ICoMST 2019 | 65th International Congress of Meat Science and Technology

Understanding determinants of consumer acceptability for meat and meat substitutes

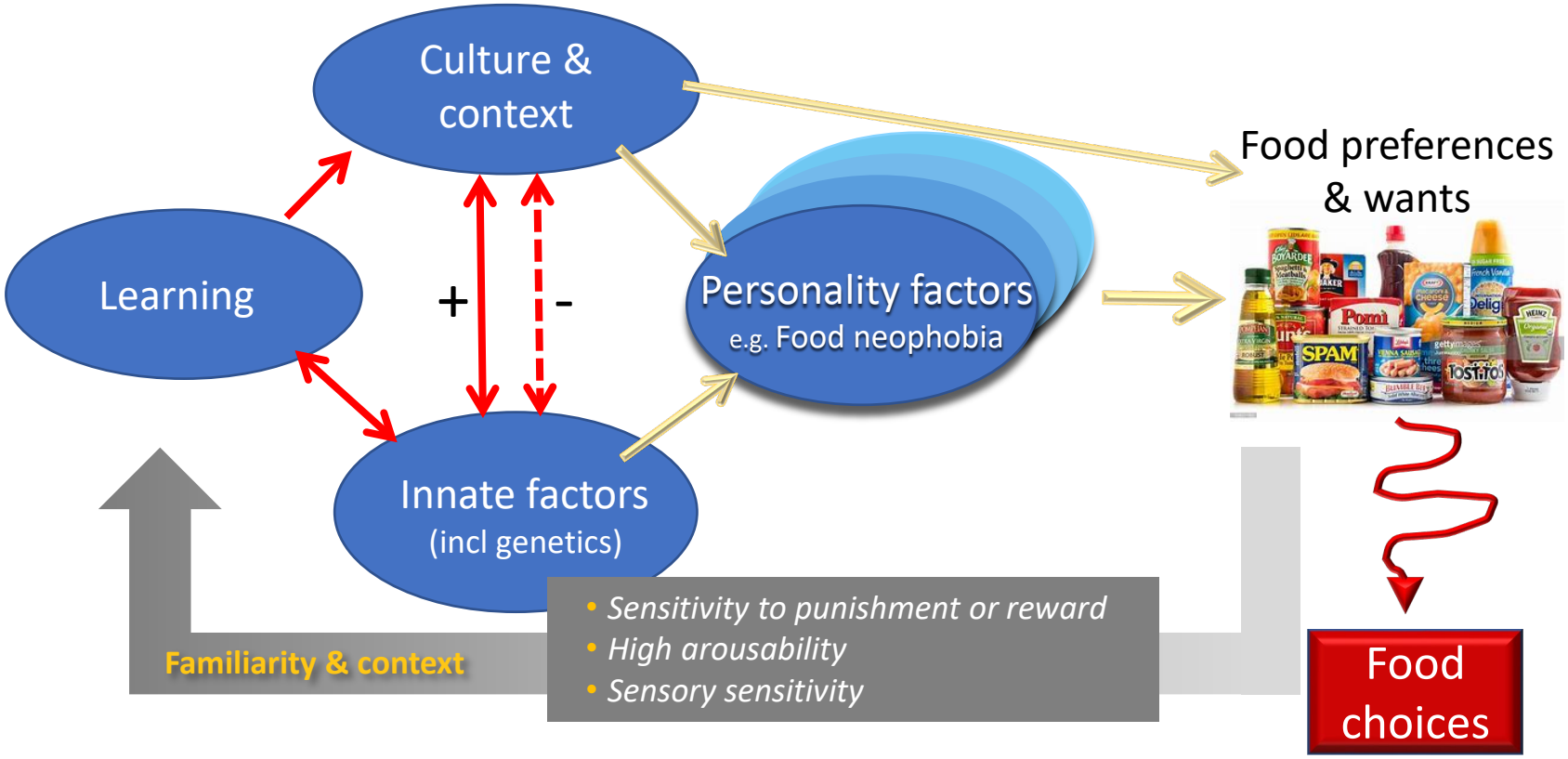
John Prescott

TasteMatters Research & Consulting, Sydney, Australia

&

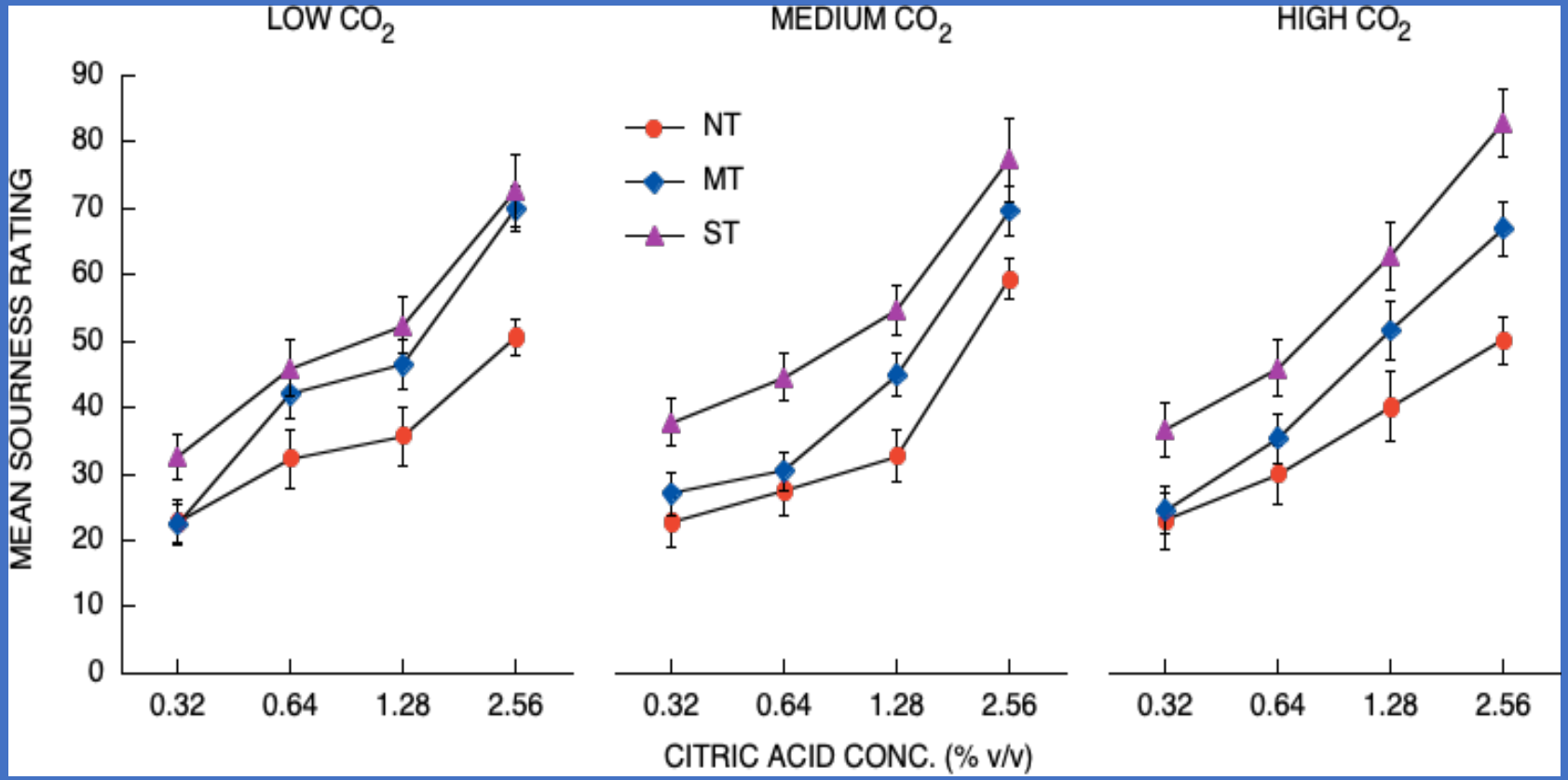
University of Florence, Italy

How do food preferences arise?



Genetic influences on food preferences

PROP group differences increase with increasing CO_2 conc



What is meant by 'personality'?

- Individual differences in *characteristic patterns* (traits) of thinking, feeling and behaving (American Psychological Association)

  Reflected in:

  → **perception**

  → **emotion**

  → **decision making**

  → **learning & behaviour**

- Personality traits may modulate the sensory response to stimuli, and consequently affect liking
  - not typically associated with different sensitivity but with the **meaning** associated with the stimulus

