

USZ Universitätsspital Zürich

 Spital Männedorf

Wirkmechanismen Bariatrische Chirurgie

Prof. Marco Bueter, MD, PhD

Adipositas-Update: Der Gastrointestinaltrakt einmal anders, WiI, 27. August 2020

1

How does bariatric surgery work?

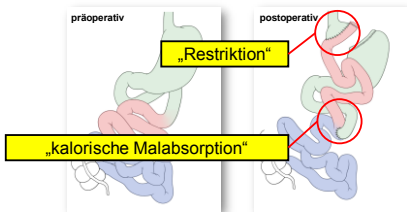
BARIATRIC WONDERLAND
Land der Märchen, Mythen und Legenden

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2

How does bariatric surgery work?



Lutz TA & Bueter M, *Am J Physiology* 2014

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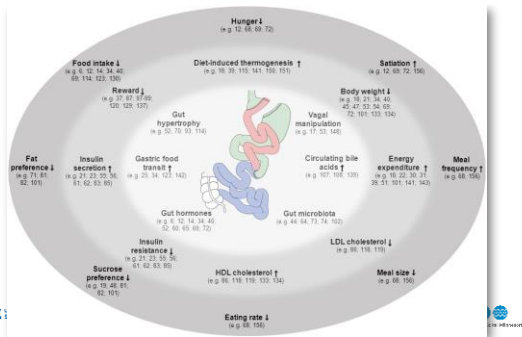
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How does bariatric surgery work?

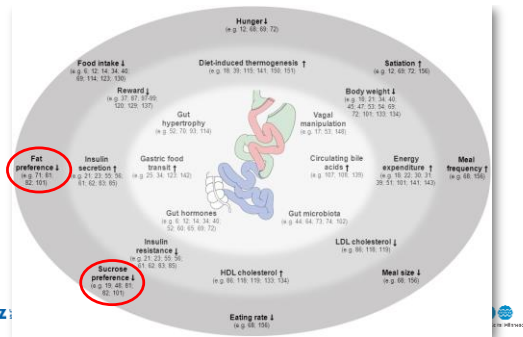
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4



5



6

Agenda

- 1. Evidence for changes in food preference in humans after BS
- 2. Direct measurements of ingestive behavior in rodents
- 3. Ongoing projects in Zurich
- 4. Summary and Acknowledgements

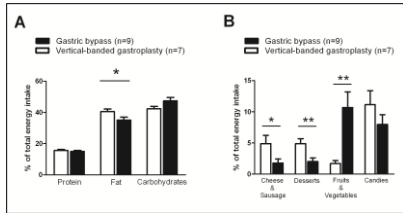
7

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8

Evidence for changes in food preference in humans after BS



Bueter M, Le Roux CW, Lutz TA, Obers T et al. *Am J Physiology* 2011



Evidence for changes in food preference in humans after BS

Journal Pre-proof

Changes in taste function and ingestive behavior following bariatric surgery
 Katie Nance, M. Bekki Acevedo, M. Yarina Pajino
 Claire M. Mathes, Alan C. Spector^{*}
 Reference: APPE 104423

Mathes CM & Spector AC. *Physiology & Behavior* 2012
 Nance K et al., *Appetite* 2019



Evidence for changes in food preference in humans after BS

Journal Pre-proof

Changes in taste function and ingestive behavior following bariatric surgery
 Reference: APPE 104423

Most human data are based on **VERBAL REPORT** which is prone to inaccuracy (**indirect measures**)

Mathes CM & Spector AC. *Physiology & Behavior* 2012
 Nance K et al., *Appetite* 2019



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Direct measurements of ingestive behavior – in rodents after BS

iove Journal of Visualized Experiments www.love.com

Video Article
Roux-en-Y Gastric Bypass Operation in Rats

Marco Buetter¹, Kathrin Abegg^{2,3}, Florian Seyfried⁴, Thomas A. Lutz^{2,3}, Carel W. le Roux⁴

¹Department of Surgery, University Hospital Zurich
²Zurich Centre for Integrative Human Physiology, Vetuisse Faculty, University of Zurich
³Institute of Veterinary Physiology, University of Zurich
⁴Imperial Weight Centre, Department of Investigative Medicine, Imperial College London

