From Lab-to-Plate: Innovating with Cellular Agriculture:

Consumer-centric Perspectives on a Novel Food Concept

Food In Canada Webinar
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Consumers + Protein Demand

- Beef demand in Canada in 2020, highest (*apart from 2016*) in over 30 years. - CanFax Research Services

- *'In the past 6 months, unexpectedly, there has been a deceleration in the category growth rates of plant-based protein. The more concerning set of facts are rooted in category performance, which has basically flatlined'* – Q3 2021 Earnings Report – Maple Leaf Foods

  Michael H McCain, president and CEO of Maple Leaf Foods

- 'The attraction to meat is evolutionarily 'hard-wired', since it has a [higher] nutritional value than most crops, vegetables or fruits.' (Zabraska 2016; Tuomisto 2018).
- 'Meat is in our biology but also in our culture, and pro-meat beliefs are [permanently] reinforced by existing social norms, values and policy (in)actions' (Nyborg et al. 2016; Treich, 2021)

Consumers + Novel Foods

- 1,800 US consumers completed a choice experiment. Holding prices constant and conditional on choosing a food product, 72% of survey participants chose farm raised beef and only 5% chose cultured meat.
- Adding brand names (Certified Angus Beef, Beyond Meat, Impossible Foods, and Memphis Meats) actually increased the share of participants choosing farm raised beef to 80%.
- Vegetarians, males and younger and more highly educated individuals tend to have relatively stronger preferences for cultured meat relative to farm-raised beef.

Asioli et al. 2020; Carlsson et al. 2021; Van Loo et al, 2020; Treich, 2021

Consumers + Novel Foods

'In vitro meat' – A survey of potential consumers in the USA

- Although most respondents are willing to try 'in vitro meat', only 33% were definitely or probably willing to eat in vitro meat regularly or as a replacement for farmed meat.
- Men were more receptive to 'in-vitro meat' than women.
- Vegetarians and vegans were more likely to perceive benefits compared to farmed meat, but they were less likely to want to try it than meat eaters.

Phillips, 2017

Consumers + Novel Foods

Internet survey in 10 countries (Australia, China, England, France, Germany, Mexico, South Korea, Spain, Sweden, and the USA) with over 6,100 participants.

- 'Large cultural differences regarding acceptance of cultured meat'
- 'No consensus, whether cultured meat will be more environmentally friendly compared with traditional meat' (Chriki & Hocquette, 2020).
- 'In one of the first studies on consumer acceptance of cultured meat, only 25% of participants would have been willing to try it, if some basic information was provided' (Verbeke, Sans, & Van Loo, 2015).

Siegrist and Hartmann, 2020

Consumers + Novel Foods

Age and Consumer Readiness to Accept Alternative, More Sustainable Protein Sources in the EU.

- A consumer survey of 1,825 community-dwelling older adults aged 65+ in 5 EU countries (UK, the Netherlands, Poland, Spain, and Finland).
- Dairy-based protein was generally the most accepted protein sources in food products (75% of the respondents found its consumption acceptable or very acceptable)
- Cultured proteins or ‘in-vitro’ meat-based protein acceptance was 6%.

Grasso et al, 2019

Consumers + Novel Foods

Cultured Meat and Australia's Generation Z

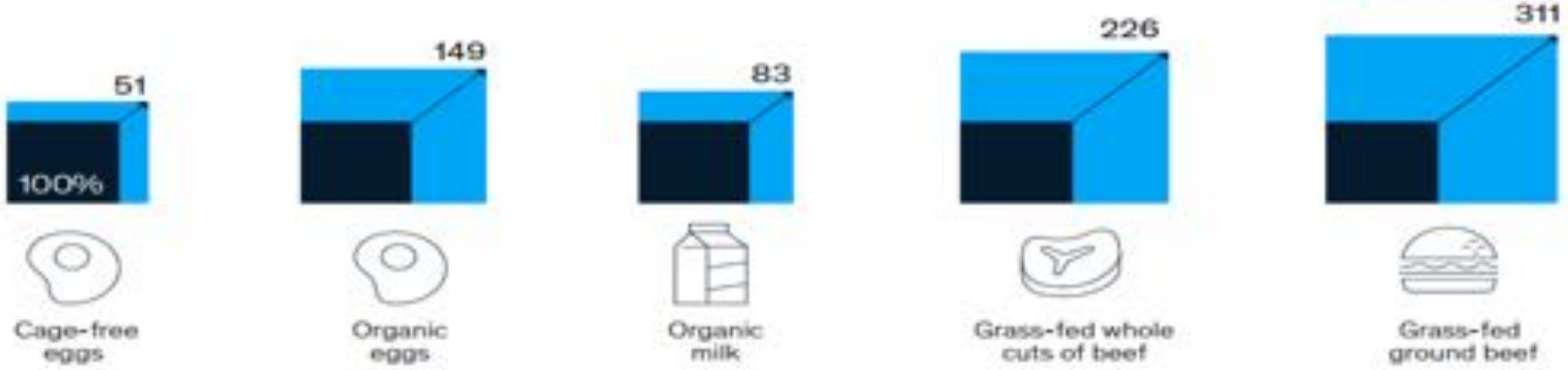
- A study of Gen Z consumers (n=227) examined the perceptions and opinions about cultured meat of young adults residing in Sydney, Australia.
- 'The majority (72%) of the participants are not ready to accept cultured meat; nonetheless, many think that it is a viable idea because of the need to transition to more sustainable food options and improve animal welfare.'

Bogueva and Marinova, 2020 – Frontiers in Nutrition

Consumers + Novel Foods:
Consumer WTP for Premium Alternative Proteins

Consumers currently pay a premium for protein alternatives that are important to them.

Willing to pay for premium food, % over regular costs[1]



[1] Based on US pricing data. Cage-free egg premium and organic-egg premium is based on the premium for Grade A eggs using the average price from January 2018 to October 2020 from the US Department of Agriculture (USDA). Organic-milk premium is calculated based on the comparison of pricing for nonorganic milk based on the 2020 average pricing per half gallon from USDA. Grass-fed, whole-cut, and ground beef is based on the 2019 to 2020 average pricing from USDA. Grass-fed beef is compared with the average pricing from all beef cuts (prime, choice, select, ungraded). Grass-fed 90 percent-plus lean ground beef is compared with non-grass-fed 90 percent-plus lean beef.

Source: McKinsey & Co, Cultivated Meat: Out of the Lab, Into the Frying Pan, June 2021.