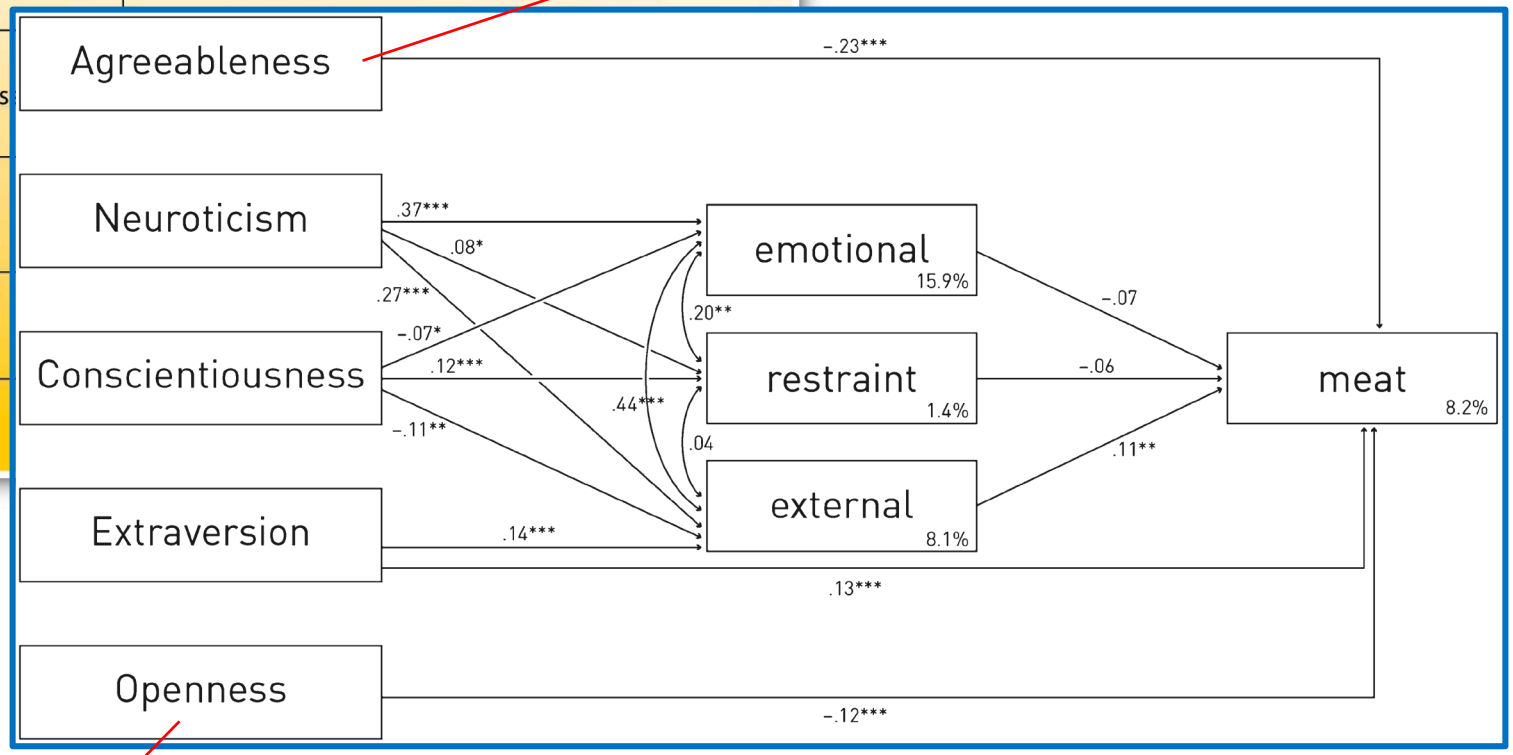
- Some traits are strongly associated with high arousal/anxiety
  - Individuals with mild anxiety are more sensitive to sensory inputs, such as pain, tone loudness, tastes

The ‘Big 5’ global personality traits

Trait	Description
Openness	Being curious, original, intellectual, creative, and open to new ideas.
Conscientiousnes	
Extraversion	
Agreeableness	
Neuroticism	

High *agreeableness* ⇢ altruistic and sympathetic … incl. sympathy for animals

Keller & Siegrist, Appetite, 2015
1052 Swiss consumers



Vegetarians & pesco-vegetarians are more open (Forestell et al., 2012)

Emotional eating: in response to negative emotions/stress
External eating: in response to environmental food cues
Restrained eating: cognitive restriction of intake

ITALIAN TASTE

3 years:
2015 - 2017

3000 consumers
(age 18-60)

20 research units; 58 researchers

Exploring influences on food choice in a large population sample: The Italian Taste project

CrossMark

AIMS:

- Demonstrate the importance of large scale, multidisciplinary studies – in the style of medical epidemiological studies – to understanding food choice mechanisms
- Uncover associations among variables along multiple dimensions that explain individual differences in food preference and choice

Food-related personality traits

Which ones are relevant and how do they mediate preferences?

Food Neophobia:

Fear or unwillingness to consume new or unknown food items

Sensitivity to disgust:

Responsivity to visceral disgust (rotten food, vermin, body fluids)

Private Body Consciousness:

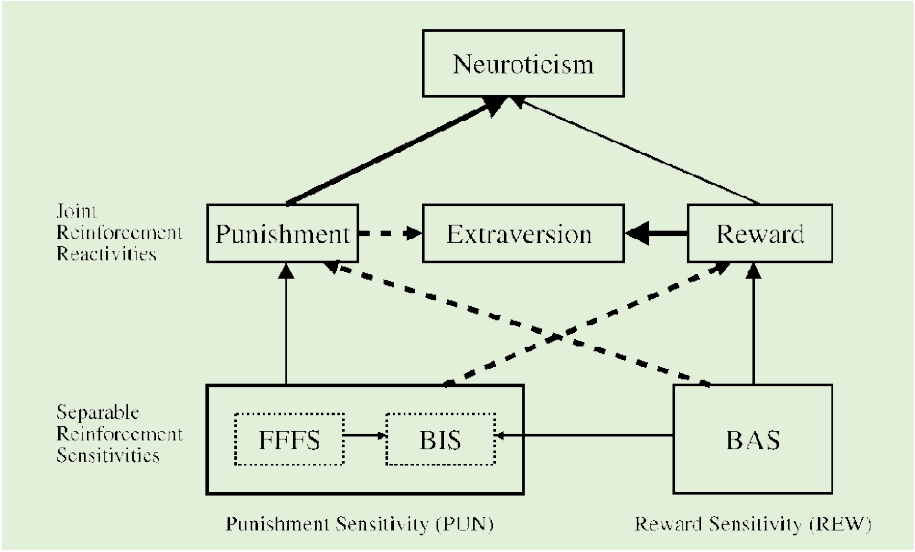
Disposition to focus on internal bodily sensations

Sensation-seeking: Seeking varied, novel, intense sensations/experiences; risk-taking

See also:

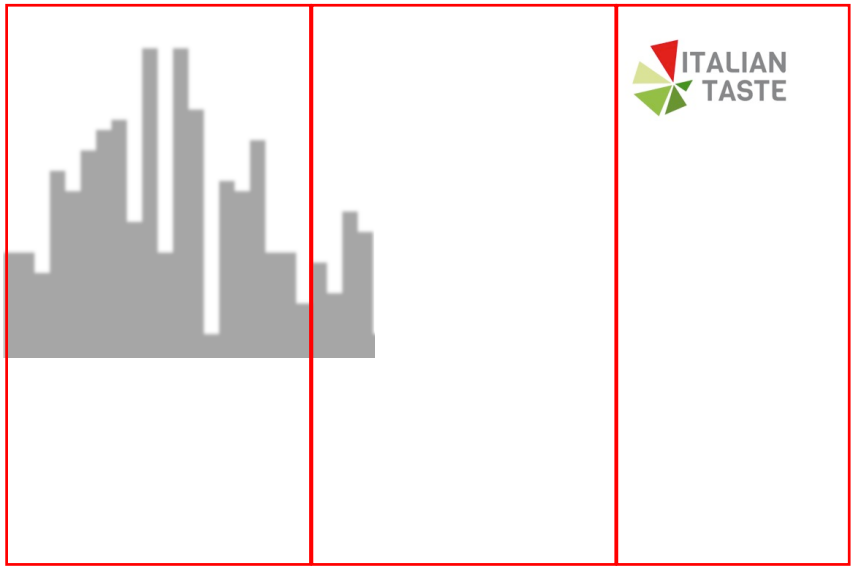
- food variety seeking
- adventurousness
- openness

Sensitivity to punishment/reward



Food Neophobia

What causes variations in dietary variety?



Appetite 116 (2017) 410–422

Relationships between food neophobia and food intake and preferences: Findings from a sample of New Zealand adults

S.R. Jaeger [a, *], M.A. Rasmussen [b], J. Prescott [c, d]

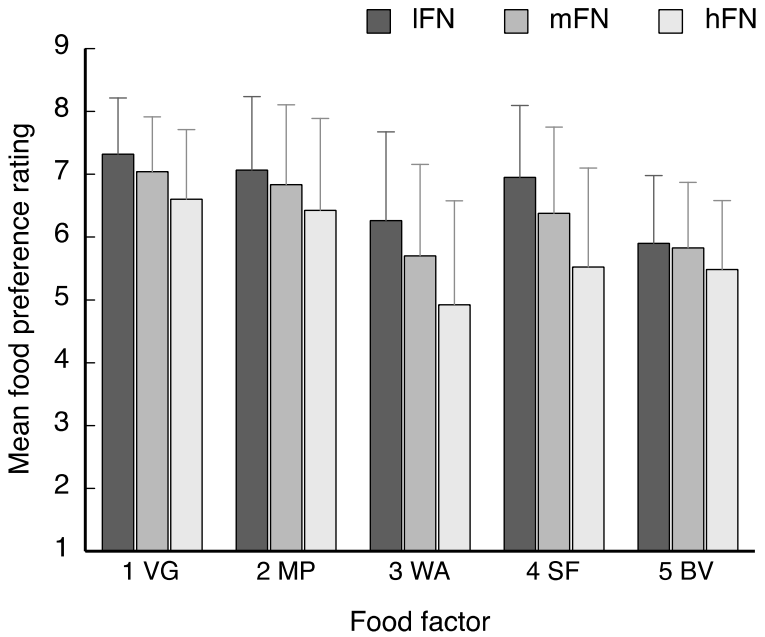


Fig. 5. Mean food preference ratings for the FN tertiles (low, medium, high) averaged across all foods within each of the preference factors.

