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Proceeding Paper

Food Choices in Snacking Moments and Biogenic Amines Exposure. A Preliminary Observation on Children and Toddlers from Abruzzo Region †

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Abstract: Snacking outside of main meals is common and often a dietary requirement, especially for children and toddlers. This habit has both social and educative dimensions, as it has become an established moment in the daily routine. We conducted an easy online survey involving students and their families from schools in the Abruzzo region, Italy. The aim of the survey was to understand the participants' habits, food choices, and meal composition during snack time. Additionally, we inquired about their general health state. Our interest lies in knowing more about this population, with sufficient data to observe if habits and food choices may be accountable for exposure to biogenic amines (BAs). BAs are unavoidable natural compounds that come from the catabolism of amino acids in tissues. They are possibly involved in reactions such as allergic-like manifestations, abdominal pain, and more severe symptoms depending on individual sensitivity. The action of BAs can be augmented by the intake of foods, mainly fermented products, which are common in the everyday diet. We collected 300 responses from students ranging from 11 to 18 years old. The most popular foods eaten were sweets (pastries, cakes) and bakery sweet products, followed by yogurt-based and milk-based products (30% and 23% respectively). Most students (58%) reported having a snack moment daily. The population was generally in good health, but some reported experiencing light discomforts after snacking, such as transient gastrointestinal pain, headache, and dermatological symptoms (8.7%, 2%, and 0.7% of the total, respectively). All this information may be linked and added to the knowledge about BAs contents in foods and their potential impact on health.

Keywords: snacking; meal composition; food choices; biogenic amines

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1. Introduction

Meal composition and its structure follows continuing changes depending on the habits of people. Nowadays, principal meals (breakfast, lunch, and dinner) are restricted in time or shifted later in the day/night. Moreover, they are easily substituted by high-convenience and time-saving options (Almoraie et al., 2019). In this frame, snacking out or in substitution of principal meals, is growing importance among all the population's segments. Aside from these considerations, snacking covers a social dimension too contributing to socialization, and mainly among young subjects, these moments are often routinary actions separating school time from free time for example (Zhao et al, 2021).

Snacking is tremendously flexible and personally tailored to satisfy multiple exigencies when it comes to choosing what foods to include. These features are principally responsible for shaping the possible exposure to biogenic amines (BAs) (Leushner et al., 2013). This hazard is generally not recognized as a risk for human health, and among BAs

just the level of histamine is a requisite to look after in specific foods (some fresh fishes and their derived products) for the official rules posed on Commission Regulation (EC) No 2073/2005. BAs, with particular interest of histamine and tyramine, can be drivers of several negative manifestations with multiple targets. Moreover, the severity is highly changing due to factors not standardizable; sensitivity that is individual specific, assumption of mono amino and di amino oxidase drugs (MAO/DAO), and personal choice about meal composition and foods/beverages inclusion in the diet (Del Rio et al., 2020).

The interest of this study is to better understand the food habits of a sensitive population (children and toddlers) when snacking. In fact, potential hazardous intakes of BAs may be assumed by common foods such as chocolate, salami, and even beverages as tea and other soft drinks. The limitations of data about threshold limits for many BAs make it difficult to define the real exposure of people and especially for children and toddlers who very often eat items with very limited contents of histamine and tyramine. Anyway, other amines non recognized as directly toxic, may interact among them and magnify the effect of histamine and tyramine (even traces). To fit with the objective of this study, a survey was specifically designed for capturing the most realistic situation lived among students at some schools from the Abruzzo region (central Italy).

The study is still ongoing, and, for this reason, data shown here are prevalently referred to participants habits.

2. Materials and Methods

2.1. Survey Elaboration

A very easy and short questionnaire was designed to get frequency of snacking and for building up a profile of the most common snacking moment of children and toddlers. Because of privacy and age issues related to the subjects, families were directly involved in filling all the sections. The active collaboration with the schools made it possible to reach the highest number of families, assuring their total involvement. Teachers and directors were prior informed about the project explaining objectives, and the importance of the issue.

Before starting survey sharing, all the questions were evaluated by the ethics committee of the provinces of L'Aquila e Teramo receiving positive statement both for rights' protection and for comprehension and clarity of each question.

The Google form service of the Google platform is used. The survey is divided into 2 sections. General recommendation for participants is to complete the form with the constant surveillance of one familiar (specifically parents of legal tutors where indicated). The first one is dedicated to at least one member of the family and the student; questions included are about sex, age, food intolerances/allergies, drugs assumption and or therapy. The second section is dedicated to the students that are asked to describe how many times a week they have a moment in the day when snacking and to tell about which foods and beverages are mostly chosen within quantities. The final question is about symptoms possibly depending on BAs.

