

poster winner

The behavioral signature of snacking – a visual analysis

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Background

Besides main meals, snacking constitutes an essential part of our daily diet (Leech, Worsley, Timperio, & McNaughton, 2015; Howard & Reeves, 2005). However, snacking is often controversially discussed as a major contributor to overweight

and obesity and findings of current research are inconsistent (Hess, Jonnalagadda, & Slavin, 2016; Mesas, Muñoz Pareja, López García, & Rodríguez Artalejo, 2012). One reason for these heterogeneous results might be the lack of a standardized definition of snacking. Moreover, snacking behavior is often affected by situational cues (Schüz, Schüz, & Ferguson, 2015; Schüz, Bower, & Ferguson, 2015) and involves multiple decisions about the time and location of consumption. Different behavioral dimensions as well as inter- and intra-individual variances are often neglected in snacking research. However, when we aim to investigate associations of snacking behavior and health outcomes like BMI, it is crucial to illustrate the behavioral signature of snacking comprehensively. Therefore, the present study aims to illustrate different dimensions of snacking behavior – including who, how much, what, when and where people snack on.

Methods

A smartphone-based Ecological Momentary Assessment of eight consecutive days was used to capture snacking behaviour in real-time and real-life. Analysis included data from 99 adults from the general population with a mean age of 47.4 years (SD = 17.29, range = 20 - 86) and a mean BMI of 25.5 kg/m² (SD = 4.59, range = 17.6 - 43.3). During the study period, 2571 eating occasions were recorded, of which 400 were classified as snacks by using a participant-based approach. Food pictures were coded by trained raters using standardized manuals to extract calories and nutrients by means of the OptiDiet Basic Software (version 5.1; GOE, 2012). To analyse and illustrate the behavioural signature of snacking, data were graphically visualized with the software Tableau (version 9.3).

Findings

Sixty-five of the 99 persons (64%) snacked at least once during the study period. Snacking frequency ranged from one to 22 snacks and 68 to 709 kcal, whereas a more frequent snacking intake was associated with higher total calorie intake ($r = .84, p < .001$). The most consumed snacks were fruits (35.3%) and sweets (31%), followed by bread (22.8%), dairy products (21%), and cakes (15%). On a daily level, visual analysis identified three distinct snacking peaks at 10am, 1pm and 4pm. More specifically, in the morning and at work predominantly fruits were consumed, whereas the consumption of sweets tended to rise in the evening and at home. On an individual level, the

associations of snacking and BMI were analysed in two ways. Statistically, snacking and BMI did not correlate significantly ($r = -.07$, $p = .564$ for frequency; $r = -.16$, $p = .198$ for calories). A more detailed analysis showed that for most of the participants, there was no predominantly unhealthy or healthy snacking pattern identifiable. Moreover, our data did not support the stereotype of overweight people ($BMI > 25 \text{ kg/m}^2$) snacking more often or unhealthier compared to normal weight participants. However, data yielded a cluster of people that showed prominently frequent and unhealthy snacking patterns compared to other participants. This cluster of people was characterized by a BMI range of 23 to 26 kg/m^2 , including individuals that are on the shift to overweight.

Conclusion

This methodological approach constitutes a promising starting point for a more detailed analysis of behavioural signatures in eating research. Analysing the signature of behaviours on an individual level might help to identify meaningful target groups at risk in order to develop tailored dietary interventions. Previous studies in terms of snacking often focused on people who are already overweight. The present study, however, was able to identify a vulnerable group of people that borders on overweight. This finding might possibly explain some of the inconsistent findings regarding the relationship between snacking and BMI. Moreover, the present study emphasizes the need to investigate the behavioural signature of snacking comprehensively and on multiple behaviour dimensions

Only by understanding the behavioural patterns of a target behaviour, effective in-moment interventions can be developed (Nahum-Shani et al., 2014; Nahum-Shani et al., 2016). As also emphasized by previous studies (Inauen, Shrout, Bolger, Stadler, & Scholz, 2016), future research should go beyond group-level data and examine

snacking behaviour on an individual and within person-level to derive adequate interventions.