(1) *VG … Vegetables* - a variety of foods – especially fresh foods;

(2) *MP … Meat/processed* - many types of meat; little fresh food;

(3) *WA … Wine/antipasto* - wine & other alcohol, cheese, preserved meats; little fresh food;

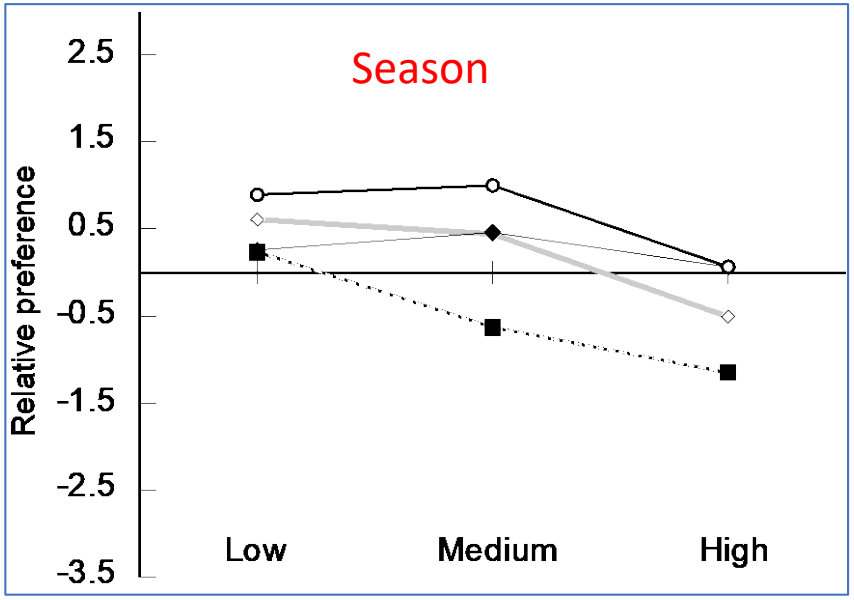
(4) *SF … Seafood* - multiple types of seafood, cheese, wine, some vegetables;

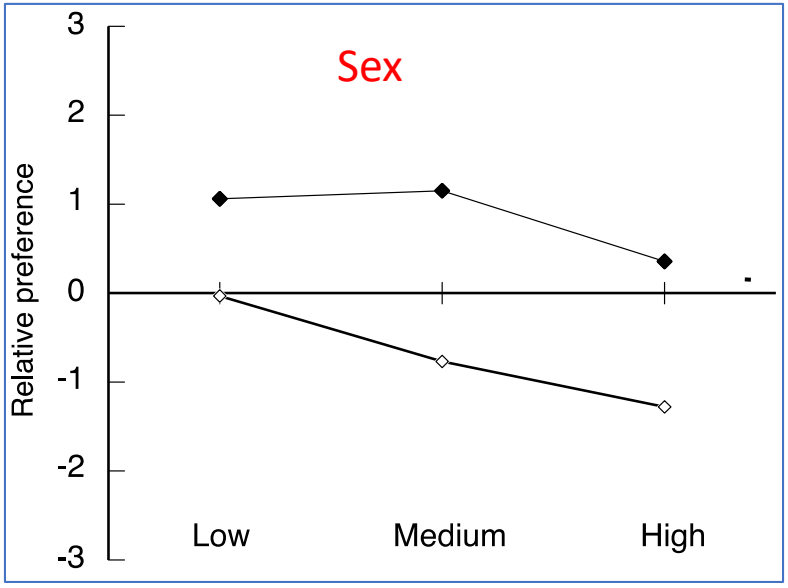
(5) *BV … Beverages* - teas, some spirits, & foods such as tofu, peanuts, wasabi.

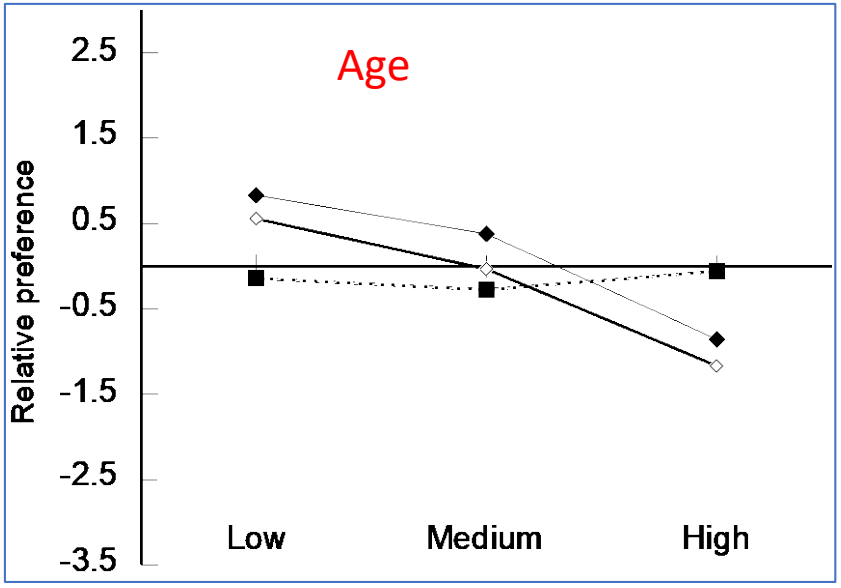

Like Lower FN Tertile (N = 112)
Like Mid FN Tertile (N = 100)
Like High FN Tertile (N = 118)
Liked
Dislike Lower FN Tertile (N = 112)
Dislike Mid FN Tertile (N = 100)
Dislike High FN Tertile (N = 118)
Disliked
lFN (N = 112)
mFN (N = 100)
hFN (N = 118)

Food neophobia
(low/med/high)

Meats/processed foods
& other food choice variables







Food Neophobia & sensory intensity

Contents lists available at ScienceDirect

Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

Associations between food neophobia and responsiveness to "warning" chemosensory sensations in food products in a large population sample

M. Laureati[a,*], S. Spinelli[b], E. Monteleone[b], C. Dinnella[b], J. Prescott[b,c], C. Cattaneo[a], C. Proserpio[a], A. De Toffoli[b], F. Gasperi[d], I. Endrizzi[d], L. Torri[e], M. Peparaio[f], E. Arena[g], F. Bonello[h], N. Condelli[i], R. Di Monaco[j], E. Gatti[k], E. Piasentier[l], F. Tesini[m], E. Pagliarini[a]

Not necessarily perceptual differences … but differences in responding to food perceptions

Table 1
Effect of food neophobia level on fungiform papillae density (FPD) and chemosensory responsiveness. Values are reported as mean (standard error).

Variable	Food neophobia level			Fisher's F	p-value
	Low (n = 329)	Medium (n = 575)	High (n = 321)		
FPD	21.6 (0.8)	21.8 (0.5)	20.0 (0.7)	$F_{(2,1105)} = 2.26$	p = 0.10
Responsiveness to:					
PROP	38.6 (1.7)	37.3 (1.2)	40.4 (1.6)	$F_{(2,1135)} = 1.21$	p = 0.30
Sweetness	41.1 (1.2)	39.8 (0.8)	39.2 (1.1)	$F_{(2,1134)} = 0.68$	p = 0.51
Bitterness	29.9 (1.3)	32.3 (0.9)	32.1 (1.3)	$F_{(2,1134)} = 1.17$	p = 0.31
Saltiness	37.4 (1.3)	37.1 (0.9)	38.6 (1.2)	$F_{(2,1134)} = 0.48$	p = 0.62
Sourness	33.5 (1.3)	33.4 (0.9)	34.7 (1.2)	$F_{(2,1134)} = 0.38$	p = 0.68
Umami	25.4 (1.2)	27.5 (0.8)	27.0 (1.1)	$F_{(2,1134)} = 1.14$	p = 0.32
Astringency	17.5 (1.1)	20.0 (0.8)	19.0 (1.0)	$F_{(2,1122)} = 1.84$	p = 0.16

Vegetables

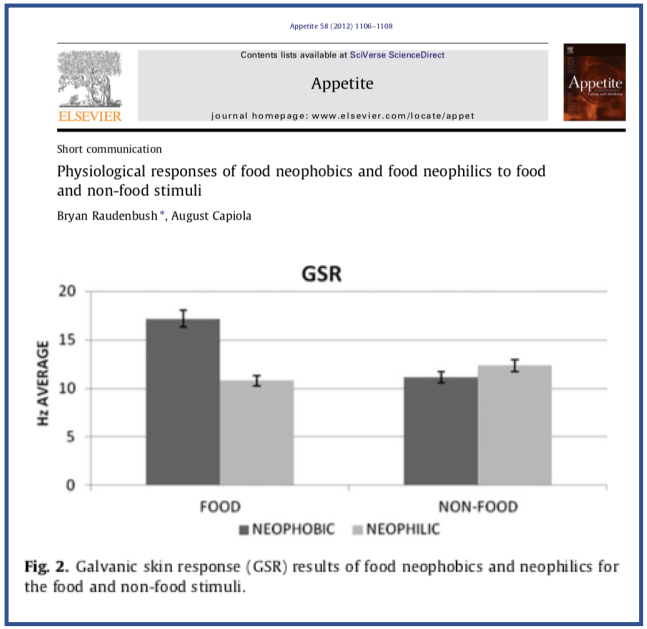
Items	Taste	Reported Liking			
			Food neophobia level		
		p-value[(1)]	Low	Medium	High
Carrot	Mild	n.s.	7.2	7.1	7.0
Cucumber	Mild	n.s.	6.0	5.9	5.7
Fennel	Mild	n.s.	7.0	7.0	6.9
Green bean	Mild	*	7.5^{a}	7.2^{b}	7.1^{b}
Green pea	Mild	n.s.	7.5	7.4	7.3
Lettuce	Mild	n.s.	7.4	7.1	7.1
Sweet corn	Mild	n.s.	6.6	6.2	6.2
Tomato	Mild	n.s.	8.0	7.7	7.8
Artichoke	Strong	**	7.5^{a}	7.1^{b}	7.0^{b}
Asparagus	Strong	**	7.4^{a}	7.1^{ab}	6.8^{b}
Broccoli	Strong	***	7.3^{a}	6.8^{b}	6.4^{c}
Cauliflower	Strong	**	6.5^{a}	6.1^{ab}	5.8^{b}
Chicory	Strong	**	6.4^{a}	6.2^{a}	5.8^{b}
Eggplant	Strong	***	7.9^{a}	7.4^{b}	7.2^{b}
Rocket	Strong	*	6.8^{a}	6.4^{b}	6.4^{b}
Radish	Strong	***	5.8^{a}	5.5^{ab}	5.0^{b}