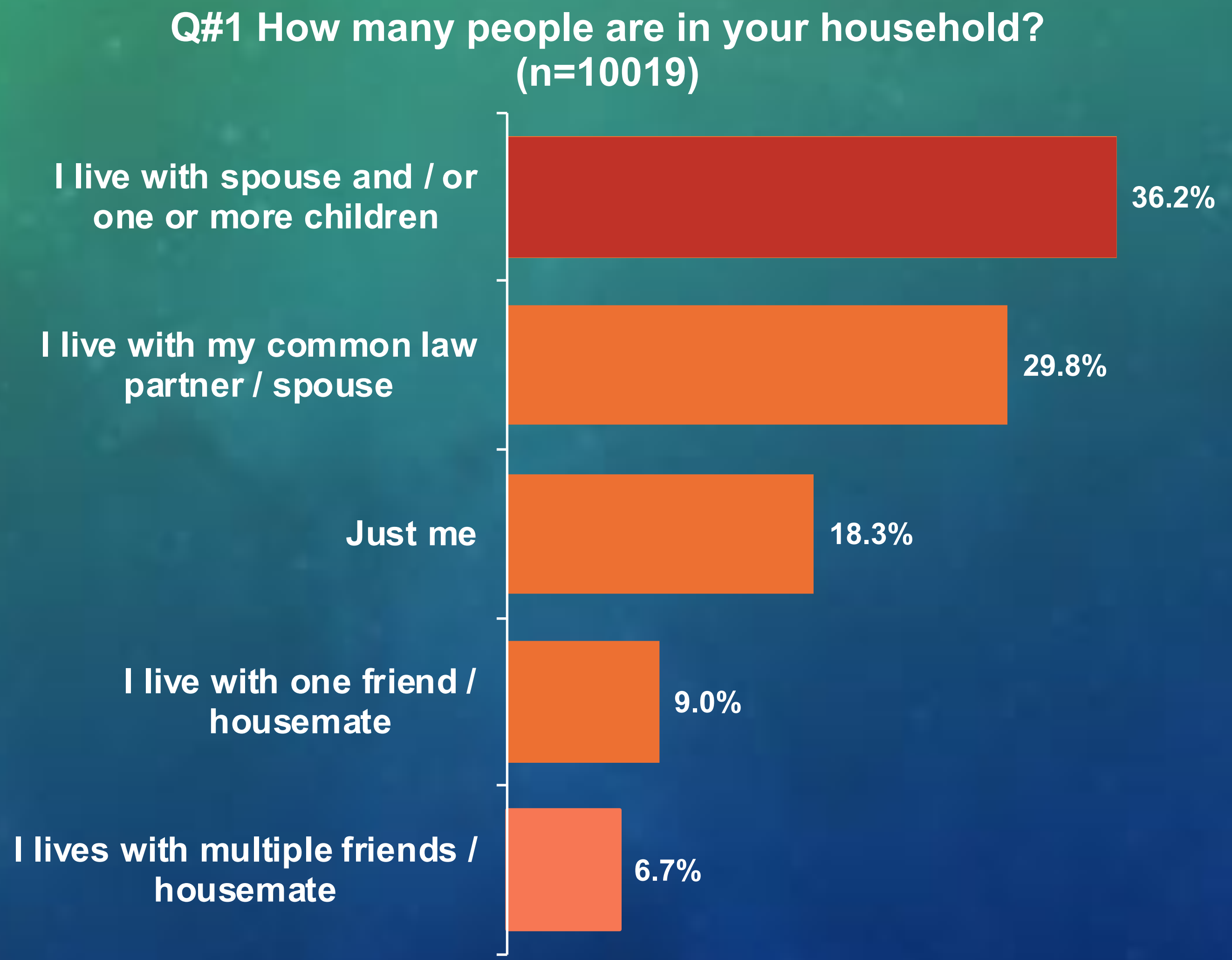
Findings: Oct 2021 Survey - Overview

Agri-food Analytics Lab – Dalhousie University in partnership with Caddle Inc.

A national survey of Canadians on their Protein Preferences and Perceptions of Cell, Cultured Proteins

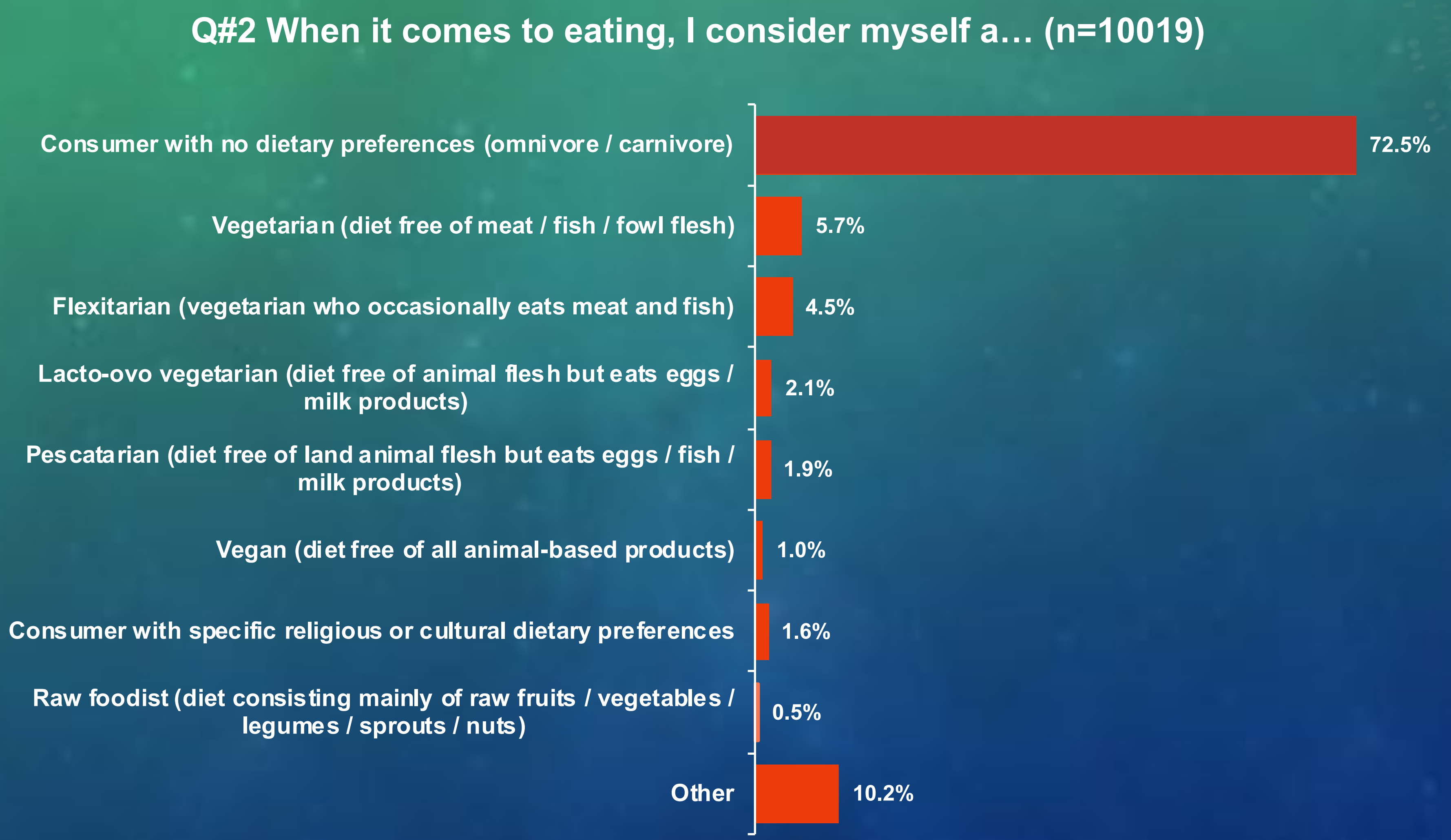
- Survey – October 20-26, 2021
- 10,019 survey respondents – 48% female / 52% male
- 32% Baby boomers | 29% Gen X | 27% Millennials | 8% Gen Z
- 41% Ontario | 23% Quebec | 13% BC | 10% Alberta | 7% Sask & Man. | 6% Atlantic Canada