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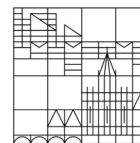
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The behavioural signature of snacking – a visual analysis

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Background

Snacking behaviour constitutes an essential part of our daily diet and is seen as one major contributor to overweight and obesity. However, empirical findings are ambiguous¹.

Compared to main meals, snacking is characterized by an irregular occurrence throughout the day, resulting in great variability not only between but also within persons².

Since multiple decisions are involved about how much, what, when and where to eat, an adequate assessment of snacking is challenging³.

To adequately investigate and illustrate snacking behaviour, research has to go beyond aggregated values and focus on individual, temporal and context-based variances in the behaviour⁴.

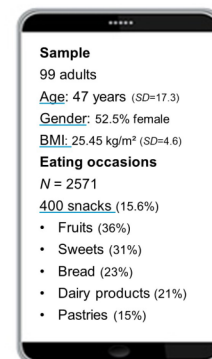
The present study aims to account for these variances by analysing different dimensions of the behavioural signature of snacking in order to reveal inconsistencies in previous research concerning snacking and BMI and derive adequate intervention strategies.

Methods

Design

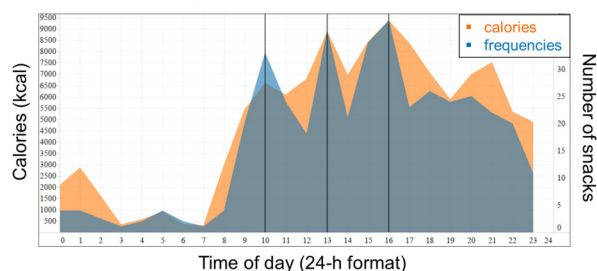
Smartphone- and photo-based EMA to capture snacking in real-time and real-life:

- Eight consecutive days
- Recording of every eating occasion by pictures and food descriptions
- Assessment of time & place
- Coding of food pictures by trained raters as well as extraction of calories & nutrients
- Data analyses via graphic visual analysis techniques (Tableau 9.3)

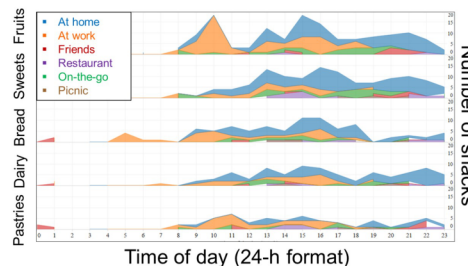


Results

The behavioural signature of snacking

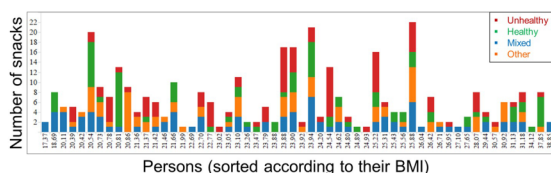


When, how often, and how much. Frequency and calorie distribution of snacking as an overlapping function of time of day reveal three pronounced snacking peaks at 10am, 1pm, and 4pm. However, the 10am peak shows a partly different pattern with a higher frequency compared to calorie intake.



When, how often, what, and where. A more detailed analysis of the top five snack categories shows that fruits are predominantly snacked in the morning at work, whereas in the afternoon, sweets and fruits are likewise snacked at home.

Snacking on an individual level



How often, what and who. To investigate snacking on an individual level, number of snacks are subdivided into four categories and displayed per person. Data showed no exclusively „unhealthy“ snacking pattern but a cluster of people bordering on overweight and snacking unhealthier and more frequent.

Discussion

The present study revealed three distinct snacking peaks at 10am, 1pm, and 4pm. More specifically, in the morning and at work predominantly fruits are consumed as snacks, explaining the mismatch of frequency and calorie distribution.

Associations of BMI and snacking frequency did not support the stereotype of overweight people snacking more often or unhealthier. However, visual analyses are able to yield a cluster of people with frequent and unhealthy snacking behaviours that borders on overweight.

This new methodological approach has the potential to identify meaningful target groups in order to improve the development of adequate and tailored dietary interventions.

References

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