Beverages

Items	Taste	Reported liking			
			Food neophobia		
		p-value[(1)]	Low	Medium	High
Sweetened coffee	Mild	n.s.	5.7	6.0	6.2
Sweetened tea	Mild	*	5.9^{b}	6.2^{ab}	6.4^{a}
Ananas juice	Mild	n.s.	6.6	6.5	6.5
Soft-drinks	Mild	*	5.8^{b}	5.8^{b}	6.1^{a}
Non-alcoholic aperitif	Mild	n.s.	6.5	6.2	6.3
Sweet spumante	Mild	n.s.	5.9	5.9	5.8
Unsweetened coffee	Strong	***	5.2^{a}	4.9^{a}	4.2^{b}
Unsweetened tea	Strong	***	6.0^{a}	5.3^{b}	4.4^{c}
Grapefruit juice	Strong	***	5.8^{a}	5.4^{b}	5.0^{b}
Alcoholic aperitif	Strong	***	6.5^{a}	6.2^{a}	5.4^{b}
Dry spumante	Strong	***	6.2^{a}	5.9^{b}	5.3^{c}
Red wine	Strong	***	7.1^{a}	6.8^{a}	6.1^{b}
Beer	Strong	***	7.1^{a}	6.6^{b}	6.2^{c}

Arousal & food neophobia

- High FN adults - more likely to have higher levels of trait anxiety (not just food related)
- Is eating associated during development with anxiety at the prospect of encountering an unfamiliar food that may taste unpleasant?
  - Experimentally increasing fearfulness/ anxiety/arousal reduces selection of novel foods (Pliner et al., 1995)



Appetite 58 (2012) 1106–1108

Contents lists available at SciVerse ScienceDirect

Appetite

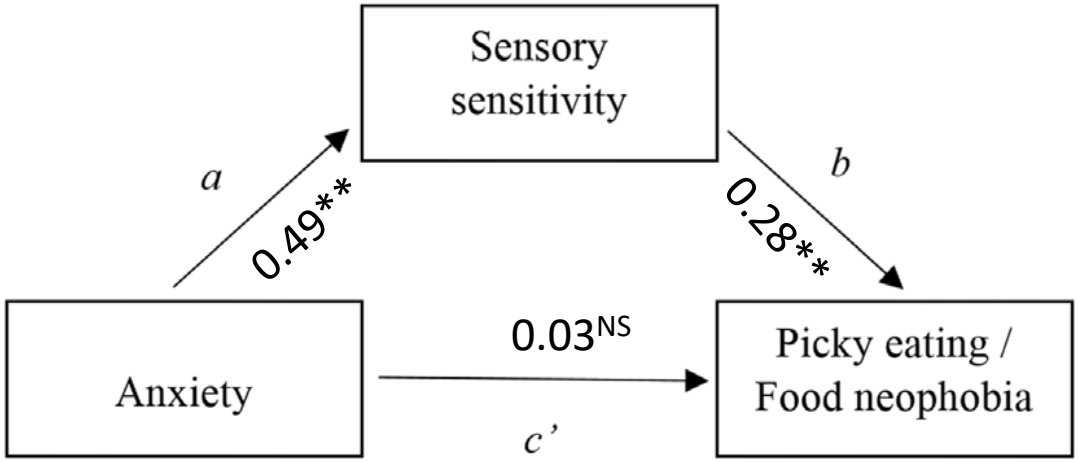
journal homepage: www.elsevier.com/locate/appet

Short communication

Physiological responses of food neophobics and food neophilics to food and non-food stimuli

Bryan Raudenbush *, August Capiola

Fig. 2. Galvanic skin response (GSR) results of food neophobics and neophilics for the food and non-food stimuli.



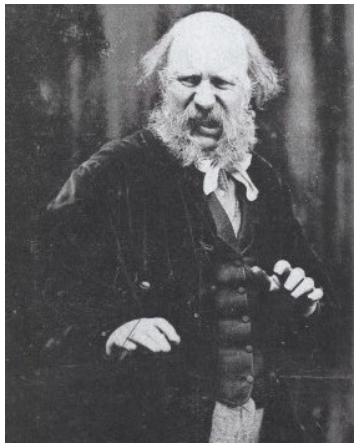
Zickgraf & Elkins (2018)

Sensory sensitivity - annoyance by sensations across 7 sensory domains

> 800 undergraduates

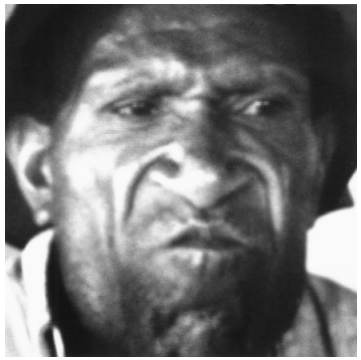
Disgust Sensitivity

Revulsion at the prospect of (oral) incorporation of an offensive object (contaminants) that can render a food unacceptable (Rozin & Fallon, 1987)



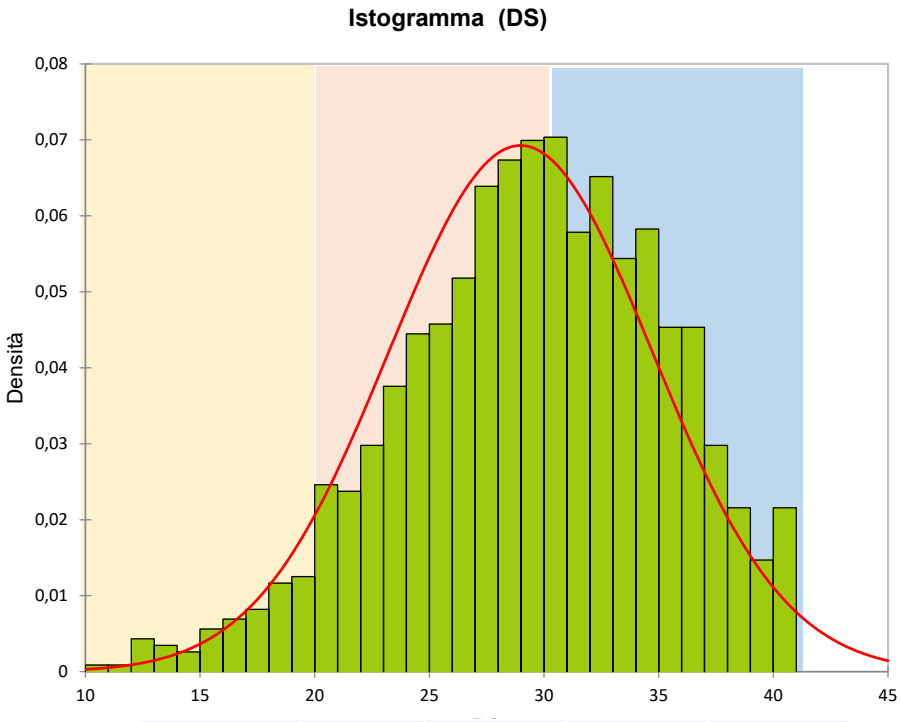
Disgust strongly invoked by animals/parts/body products, anything that has had contact with these or resemble them

- Limited range of animals eaten: no pets, primates, cute faces
  - animal-themed food decorations drastically reduced the value of the foods made of animals (Takahashi et al., 2018)



- Limited range of animal body parts eaten – esp. not the very animally bits (head and viscera)
- For adults high in disgust sensitivity, food consumption is highly influenced by how they are described, esp. meat and cheese

Disgust Sensitivity



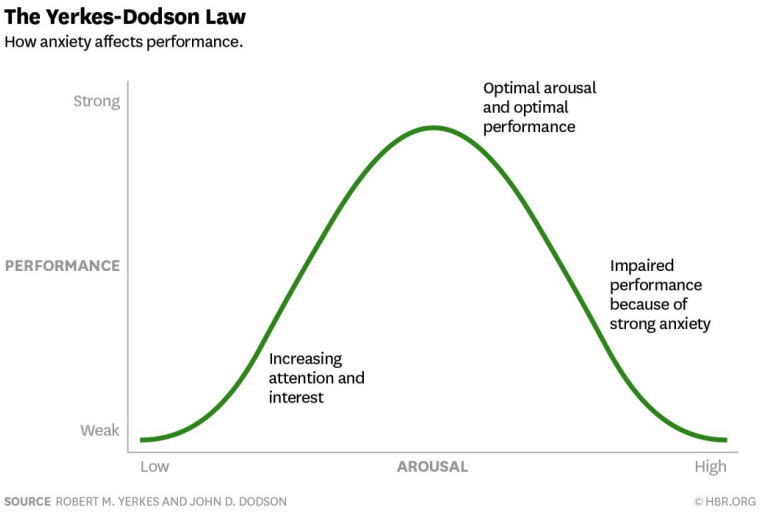
		Min	Max	Median
DS | F	1361	11.000	40.000	30.418
DS | M	956	10.000	40.000	26.923