Findings Oct 2021 Survey: *Households*



Source: Caddle Inc. - October 20 - 26, 2021

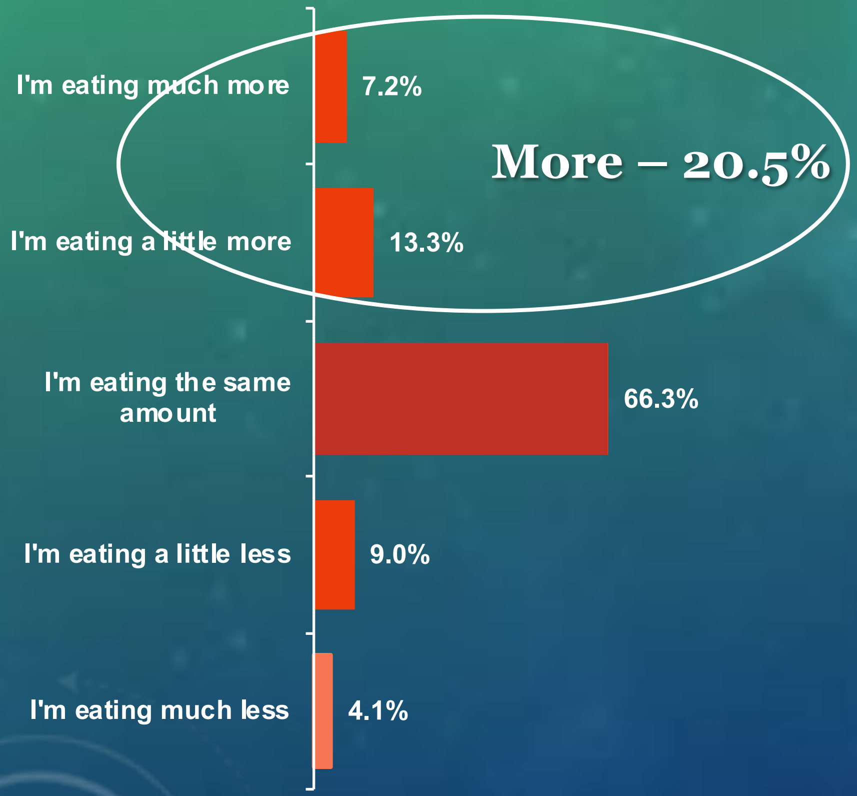
Findings Oct 2021 Survey: *Dietary Restrictions*



Source: Caddle Inc. - October 20 - 26, 2021

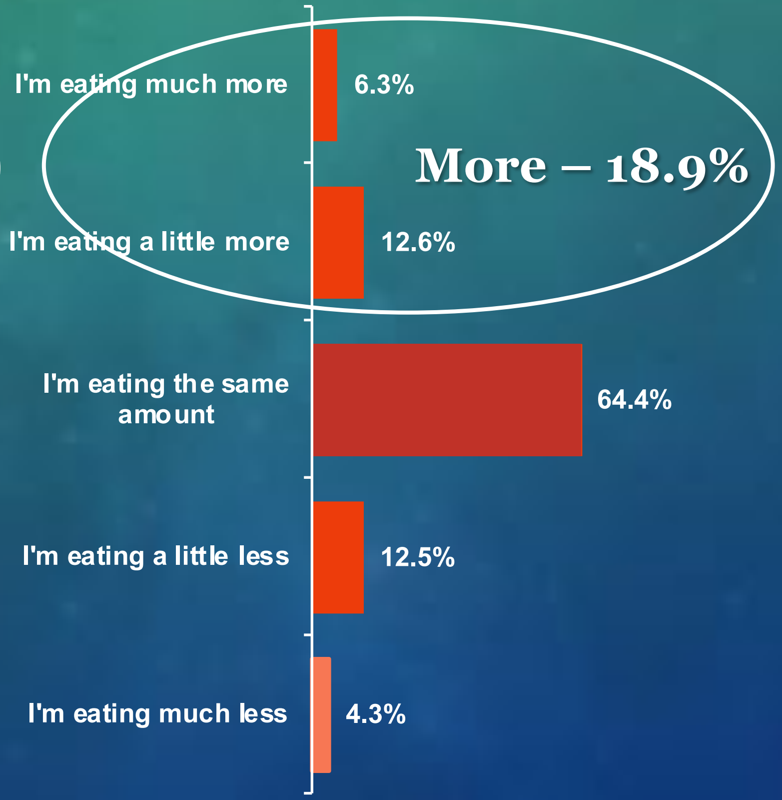
Findings Oct 2021 Survey: Types of Proteins – *In the Past 12 Months*

Q#3 Which best describes the amount of <u>dairy</u> products you've consumed? (n=10019)



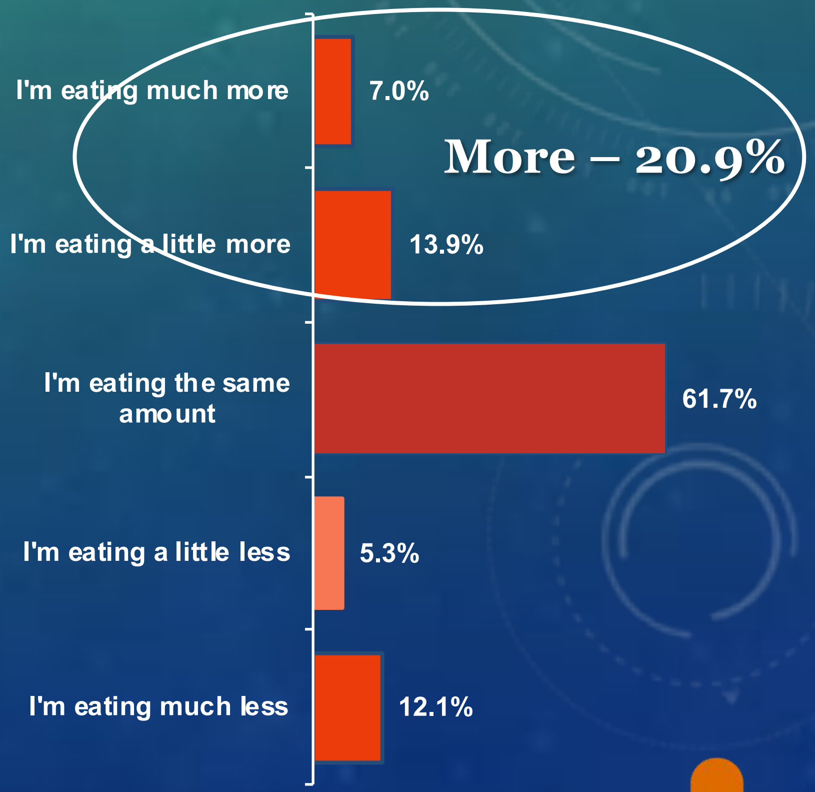
Source: Caddle Inc. - October 20 - 26, 2021

Q#4 Which best describes the amount of <u>meat</u> products you've consumed? (n=10019)