2.2. Determination of BAs in Foods/Beverages Samples

Contents of BAs from foods and beverages are in part determined ex novo, from several food matrices, and taken from internal database especially for fermented (animal-origin) foods. Experimental data were determined according to Latorre-Moratalla et al., (2009). Different classes of foods and beverages were analyzed and divided into meat-based foods, cheese and milk derived products, bakery products (sweet and salty) chocolate and other sweet items (mainly nuts spreads and others) and beverages. Mostly of the items indagated are known for their medium/high content of BAs and especially of histamine and tyramine; others are indagated because of scarcity or absence of data. From a methodological point of view, we restricted the exploration about exposure to histamine and tyramine since they have established threshold limits to which compare. The

landmark was the work of EFSA (2011) reporting for tyramine the thresholds of 6 mg/meal/person for patients treated with inhibitors of the enzyme monoaminoxidase (MAOI) drugs, 50 mg/meal/person for patients receiving third generation of MAOI drugs, so called RIMA (reversible inhibitors of MAO-A); and 600 mg/meal/person for healthy individuals. For histamine, the safe threshold considered for healthy population was 25 mg/meal/person as the most conservative level.

Calculation of exposure will be executed once a consistent number of responses is achieved. @Risk 7.0 (Palisade Corporation, NewField, NY) software will be used allowing to calculate several distributions and models. The goodness of fit will be evaluated using the Chi-square (χ^2) test. The best-fitting distributions describing tyramine or histamine contents and the consumption will be selected as an input for the assessment of the exposure to these compounds by the probabilistic estimation using the Monte Carlo simulation technique with 10,000 iterations. Exposure will be the result of crossing quantities of product eaten per occasion (g/snacking time) with contents of histamine and tyramine (mg/kg of product) and summing all the products eaten/drunk for that occasion.

3. Results and Discussion

Until now 300 responses have been collected from students ranging from 11 to 18 years old. The population is near fifty-fifty male and female subjects (52.7% and 47.3% respectively). The most popular foods eaten are sweets (pastries, cakes) and bakery sweet products, followed by yogurt-based and milk-based products (30% and 23% respectively). Most students (58%) reported having a snack moment daily. The population is generally in good health, but some reported experiencing light discomforts after snacking, such as transient gastrointestinal pain, headache, and dermatological symptoms (8.7%, 2%, and 0.7% of the total, respectively). Literature revision (Restuccia et al., 2015; Schirone et al., 2022; Ruiz-Capillas & Herrero, 2019) and our preliminary determination of BAs contents in foods and beverages give back safe contents in food analyzed, moreover quantities eaten by young consumers seem not indicating hazardous scenarios. At any rate final calculations are still not available for risk assessment of this population.

4. Conclusions

A new perspective about BAs it is needed for recognizing the real exposure of people to them. The scientific community with medical doctors must collaborate more to communicate consumers the risk connected to BAs, but especially stressing about testing personal sensitivity and MAO/DAO impairment, and educating people on dietary patterns, meal choice, and food inclusion in daily life.

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References

1. Almoraie, N.M.; Saqaan, R.; Alharthi, R.; Alamoudi, A.; Badh, L.; Shatwan, I.M. Snacking patterns throughout the life span: Potential implications on health. *Nutr. Res.* **2021**, *91*, 81–94. https://doi.org/10.1016/j.nutres.2021.05.001.
2. Zhao, X.; Zhao, X.; Gweon, H.; Kushnir, T. Leaving a choice for others: Children's evaluations of considerate, socially-mindful actions. *Child Dev.* **2021**, *92*, 1238–1253.
3. Leuschner, R.G.; Hristova, A.; Robinson, T.; Hugas, M. The Rapid Alert System for Food and Feed (RASFF) database in support of risk analysis of biogenic amines in food. *J. Food Compos. Anal.* **2013**, *29*, 37–42. https://doi.org/10.1016/j.jfca.2012.09.004.
4. Commission Regulation (EC) No 2073/2005 of 15 November 2005 on microbiological criteria for foodstuffs.

5. del Rio, B.; Redruello, B.; Fernandez, M.; Cruz Martin, M.; Ladero, V.; Alvarez, M.A. The biogenic amine tryptamine, unlike β -phenylethylamine, shows in vitro cytotoxicity at concentrations that have been found in foods. *Food Chem.* **2020**, *331*, 127303. https://doi.org/10.1016/j.foodchem.2020.127303.
6. Latorre-Moratalla, M.; Bosch-Fusté, J.; Lavizzari, T.; Bover-Cid, S.; Veciana-Nogués, M.; Vidal-Carou, M. Validation of an ultra high pressure liquid chromatographic method for the determination of biologically active amines in food. *J. Chromatogr. A* **2009**, *1216*, 7715–7720. https://doi.org/10.1016/j.chroma.2009.08.072.
7. EFSA Panel on Biological Hazards (BIOHAZ). Scientific opinion on risk based control of biogenic amine formation in fermented foods. *Efsa J.* **2011**, *9*, 2393.
8. Restuccia, D.; Spizzirri, U.G.; Puoci, F.; Picci, N. Determination of biogenic amine profiles in conventional and organic cocoa-based products. *Food Addit. Contam. Part A* **2015**, *32*, 1156–1163. https://doi.org/10.1080/19440049.2015.1036322.
9. Schirone, M.; Esposito, L.; D'onofrio, F.; Visciano, P.; Martuscelli, M.; Mastrocola, D.; Paparella, A. Biogenic Amines in Meat and Meat Products: A Review of the Science and Future Perspectives. *Foods* **2022**, *11*, 788. https://doi.org/10.3390/foods11060788.
10. Ruiz-Capillas, C.; Herrero, A.M. Impact of Biogenic Amines on Food Quality and Safety. *Foods* **2019**, *8*, 62. https://doi.org/10.3390/foods8020062.