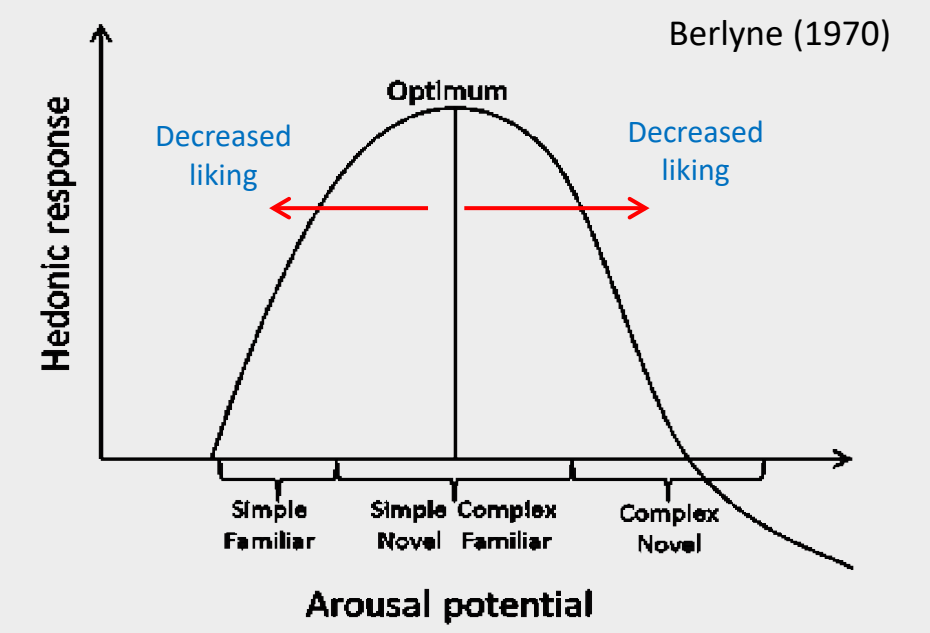
Disgust Sensitivity (like FN)

+ve assoc with unpleasantly high arousal

-ve assoc with food variety/sensation seeking

Effects of arousal





Arousal induced by a food:

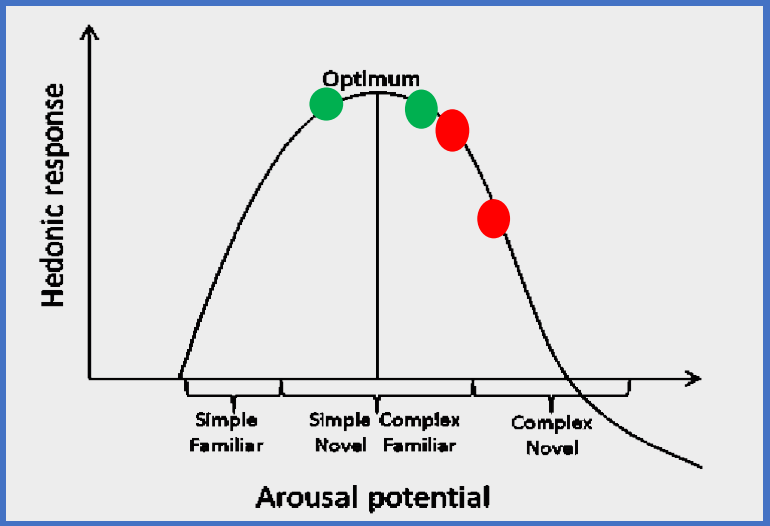
Low arousal* individual

High arousal* individual

*FN; DS; PROP

+

- INFORMATION (pesticides, additives, animal issues, GMO, disgust elicitors)
- NOVELTY (uncertainty → potential danger)
- INTENSITY (strong flavours)



Personality & Food Choice

- What explains the desire to eat something that is painful?
- What personality factors might explain pungent food choices or barriers to such choices?

Context	Non-pungent option	Pungent option
Lunch /dinner	Spaghetti with tomato sauce	Spaghetti with hot tomato sauce
Lunch /dinner	Spaghetti with garlic and olive oil	Spaghetti with garlic, olive oil and hot chili pepper
Lunch /dinner	Rice with saffron	Rice with curry
Lunch /dinner	Sweet provolone cheese	Hot provolone cheese
Aperitif	Chips	Chips with paprika

The Pungent Food Choice Index

Personality associations with pungency choice

Correlated with **Pungent Food Index**:

- *Intensity of burning* -ve
- *Food Neophobia* -ve
- *Disgust sensitivity* -ve

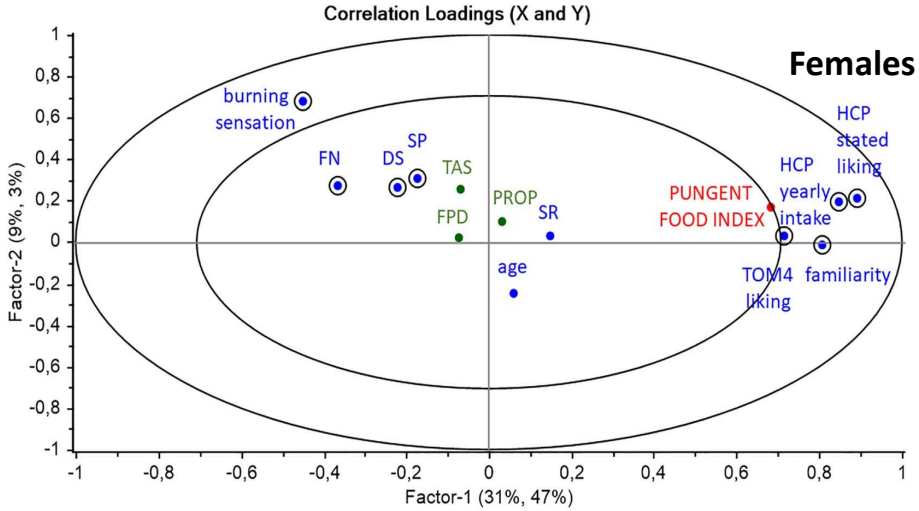
+

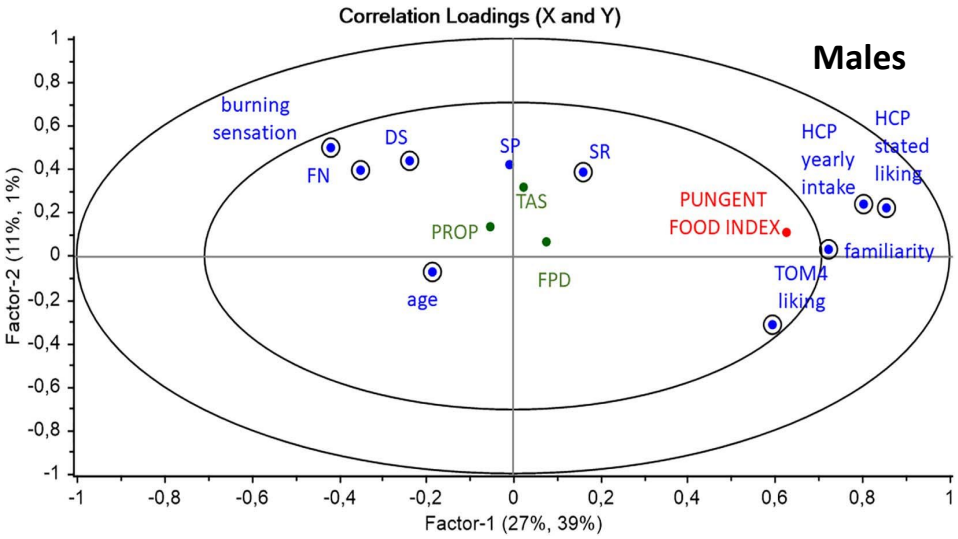
females: *sensitivity to punishment* -ve

males: *Age* (-ve) & *sensit to reward* +ve

NS: *alexithymia, PROP, FP density*

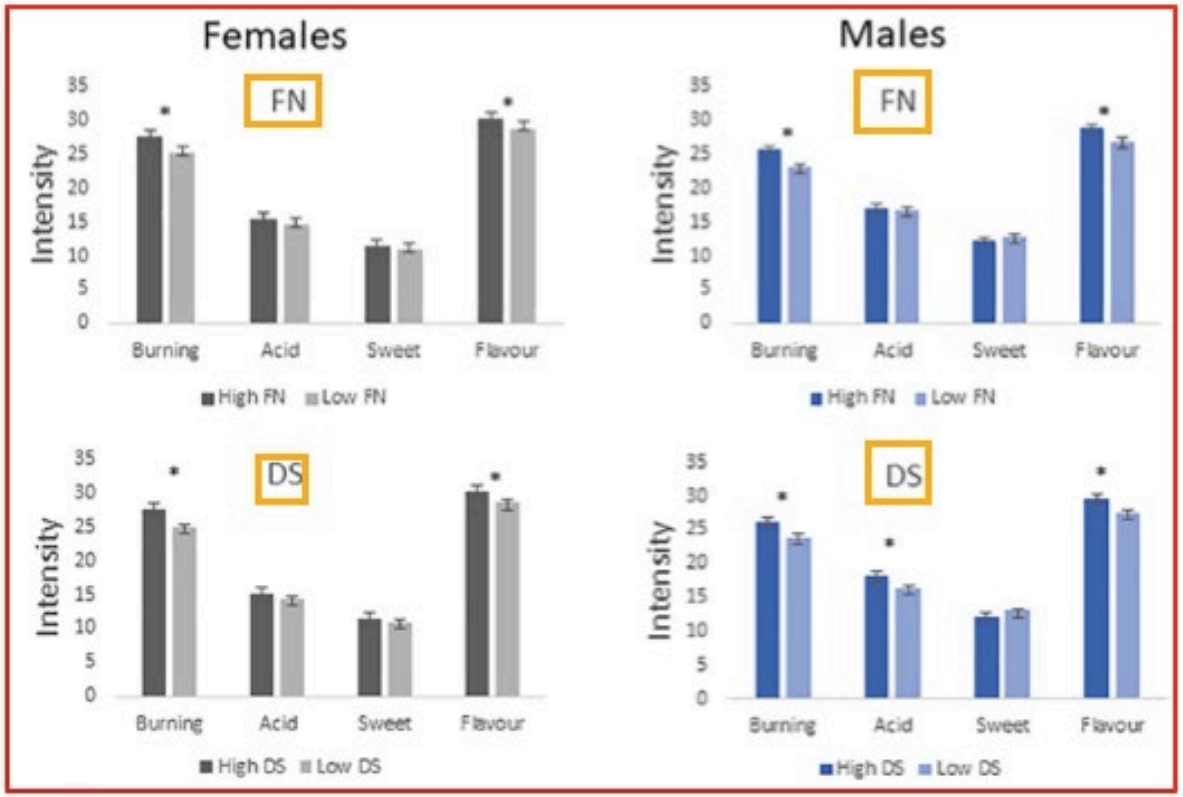
SR – sensitivity to reward
SP – sensitivity to punishment
PBC – Private body consciousness
TAS – alexithymia
FN – food neophobia
DS – disgust sensitivity