Source: Caddle Inc. - October 20 - 26, 2021

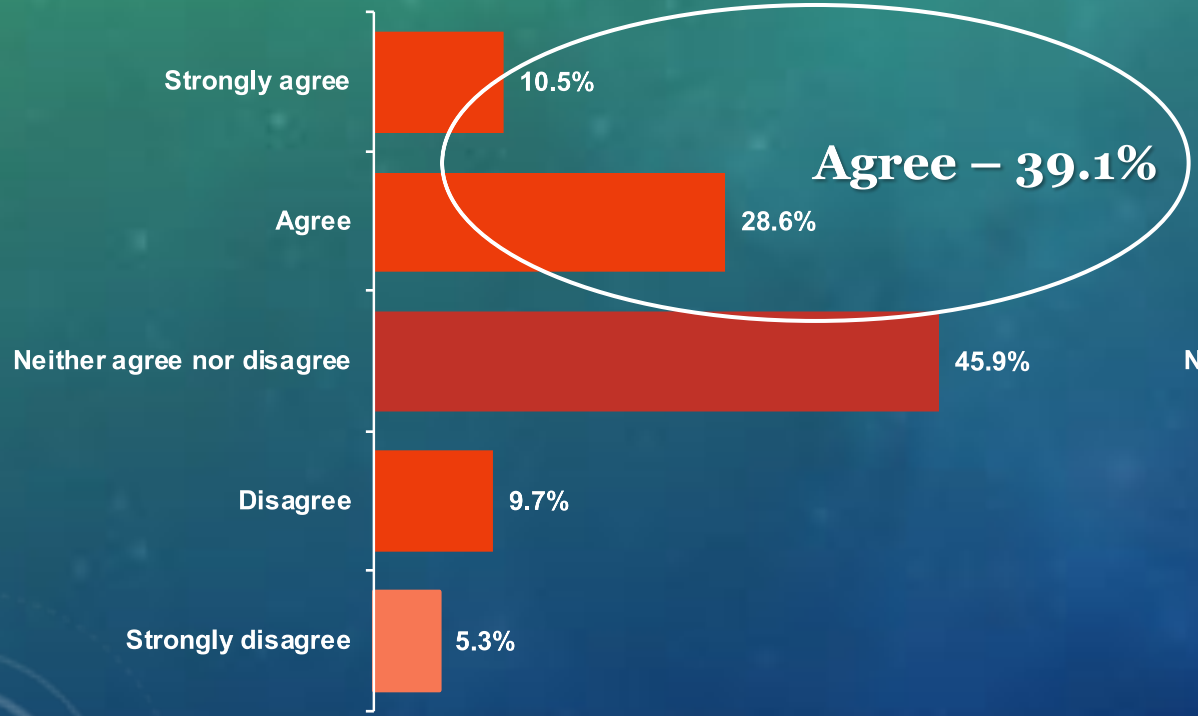
Q#5 Which best describes the amount of <u>plant-based</u> meat / protein alternatives you've consumed? (n=10019)



Source: Caddle Inc. - October 20 - 26, 2021

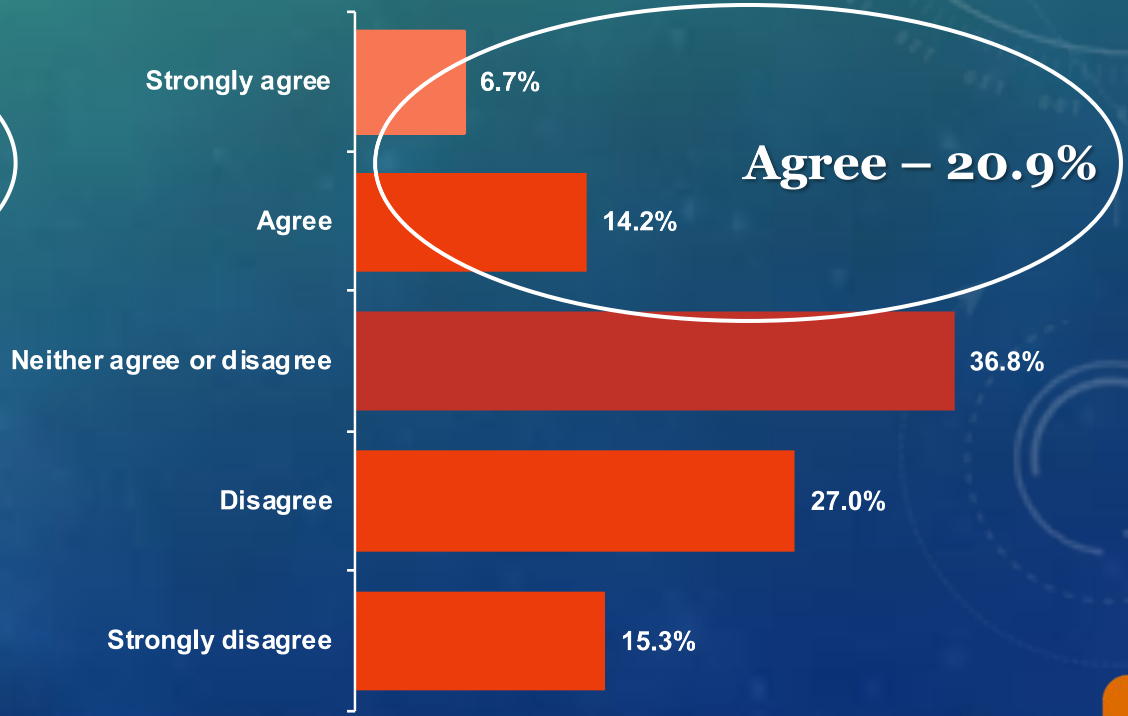
Findings Oct 2021 Survey:
Perceived Awareness and Knowledge

Q#6 'I am *aware that cultured, cell-based or lab-grown proteins exist but are not commercially available* (e.g. meat, dairy, poultry, seafood alternatives)'. (n=10019)



Source: Caddle Inc. - October 20 - 26, 2021

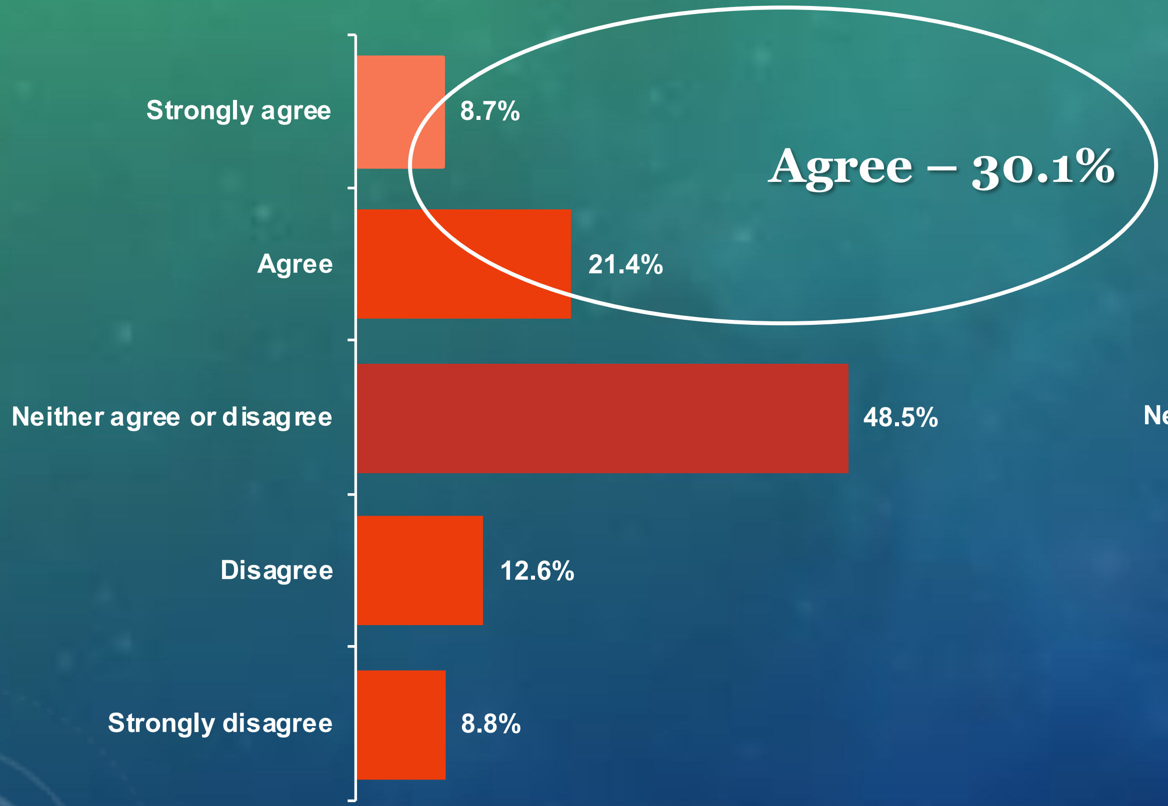
Q#7 'I consider myself to be *very knowledgeable of cultured, cell-based or lab-grown proteins* (e.g. meat, dairy, poultry, seafood alternatives)'. (n=10019)



