as common diets are low in calcium and magnesium.

To reduce lingering misconceptions regarding the quality of drinking water and bottled water, it is essential for municipal figures to actively communicate the benefits and drawbacks of these water sources.

References and Notes:

- 5 1. Statistics Canada, Fruit and vegetable consumption, 2017. *Statistics Canada* (2019). Retrieved October 15, 2019 from <https://www150.statcan.gc.ca/n1/pub/82-625-x/2019001/article/00004-eng.htm>
2. L. Li, R. B. Pegg, R. R. Eitenmiller, J. Chun, A. L. Kerrihard, Selected nutrient analyses of fresh, fresh-stored, and frozen fruits and vegetables. *J. Food Compos. Anal.* **59**, 8-17 (2017).
- 10 3. S. Miller, B. Knudson, *Nutrition & Costs Comparisons of Select Canned, Frozen and Fresh Fruits and Vegetables* (Michigan State University, East Lansing, MI, 2012).
4. A. Bouzari, D. Holstege, D. M. Barrett, Vitamin Retention in Eight Fruits and Vegetables: A Comparison of Refrigerated and Frozen Storage. *J. Agric. Food Chem.* **63**, 957-962 (2015).
5. D. J. Favell, A comparison of the vitamin C content of fresh and frozen vegetables. *Food*

15 *Chem.* **62**, 59-64 (1998).
6. D. A. Golden, L. Arroyo-Gallyoun, *Relationship of Frozen-Food Quality to Microbial Survival* (Springer, Boston, MA, 1997).
7. J. M. Leal, L. V. Suárez, R. Jayabalan, J. H. Oros, A. Escalante-Aburto, A review on health

benefits of kombucha nutritional compounds and metabolites. *CYTA. J. Food.* **16**, 390-399

20 (2018).
8. J. M. Kapp, W. Sumner, Kombucha: systematic review of the empirical evidence of human

health benefit. *Ann. Epidemiol.* **30**, 66-70 (2019).

9. R. Jayabalan, R. V. Malbaša, E. S. Lončar, J. S. Vitas, S. Muthuswamy, A review on kombucha tea – microbiology, composition, fermentation, beneficial effects, toxicity, and tea fungus. *Compr. Rev. Food. Sci. Food. Saf.* **13**, 538-550 (2014).
10. S. Talawat, P. Ahantharik, S. Laohawiwattanakul, A. Premasuk, S. Ratanapo, Efficacy of fermented teas in antibacterial activity. *Nat. Sci.* **40**, 925-933 (2006).
11. R. Vijayaraghavan, M. Singh, P. V. L. Rao, R. Bhattacharya, P. Kumar, K. Sugendran, O. Kumar, S. C. Pant, R. Singh, Subacute (90 days) oral toxicity studies of kombucha tea. *Biomed. Environ. Sci.* **13**, 293-299 (2000).
12. Should You Take Dietary Supplements? [PDF File], News In Health. 2013. Retrieved from <https://newsinhealth.nih.gov/2013/08/should-you-take-dietary-supplements>.
13. C. Lamberg-Allardt, Vitamin D in foods and as supplements. *Progress in Biophysics and Molecular Biology.* **92**, 33–38. (2016)
14. K. Kennel, M. Drake, & D. Hurley, Vitamin D Deficiency in Adults: When to Test and How to Treat. *Mayo Clinic Proceedings.* **85**, 752-758 (2010)
15. 15. J. R. Hoffman, & M. J. Falvo, Protein- which is best. *J. Sports. Sci. Med.* **3**, 118–130 (2004). Retrieved from <https://www.jssm.org/vol3/n3/2/v3n3-2pdf.pdf>
16. K. Wirunsawanya, S. Upala, V. Jaruvongvanich, & A. Sanguankeo, Whey protein supplementation improves body composition and cardiovascular risk factors in overweight and obese patients: a systematic review and meta-analysis. *J. Am. Coll. Nutr.* **37**, 60–70 (2018). <https://doi.org/10.1080/07315724.2017.1344591>
17. A. E. Cundiff, Can a protein shake substitute for a meal? (2017) Retrieved October 10, 2019, from <https://www.bestfoodfacts.org/can-a-protein-shake-substitute-for-a-meal/>

18. B. Greenwood, Whey protein vs. lean meat. Retrieved October 10, 2019, from
<https://www.livestrong.com/article/553893-whey-protein-vs-lean-meat/>
19. Canadian Diabetes Association, Type 2 diabetes, 2019. Retrieved October 12, 2019 from
<https://www.diabetes.ca/recently-diagnosed/type-2-toolkit>.
- 5 20. J.W. Anderson & K. Ward, High-carbohydrate, high-fiber diets for insulin-treated men with
 diabetes mellitus. *Am. J. Clin. Nutr.* **32**, 2312-2321 (1979).
21. W. Sami, T. Ansari, N.S. Butt, & M.R.A. Hamid, Effect of diet on type 2 diabetes mellitus: a
 review. *Int. J. Health Sci (Qassim)*. **11**, 65-71 (2017).
22. D. Aune, G. Ursin, & M.B. Veierod. Meat consumption and the risk of type 2 diabetes: a
 10 systematic review and meta-analysis of cohort studies. *Diabetologia*. **52**, 2277-2287 (2009).
23. General Assembly, International Decade for Action “Water for Life” 2005-2015.
 Focus Areas: The human right to water and sanitation.
24. A. Azoulay, P. Garzon, M. J. Eisenberg, Comparison of the mineral content of tap water and
 bottled waters. *J. Gen. Intern. Med.* **16**, 168–175 (2001).
- 15 25. G. Hawkins, The impacts of bottled water: an analysis of bottled water markets and
 their interactions with tap water provision. *Wiley Interdiscip. Rev. Water*. **4**, e1203 (2017).
26. M. E. Zamberlan da Silva, R. G. Santana, M. Guilhermetti, I. C. Filho, E. H. Endo, T. Ueda-
 Nakamura, C. V. Nakamura, B. P. Dias Filho, Comparison of the bacteriological quality of
 tap water and bottled mineral water. *Int. J. Hyg. Environ. Health*. **211**, 504–509 (2008).

27. J. G. Levêque, R. C. Burns, Drinkingwater in West Virginia (USA): Tapwater or bottled water - what is the right choice for college students? *J. Water Health*. **16**, 827–838 (2018).

28. M. F. Doria, Bottled water versus tap water: understanding consumers' preferences. *J. Water Health*. **4**, 271–276 (2006).

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