Personality & sensory intensity

+ Capsaicin 1.52 mg/kg



Personality correlates of fat in meat

Choice for fat-rich meat

1208 individuals (58% females)

Fat-rich meat choice index (FI)

LOW FAT	HIGH FAT
Calf rib	Lamb rib
Grilled cutlet	Breaded cutlet
Chicken breast	Sausage
Chicken	Lamb
Cooked ham	Mortadella
Carpaccio	Sliced steak
Cooked ham	Cured ham

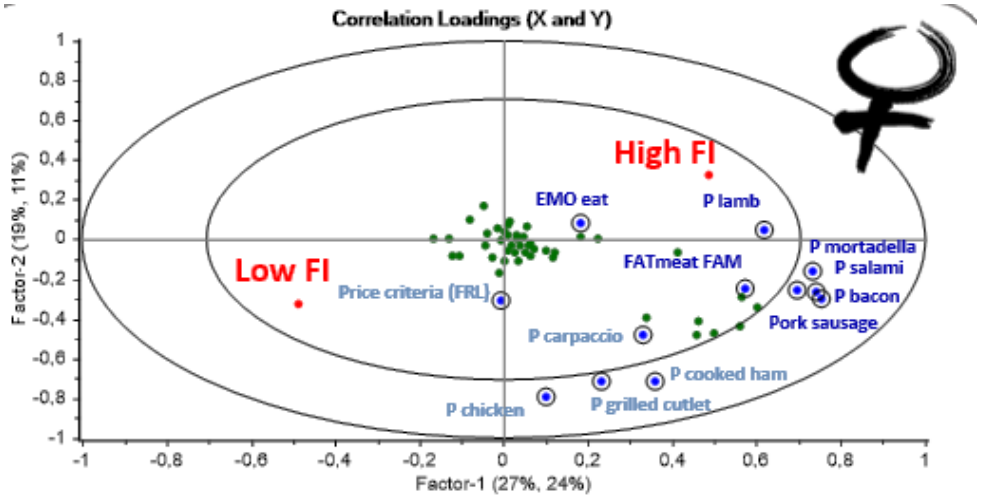
Correlated with **Meat Fat Index**:

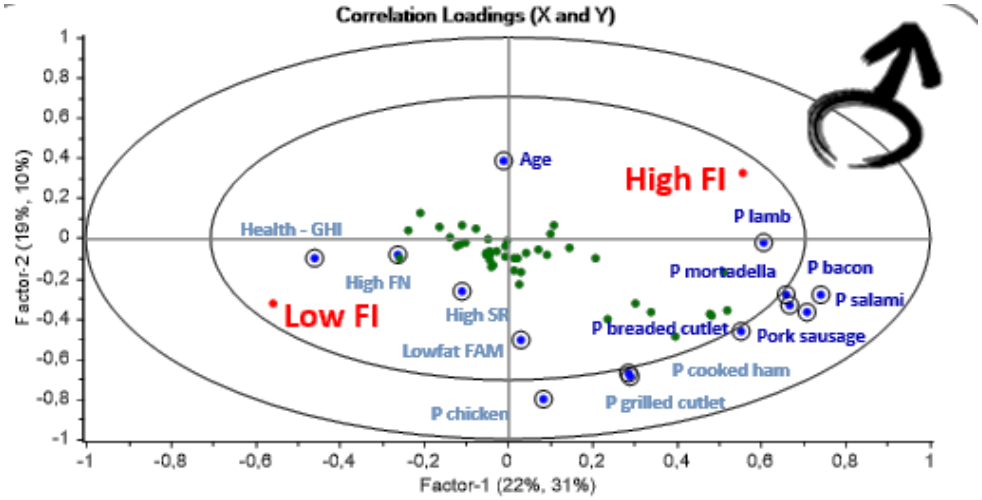
F *Emotional eating (EMO)* *+ve*

M *Food Neophobia (FN)* *-ve*

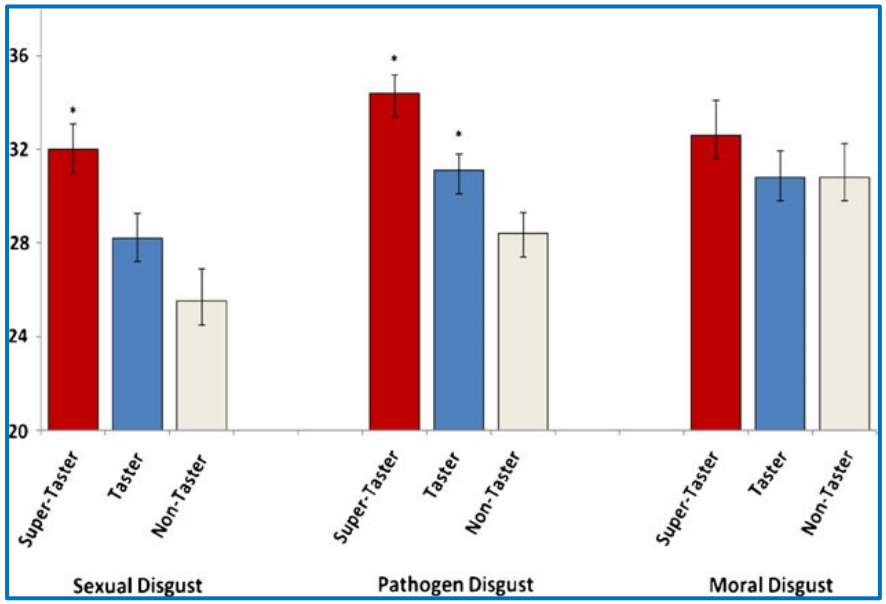
Sensitivity to reward (SR) *-ve*

Health interest (GHI) *-ve*





Disgust, food neophobia & sensory intensity (PROP)



Herz (2011), *Chem. Percept*.

PROP Taste Sensitivity is Related to Visceral (pathogen) but Not Moral Disgust

Martins & Pliner (2005) *Appetite*

Willingness to try novel foods

Table 3
Summary of final regression analysis for variables predicting willingness to try novel foods

Variable	ΔR^2	B	$SE\ B$	β
Nonanimal ($R^2 = .45$; $N = 67$)				
Disgust attributes	0.32	−0.714	0.154	−0.447*
Interest	0.13	0.464	0.117	0.380*
Animal ($R^2 = .58$; $N = 64$)				
Disgust attributes	0.53	−0.899	0.124	−0.641*
Interest	0.05	0.342	0.127	0.239*

*$p < .01$.

Laith Al-Shawaf et al. (2015) *Appetite*

FN positively correlated with pathogen disgust in women; moral disgust unrelated to FN

Disgust Sensitivity & rejection of meat consumption

Adopting vegetarianism for moral reasons has been linked to meat disgust

- But …. individuals who report avoiding meat for moral reasons were not more DS than those who avoided meat for other reasons
- suggests that moral vegetarians' disgust for meat is caused by their moral beliefs, rather than vice versa

(Fessler et al., 2003)

Appetite 127 (2018) 28–36

Contents lists available at ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

How people's food disgust sensitivity shapes their eating and food behaviour

Aisha Egolf*, Michael Siegrist, Christina Hartmann

Table 6
Spearman's rho correlation and partial correlation coefficients between food frequency consumption (per week) and food disgust sensitivity (FDS short).

	Correlation		Partial correlation[1]	
	r	p-value	r	p-value
Fruits (in portions)	-.02	.488	-.04	.178
Vegetables (in portions)	**-.11**	< .001	**-.13**	< .001
Eggs	**-.08**	.005	**-.09**	.003
Processed meat (e.g. sausages, cold cuts)	-.02	.452	.01	.831
Beef and veal	-.03	.264	.01	.840
Special meats (e.g. venison, lamb, ostrich meat)	**-.14**	< .001	**-.12**	< .001
Pork	**-.08**	.005	-.05	.097
Poultry (e.g. chicken, turkey)	< .01	.962	< .01	.940
Innards (e.g. liver, beef tribe)	**-.08**	.005	-.06	.034
Fish	-.05	.098	-.04	.158
Seafood (e.g. mussels, shrimp)	**-.09**	.002	**-.08**	.004
Sweets and savories	-.04	.145	-.04	.189

Disgust Sensitivity & rejection of meat consumption

Relationships between disgust, sensory responses to meat, other attitudes to animal products and type of vegetarianism (moral vs. health)

119 individuals who avoid eating meat

Measure	Correlation (*r*) With MORECSUM[a]	With HEALTHSUM[b]	With MORECSUM after HEALTHSUM correlation is partialed out
Disgust measures			
I dislike "meat" because of what it is or where it comes from. (% TRUE)	.60***	.30**	.55***
The thought of eating "meat" makes me nauseous. (% TRUE)	.30**	.36***	.18
Contamination with a trace of meat[c]	−.55***	−.25*	−.51***
I resist (avoid) eating "meat" because eating "meat" is offensive, repulsive, or disgusting[d]	.64***	.51***	.55***
Overall disgust (DISGSUM)[e]	.61***	.48***	.52***
Sensory measures[f]			
Taste of "meat"	−.10	−.30**	−.02
Smell of "meat"	−.42***	−.33***	−.33***
Texture of "meat"	−.08	−.16	−.02
Appearance of "meat"	−.30**	−.40***	−.16
Other measures			
I resist (avoid) eating "meat" because emotionally, I just can't chew and swallow "meat."[d]	.81***	.30**	.79***
Personality reasons (PERSONSUM): Summed score on three personal reasons from Table 1	.77***	.43***	.72***

MORALIZATION AND BECOMING A VEGETARIAN:
The Transformation of Preferences Into Values and the Recruitment of Disgust

Paul Rozin, Maureen Markwith, and Caryn Stoess

Psychological Science, Vol. 8, No. 2 (Mar., 1997), pp. 67-73

Disgust Sensitivity & rejection of meat consumption

Sources of moral disgust - related to an animal's perceived similarity to humans?