Correspondence to: Marco Buetter at marco.buetter@usz.ch

URL: <http://www.love.com/video/3940/>
 DOI: 10.3791/3940

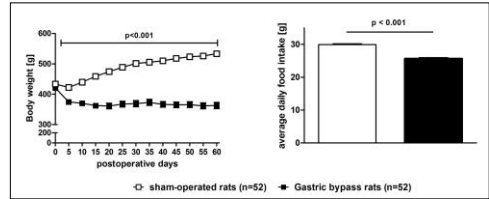


Buetter M et al., *Journal of visualized experiments (JOVE)* 2013



13

Direct measurements of ingestive behavior – in rodents after BS



Buetter M et al., *Journal of visualized experiments (JOVE)* 2013



14

Direct measurements of ingestive behavior – in rodents after BS

Two-Bottle-Intake Test



- 2 bottles: H₂O vs. Intralipid®
- Food *ad libitum*
- 7 ascending Intralipid® Concentrations (0.005%, 0.01%, 0.05%, 0.1%, 0.5%, 1%, 5%)
- each concentration is tested for 48 h

$$\text{Preference} = \frac{\text{Intralipid}^{\circledR} \text{ (in ml)}}{[\text{H}_2\text{O} + \text{Intralipid}^{\circledR} \text{ (in ml)}]} \times 100$$

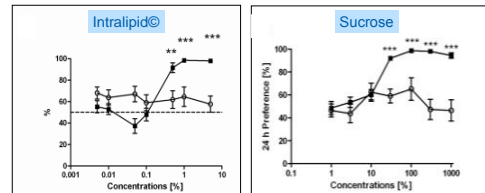
Buetter M, Le Roux CW, Lutz TA et al., *Am J Physiology* 2011



15

Direct measurements of ingestive behavior – in rodents after BS

Two-Bottle-Intake Test



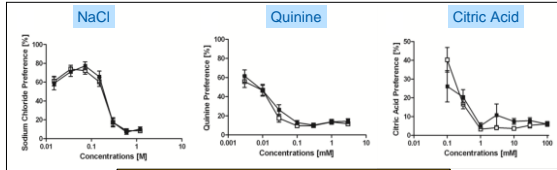
Buetter M, Le Roux CW, Lutz TA et al., *Am J Physiology* 2011

Buetter M et al., *Physiology & Behavior*



16

Direct measurements of ingestive behavior – in rodents after BS
Two-Bottle-Intake Test



....but not for all taste qualities....



Bueter M, Le Roux CW, Lutz TA et al. Am J Physiology 2011
Bueter M et al., Physiology & Behavior 2011



17

Direct measurements of ingestive behavior – in rodents after BS



18

Direct measurements of ingestive behavior – in rodents after BS
Brief access test – The Davis Rig

Appetitive Behavior - "Wanting"
Consummatory Behavior - "Liking"

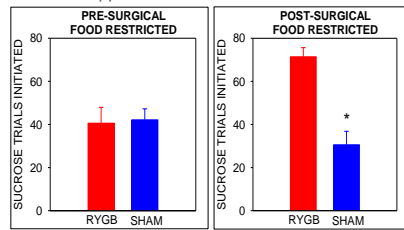


Courtesy of Alan C Spector, FSU



19

Direct measurements of ingestive behavior – in rodents after BS
Brief access test – Appetitive behavior



Mathes CM, Bueter M et al., Am J Physiol Regul Integr Comp Physiol 2012

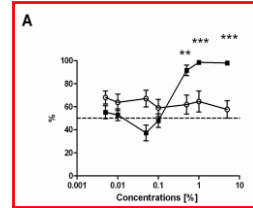


20

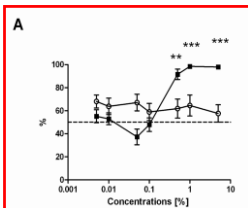
Direct measurements of ingestive behavior – in rodents after BS
 Conditioned (learned) Taste Aversion



Direct measurements of ingestive behavior – in rodents after BS
 Conditioned (learned) Taste Aversion