Source: Caddle Inc. - October 20 - 26, 2021

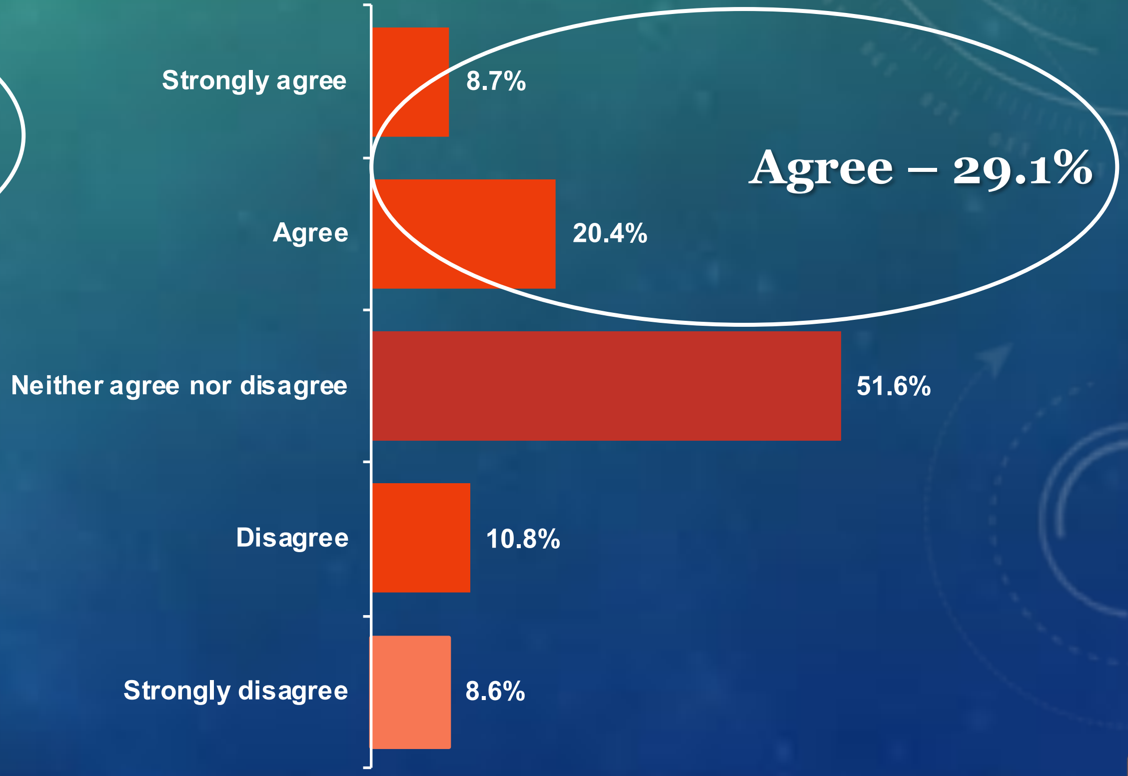
Findings Oct 2021 Survey:
Support for Development and Commercialization

Q#8 ‘I am *supportive of the development of cultured, cell-based, or lab-grown protein alternative products in Canada*’. (n=10019)



Source: Caddle Inc. - October 20 - 26, 2021

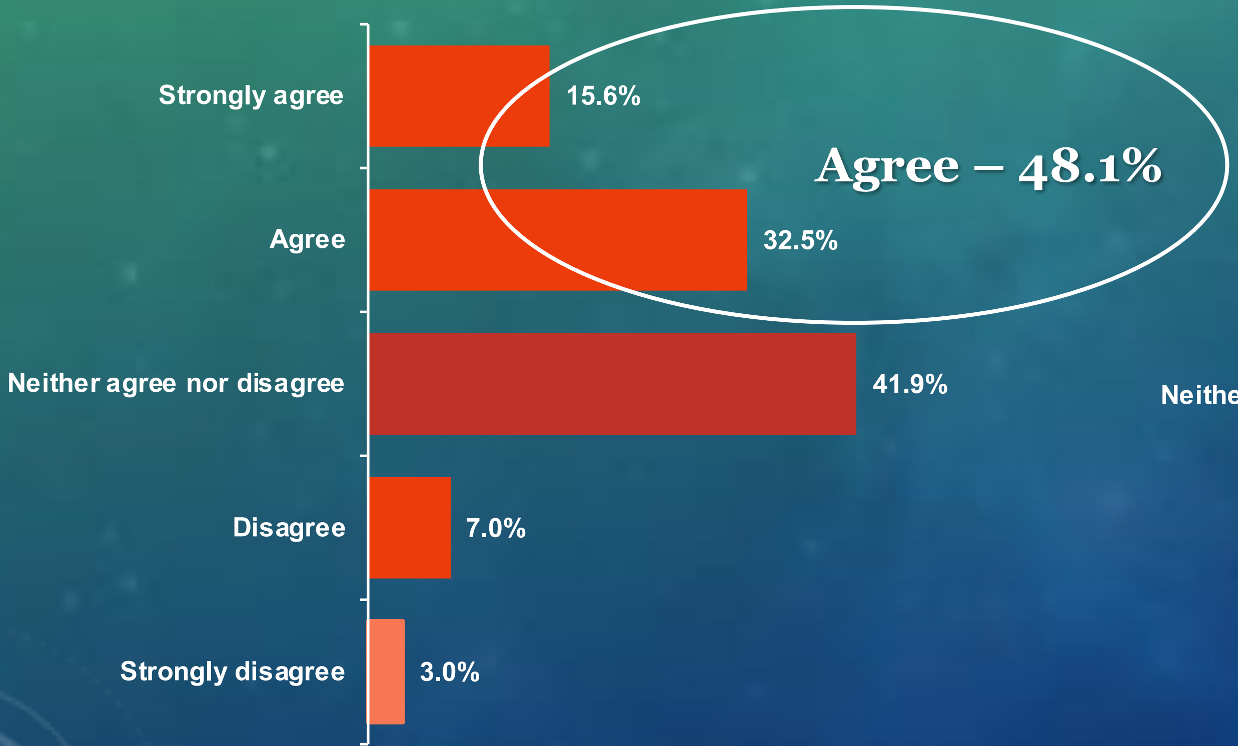
Q#9 ‘*I believe cultured, cell-based, or lab-grown protein alternatives should be commercialized in Canada*’. (n=10019)