Appetite 59 (2012) 47–52

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journal homepage: www.elsevier.com/locate/appet

Research report

Too close to home. Factors predicting meat avoidance

Matthew B. Ruby *, Steven J. Heine

Animal characteristics that predict disgust

	Study 1		Study 2	
	Euro-Canadian	Hong Kong Chinese	Euro-American	Indian
Suffering	0.029	−0.017	0.031	0.011
Appearance	**−0.201*****	**−0.225*****	**−0.252*****	**−0.200*****
Appearance^2	**0.169*****	**0.144*****	**0.259*****	**0.110****
Emotion	−0.041	**0.060****	0.081	**−0.100***
Intelligence	**0.509*****	**0.344*****	**0.267*****	**0.303*****

Appearance: disgust at eating ugly animals

Appearance^2: disgust at eating animals that deviated from the neutral point of the scale

Insects as protein sources: Disgust & Neophobia

Lammers et al (2019) FQAP: Willingness to consume ‘insect burger’
518 German consumers

Food neophobia	**-0.21***
Food disgust	**-0.68*** **
Food technology neophobia	-0.21
Sensation seeking	0.30**
Sustainability consciousness	-0.07

Food Quality and Preference 64 (2018) 120–125

Contents lists available at ScienceDirect

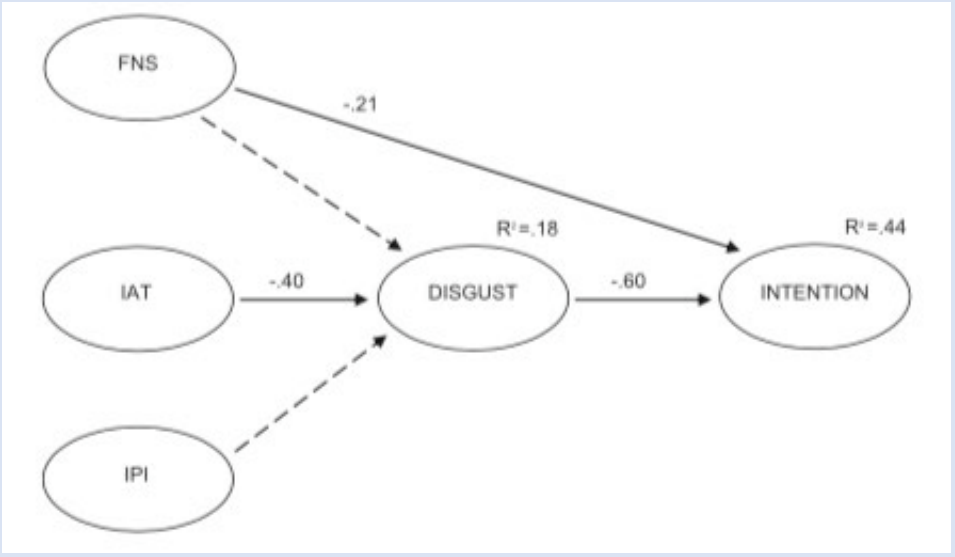
Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

Understanding Westerners’ disgust for the eating of insects: The role of food neophobia and implicit associations

Francesco La Barbera[a], Fabio Verneau[a,*], Mario Amato[a], Klaus Grunert[b]

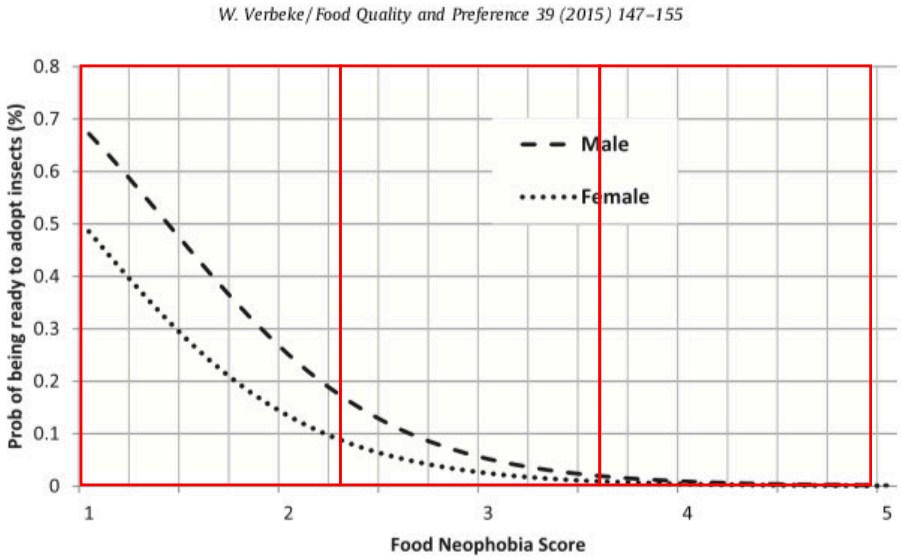
IPI: ingredient preference index
IAT: implicit association test

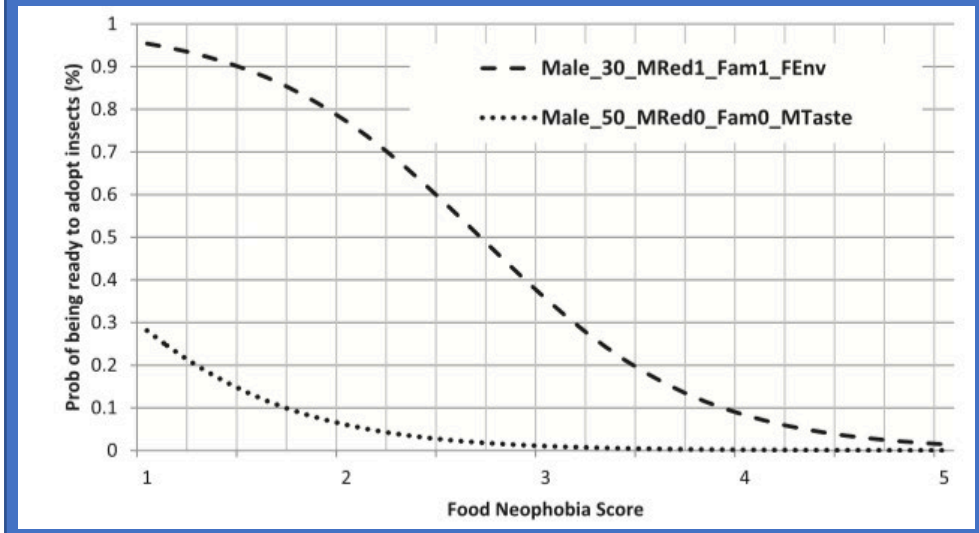


Insects as protein sources: Disgust & Neophobia

368 Belgian meat consumers asked their agreement with the statement: ‘‘*I would be prepared to eat insects as a substitute for meat*’’

Predicted probability of being ready to adopt insects as a substitute for meat depending on food neophobia





Predicted probability being ready to adopt insects as a substitute for meat depending on the food neophobia score for -

30-year old male who:

- plans to reduce meat intake
- is familiar with the idea of eating insects
- focuses on the environmental impact of food choice

50-year old male ‘meat lover’ who:

- does not plan to reduce meat intake
- is not familiar with the idea of eating insects
- focuses heavily on taste in meat choice

Comparing vegetarians, flexitarians and omnivores

The role of implicit beliefs

Conflict between implicit (impulsive choices) and explicit (deliberate choices) attitudes may lead to ambivalence toward meat consumption


Food Quality and Preference 68 (2018) 276–291

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Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

The influence of psychological traits, beliefs and taste responsiveness on implicit attitudes toward plant- and animal-based dishes among vegetarians, flexitarians and omnivores

Danny Cliceri[a,*], Sara Spinelli[a], Caterina Dinnella[a], John Prescott[a,b], Erminio Monteleone[a]

Aim: to explore associations toward plant-based and animal-based dishes among vegetarians, flexitarians and omnivores

The Implicit Association Test (IAT) seeks to uncover links (attitudes, beliefs) not open to conscious introspection or are biased by demand characteristics without having to directly ask the participant

"I should say that I like healthy foods, even if I prefer sugar and fat"

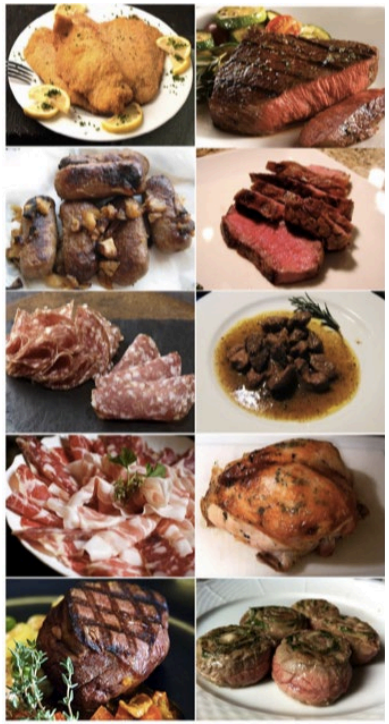
- IAT exploits the effects of links between stimuli on performance: shorter RTs for stimuli assigned to the same response when they are associated with each other (compatible) than when incompatible