Direct measurements of ingestive behavior – in rodents after BS
 Conditioned (learned) Taste Avoidance



Direct measurements of ingestive behavior – in rodents after BS
 Conditioned (learned) Taste Avoidance

Tequila VS. Bier



Further evidence that learning is involved

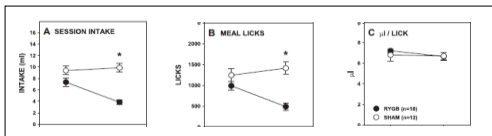
Direct measurements of ingestive behavior – in rodents after BS

Drinking microstructure



Direct measurements of ingestive behavior – in rodents after BS

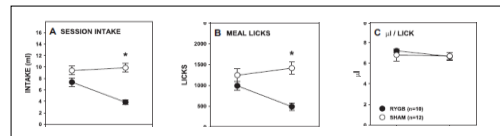
Drinking microstructure



Mathes CM et al., *Am J Physiol Regul Integr Comp Physiol*, 2015

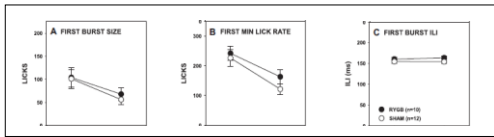
Direct measurements of ingestive behavior – in rodents after BS

Drinking microstructure



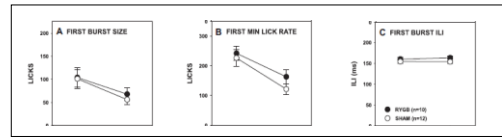
In the first minutes of a drinking episode, the behavior is more under control of the orosensory properties of the stimulus because it precedes any significant fluid accumulation in the stomach or small bowel

Direct measurements of ingestive behavior – in rodents after BS
Drinking microstructure



Mathes CM et al., *Am J Physiol Regul Integr Comp Physiol*. 2015

Direct measurements of ingestive behavior – in rodents after BS
Drinking microstructure



No change in palatability after RYGB

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Direct measurements of ingestive behavior
Drinking microstructure

HOW MUCH?

how? why? what?

Direct measurements of ingestive behavior

Drinking microstructure

Wein

Wasser

Different motivational states.....



33

Ongoing project in Zurich #1

Joint venture to develop a "new" drinkometer for humans



Neuroscientist
Alan Spector



Bariatric surgeons
Daniel Gero & me



Bionic engineer
Balint File

Bioinformatician – Engineer
Jörg Justiz



34

Ongoing project in Zurich #1

Joint venture to develop a "new" drinkometer for humans



Gero D et al., *Appetite* 2019



35

Ongoing project in Zurich #1

Joint venture to develop a "new" drinkometer for humans



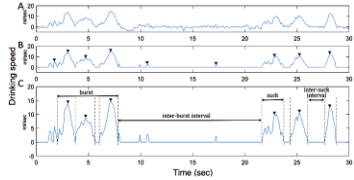
Gero D et al., *Appetite* 2019



36

Ongoing project in Zurich #1

Joint venture to develop a "new" drinkometer for humans



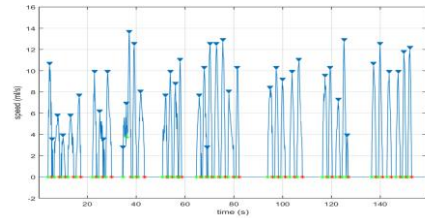
Gero D et al., Appetite 2019



37

Ongoing project in Zurich #1

Joint venture to develop a "new" drinkometer for humans



38

Ongoing project in Zurich #1

Joint venture to develop a "new" drinkometer for humans

	Female	Male	Δ	% (Female to Male)	p
Caloric intake (kcal)	34.42	55.72	21.30	62	0.019
Total volume (ml)	314.11	456.28	142.17	69	0.000
Total drinking time (sec)	83.66	107.37	23.71	78	0.000
Average speed (ml/sec)	3.82	4.47	0.65	85	0.016
V_{max} mean (ml/sec)	12.40	11.92	-0.48	104	0.430
Number of sucks (n)	21.63	35.64	14.01	61	0.000
Suck volume (ml)	13.21	11.91	-1.31	111	0.116
Suck rate (ml/sec)	10.95	10.28	-0.67	107	0.143