Source: Caddle Inc. - October 20 - 26, 2021

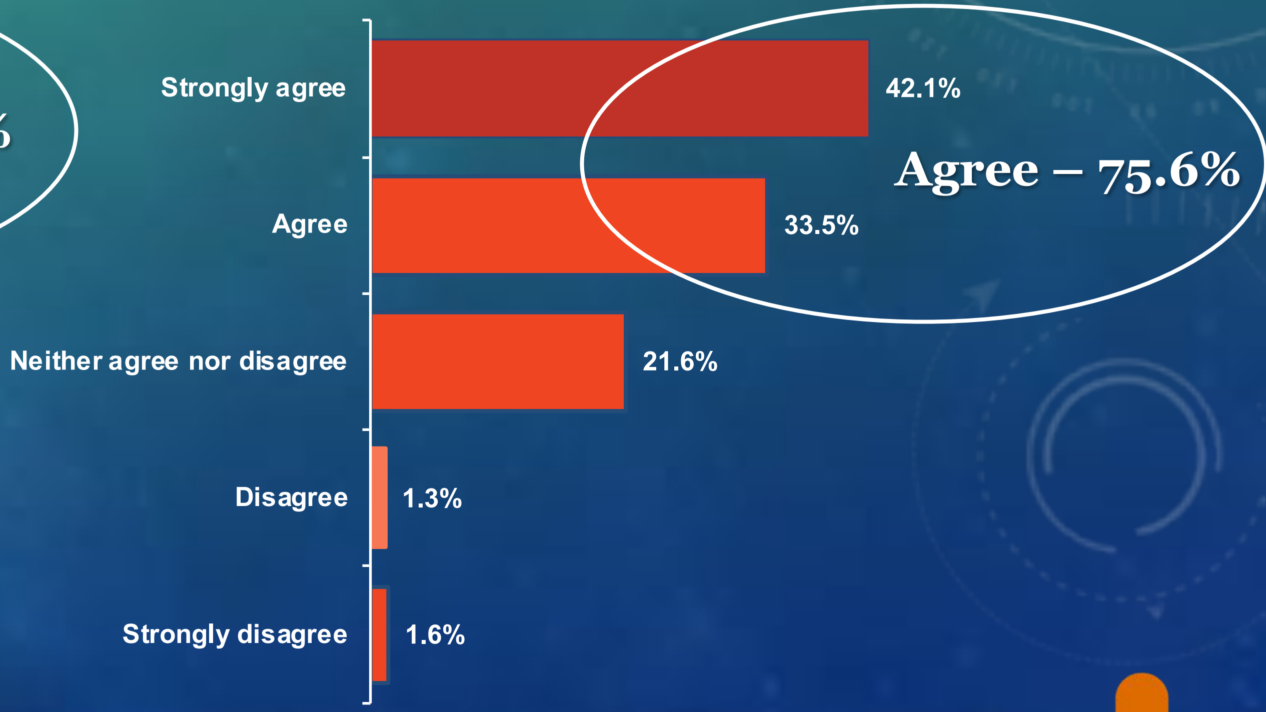
Findings Oct 2021 Survey: *Safety and Labeling*

Q#10 "*I am concerned about the safety of consuming cultured-protein alternatives*, compared to animal-based or plant-based foods". (n=10019)



Source: Caddle Inc. - October 20 - 26, 2021

Q#13 "I believe processed foods (e.g. burgers, beverages, snacks) that contain cultured protein should be required *to provide detailed labeling and information for consumers*". (n=10019)



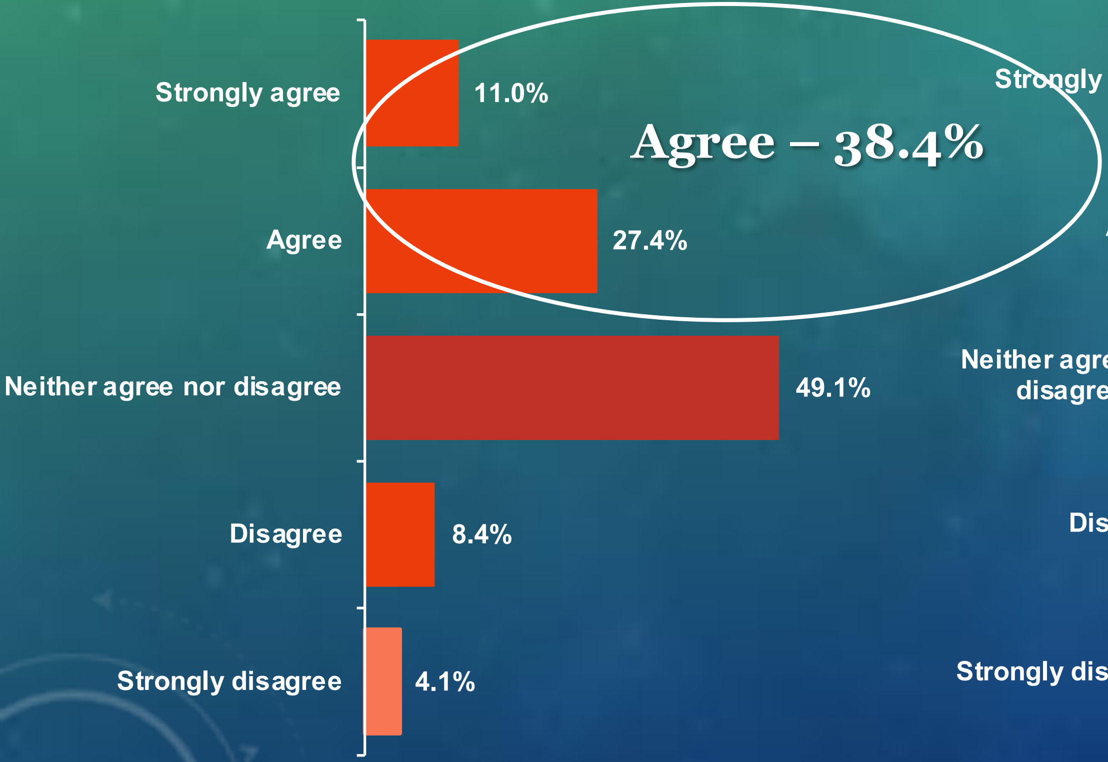
Source: Caddle Inc. - October 20 - 26, 2021