Comparing vegetarians, flexitarians and omnivores

Attitudes towards meat, vegetable & dairy foods were examined by pairing pictures with positive and negative words and measuring RTs

Positive: *happiness, cheerfulness, enthusiasm, relaxation, satisfaction, joy, pleasure, amusement*

Negative: *disgust, distress, boredom, annoyance, sadness, dissatisfaction, disappointment, shame*



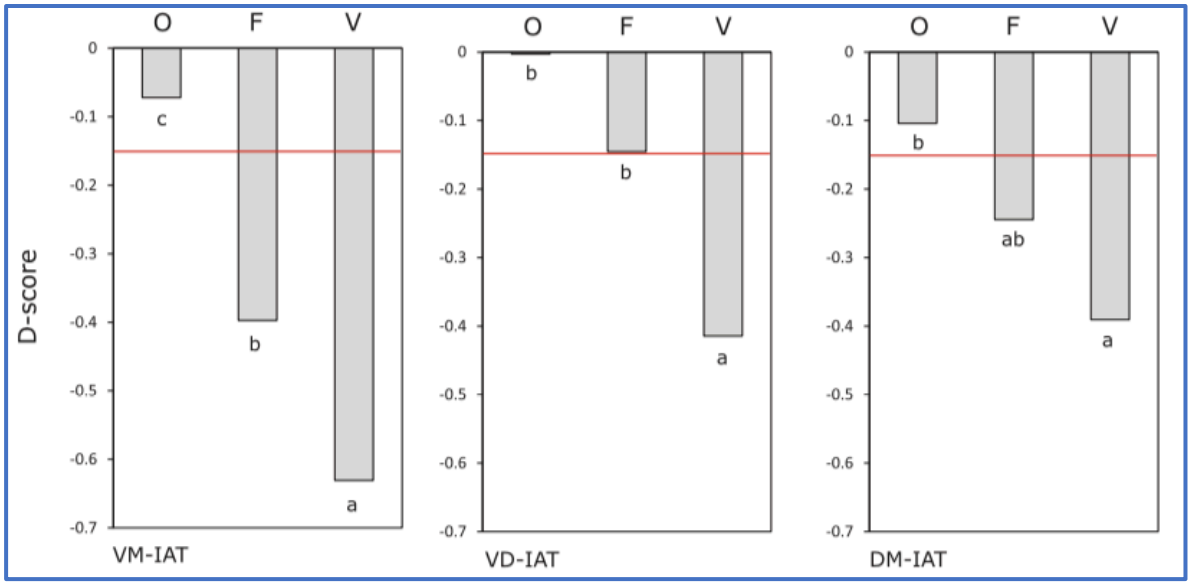
Comparing vegetarians, flexitarians and omnivores

Lower D-scores (below red line) = stronger links between:

VM: vegetables + positive emotions & meat + negative emotions, than vice versa

VD: vegetables + positive emotions and dairy + negative emotions, than vice versa

DM: dairy + positive emotions & meat + negative emotions, than vice versa



These results suggest that being vegetarian involves a preference toward vegetables over both meat and dairy products, while being flexitarian involves only a preference of vegetables over meat.

- No diffs in Food Neophobia
- Higher Pathogen Disgust in Omnivores/Flexitarians vs. Vegetarians
- Higher scores in Vegetarians compared to Omnivores (Flexitarians intermediate) in the belief that animals share emotional states and mental capacities with humans

Variations in emotion experience/expression

- Intensity
- Granularity

  Ability to distinguish between subtle emotion variations
- Focus
  - Valence-focused: more sensitive to positive/negative information
  - Arousal-focused: more responsive to physiological cues
- Alexithymia

  Difficulty identifying emotional feelings/distinguishing feelings from bodily sensations of arousal

Emotional conditioning: Comfort foods

- Positive associations with friends, family, home, culture, country, cuisine
- These foods are liked because they elicit the positive feelings with which they were originally paired

Variations in emotion experience/expression

Mora et al. (2019), FQAP: Effect of personality on the emotional response elicited by wines

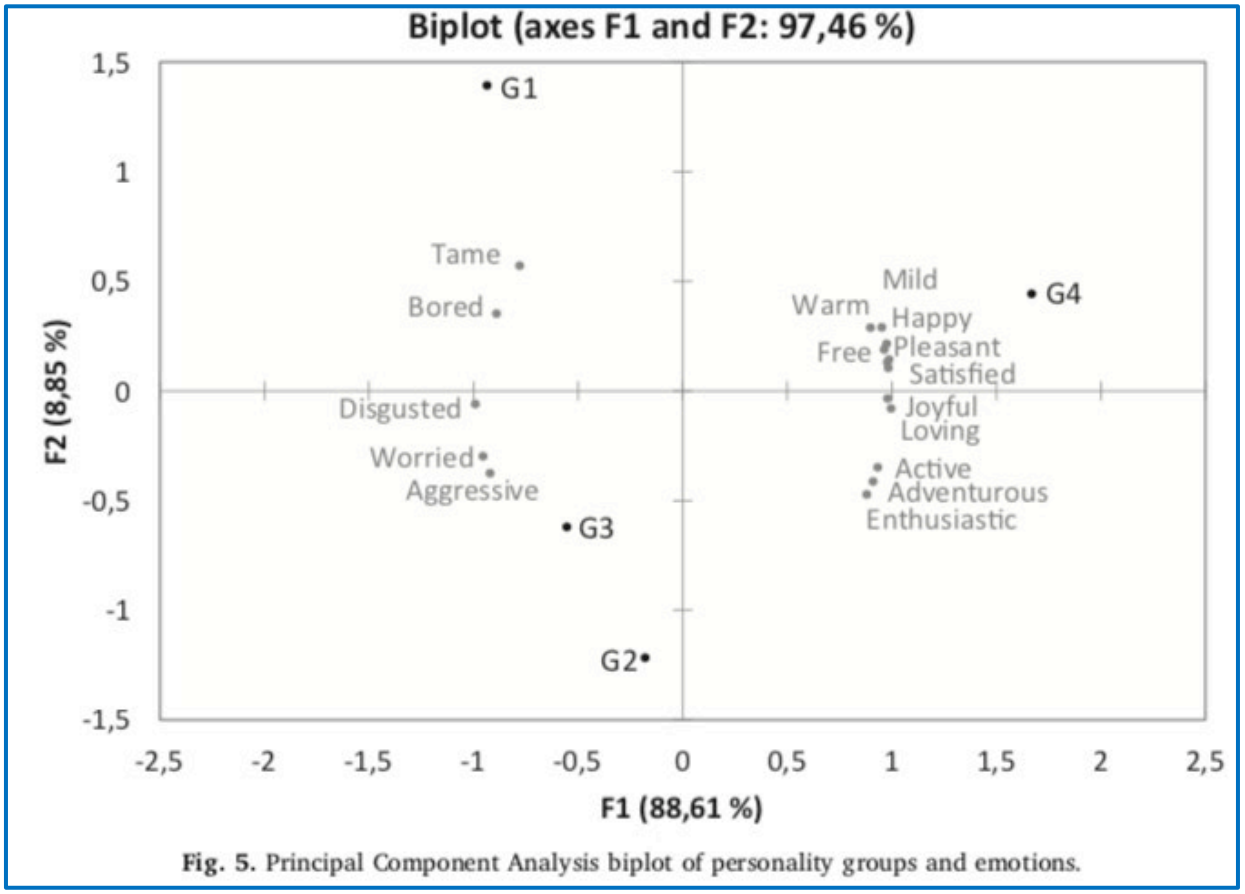
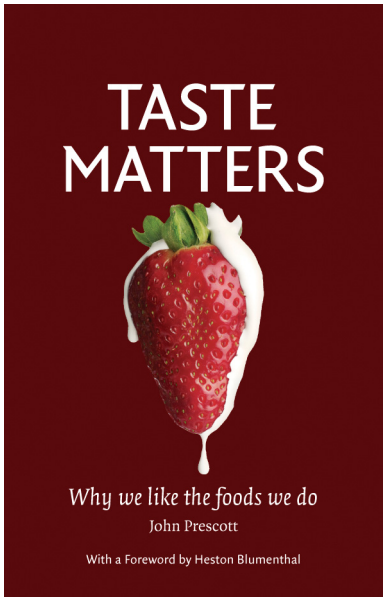
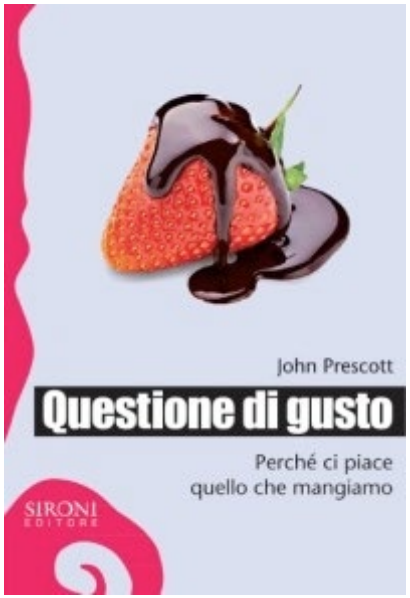


Fig. 5. Principal Component Analysis biplot of personality groups and emotions.

G1: higher *Neuroticism*; lower *Extraversion* and *Agreeableness*
G4: higher scores on the *Extraversion, Agreeableness, Consciousness*; lower *Neuroticism* G2, G3: in-between characteristics

THANK YOU FOR YOUR ATTENTION





www.taste-matters.org

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