Gero D et al., Appetite 2019



39

Ongoing project in Zurich #1

Ingestive behaviour after RYGB – exploratory pilot study

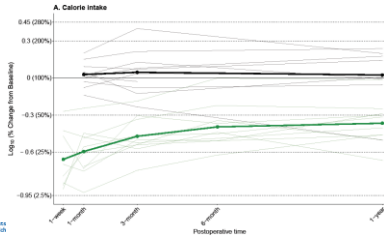
ALBERT LUSCHNIGER
ClinicalTrials.gov
NCT03747445



40

Ongoing project in Zurich #1

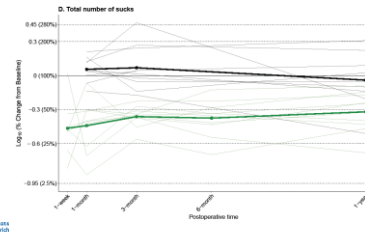
Ingestive behaviour after RYGB – unpublished



41

Ongoing project in Zurich #1

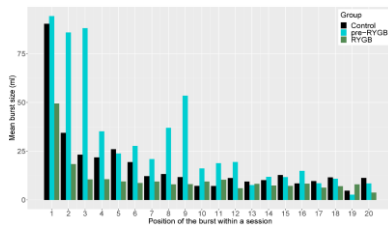
Ingestive behaviour after RYGB – unpublished



42

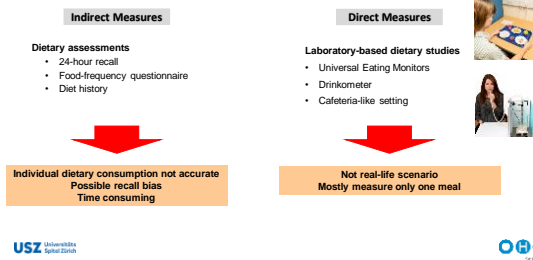
Ongoing project in Zurich #1

Ingestive behaviour after RYGB – unpublished



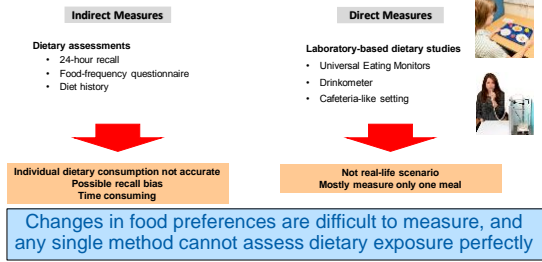
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Ongoing project in Zurich #2



44

Ongoing project in Zurich #2



45

Ongoing project in Zurich #2

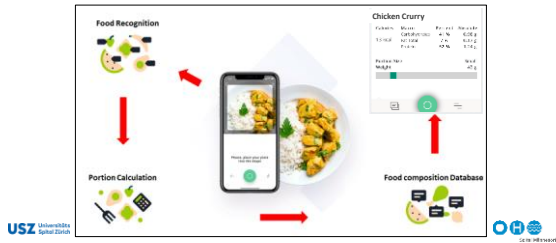
Dietary Records using Photographic Food Recognition Mobil App (SNAQ)



46

Ongoing project in Zurich #2

Dietary Records using Photographic Food Recognition Mobil App (SNAQ)



47

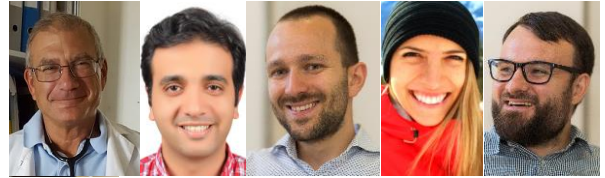
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48

Summary

1. Changes in food preferences after RYGB are a real phenomenon
2. Underlying mechanisms involve «Learning» and «Experience»
3. Role of an altered palatability unclear



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Robert E. Steiner , PhD	Philipp Gerber , MD	Aliman M. Ismaeil , MD					
Rolf Graf , PhD	Lukas Frick , MD	Nathalie Deferm , MD					

Olga Mayenfisch Stiftung

Thank you!