Findings Oct 2021 Survey: *Affordability*

Source: Caddle Inc. - October 20 - 26, 2021

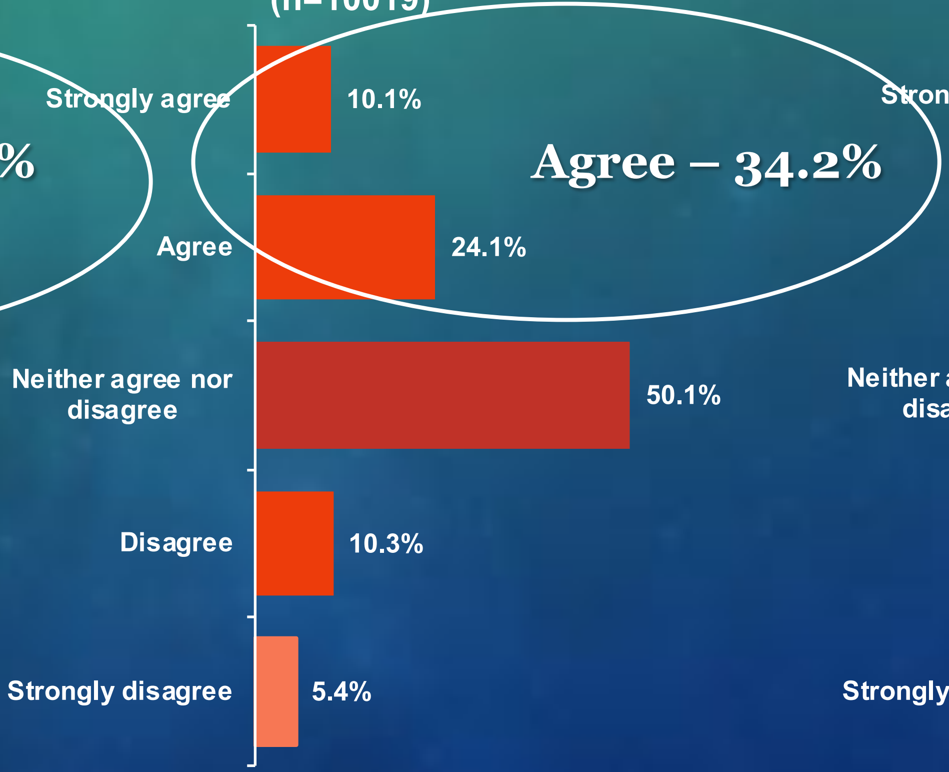
Findings Oct 2021 Survey: Sustainability and Ethics – *Level of Agreement with the Statement*

Q#15 "Cultured proteins (e.g. meat / poultry / dairy / seafood alternatives) will be *less impactful on the environment*". (n=10019)



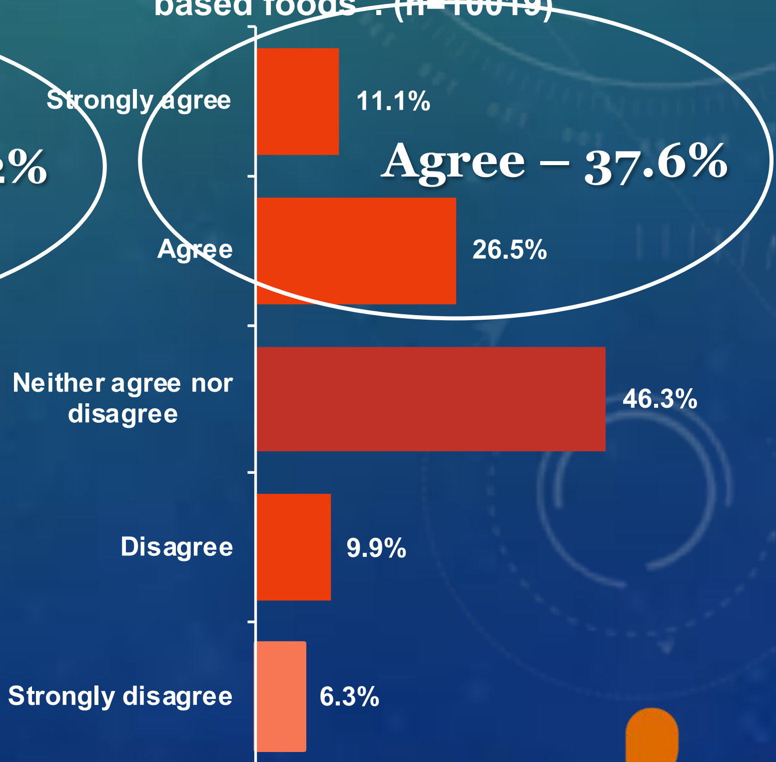
Source: Caddle Inc. - October 20 - 26, 2021

Q#16 "Cultured proteins (e.g. meat / poultry / dairy / seafood alternatives) will *help ease climate change*". (n=10019)



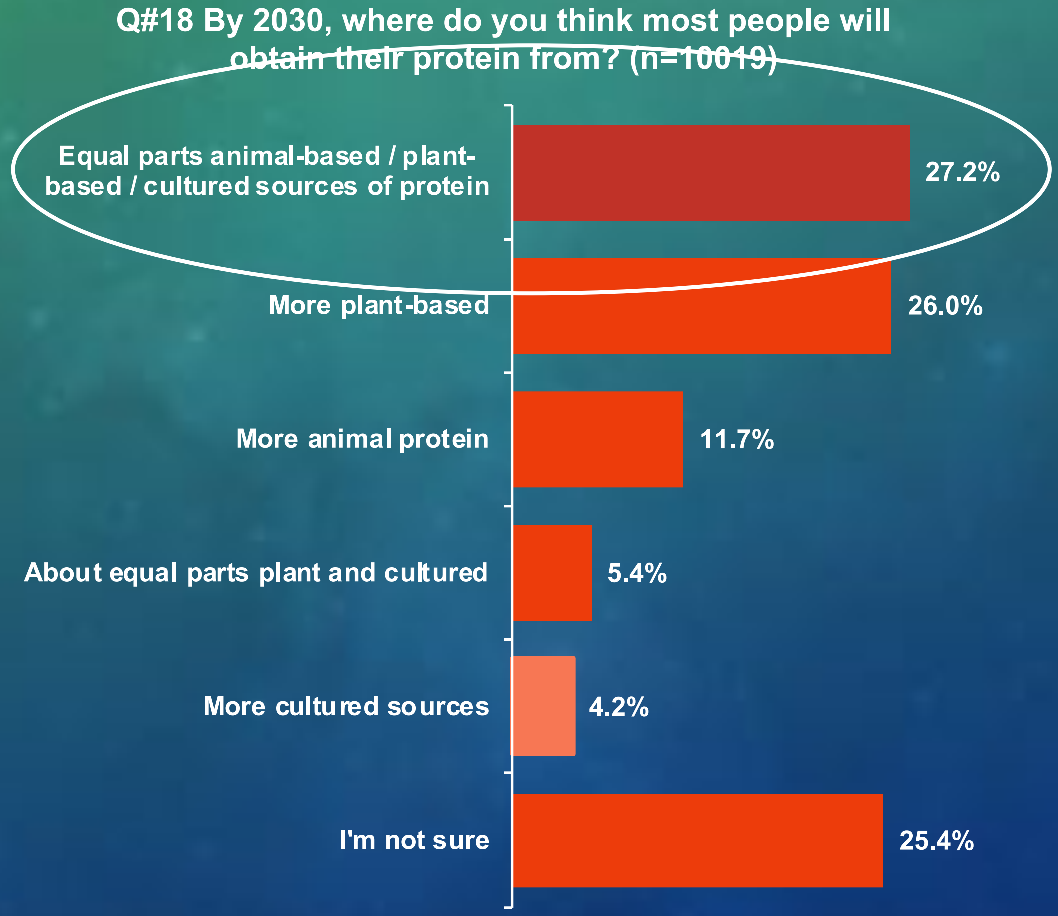
Source: Caddle - October 20 - 26, 2021

Q#17 "Cultured proteins (e.g. meat / poultry / dairy / seafood alternatives) will *be more ethical* to eat than animal-based foods". (n=10019)



Source: Caddle October 20 - 26, 2021

Findings Oct 2021 Survey: Future Perception – *Type of Protein in 2030*



Source: Caddle Inc. - October 20 - 26, 2021

Findings Oct 2021 Survey: Canadian Gen Z (n=823)

For this survey – Gen Z (born between 1997-2005)

- 2X more likely to be ***vegetarian*** compared to the Canadian avg.
- 10% more likely to believe cell cultured proteins will ***help ease climate change***
- 12% more likely to have some type of ***dietary restriction***
- 13% more likely to have eaten ***more meat and dairy*** in past year
- 14% more likely to support ***development of*** cell cultured proteins

Consumers and Sub-Sectors of the Market for Cell Cultured Proteins

Consumers and Sub-sectors of the market: Cell cultured proteins – Milk Alternatives

Dairy 3.0 – Cell. Ag and the Future of Milk

- *'Factors impede the spread of milk alternatives. Consumer acceptance can be a challenge, as products have sensory characteristics which can be objectionable to some palates'* (Makinen et al, 2016; Sethi, Tyagi, and Anurag, 2016).
- *'The digestibility of plant-derived alternatives is also an issue.'* (Mendly-Zambo, Powell, Newman, 2021)

Some emerging cultured milk companies:

- Perfect Day – USA and India
- The Not Company – Chile
- Bon Vivant – France (precision fermentation)

Consumers and Sub-sectors of the market: Cell cultured proteins – Meat Alternatives

'Cultivated meat must still secure regulatory approval at the EU level before it can be sold to consumers'

Alex Holst, senior policy manager at the Good Food Institute Europe (March 2022).

Some emerging cultured meat companies:

- Upside Foods – USA (initially chicken)
- Future Meat Technologies – Israel (chicken)
- Aleph Farms – Israel (whole steaks)
- BioTech Foods – Spain (meat)
- Mosa Meat – Netherlands (cultured meat)

Consumers and Sub-sectors of the market: Cell cultured proteins – Seafood Alternatives

Some emerging cultured seafood companies:

- Wanda Fish Technologies – (cultivated fish)
- Blue Nalu - (cultivated fish – yellowtail tuna, etc.)
- Wild Type Foods (sushi grade cell cultured salmon – USA
- Magic Caviar – (cell-based cultivated caviar) - Netherlands

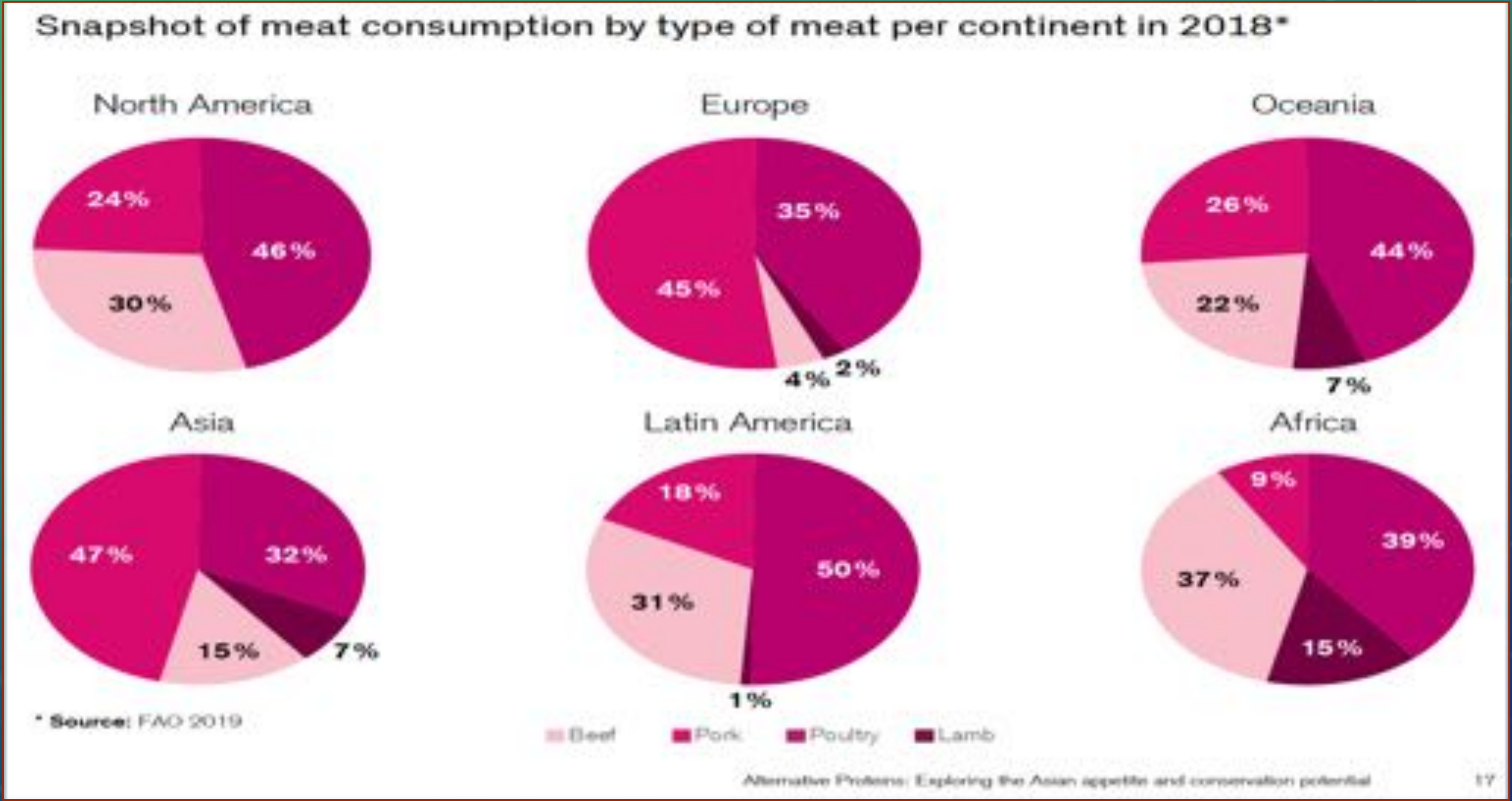
BlueNalu's whole-muscle, cell-cultured yellowtail prepared in a poke bowl

Consumers and Sub-sectors of the Market:
Cell cultured proteins – Consumer Demand + Regulation

- In Dec. 2020, the Singapore Food Agency approved Eat Just's cultured chicken for human consumption, the first approval of its kind.

- The world's first restaurant serving cultured meat (chicken) was launched near Tel Aviv at the end of 2020 by Israel's SuperMeat.

Meat Consumption By Continent - 2018



Source: *Credit Suisse, 2020 – Alternative Proteins: Exploring the Asian appetite and conservation potential. NB: graph does not include prominence of seafood, esp. in Asian diets*

Consumers and Sub-sectors of the Market:
Cell cultured proteins – Consumer Demand + Regulation

- New study by SMU: Singaporeans more open to cultivated meat than US Consumers, study linked term 'kiasu-ism' referring to a cultural trait that makes people worry about missing out on a trend, similar to 'FOMO' (Fear of Missing Out). Singapore's 30 by 30 initiative sets to increase local and sustainable food security connected to a growing cultivated sector
- Acceptance of 'clean meat' varies substantially across cultures.
- Study: higher food neophobia, and lower meat attachment in India compared to China and the USA (Bryant et al, 2019 - Consumer perceptions of plant-based and clean meat: USA, India, China)
- PHW Group (An EU poultry producer) and SuperMeat (Israel) partnering to bring cell cultured poultry to the EU
- Charoen Pokphand Foods (Thailand) and Future Meat (Israel) partnering to co-develop a line of hybrid cultivated meat for Asian markets
- March 2022 – Netherlands House of Reps pass motion to make cultivated meat sampling legal under controlled conditions – NB: This adds pressure for other jurisdictions to set policies ahead of commercial approval

Questions?

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