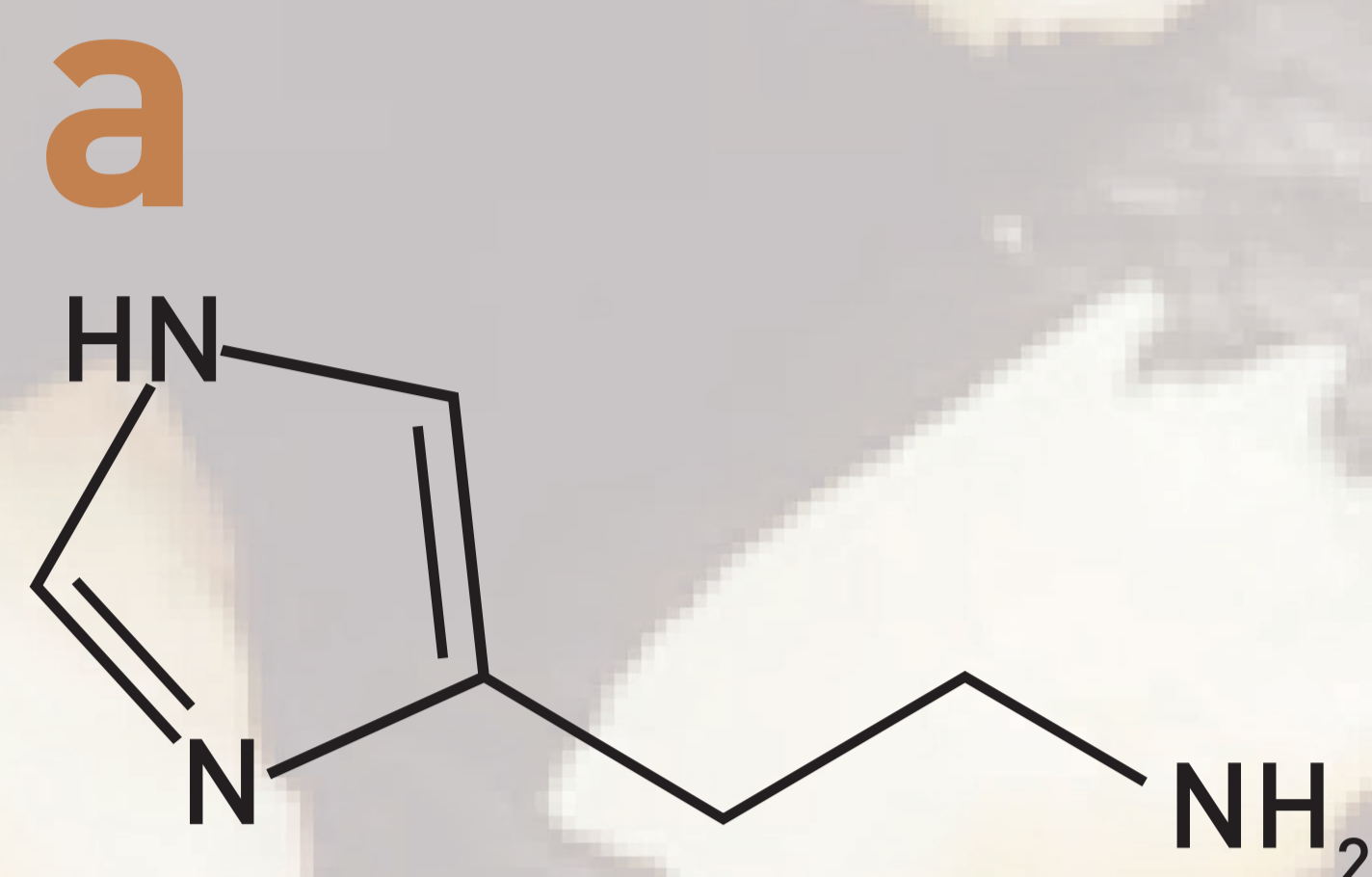
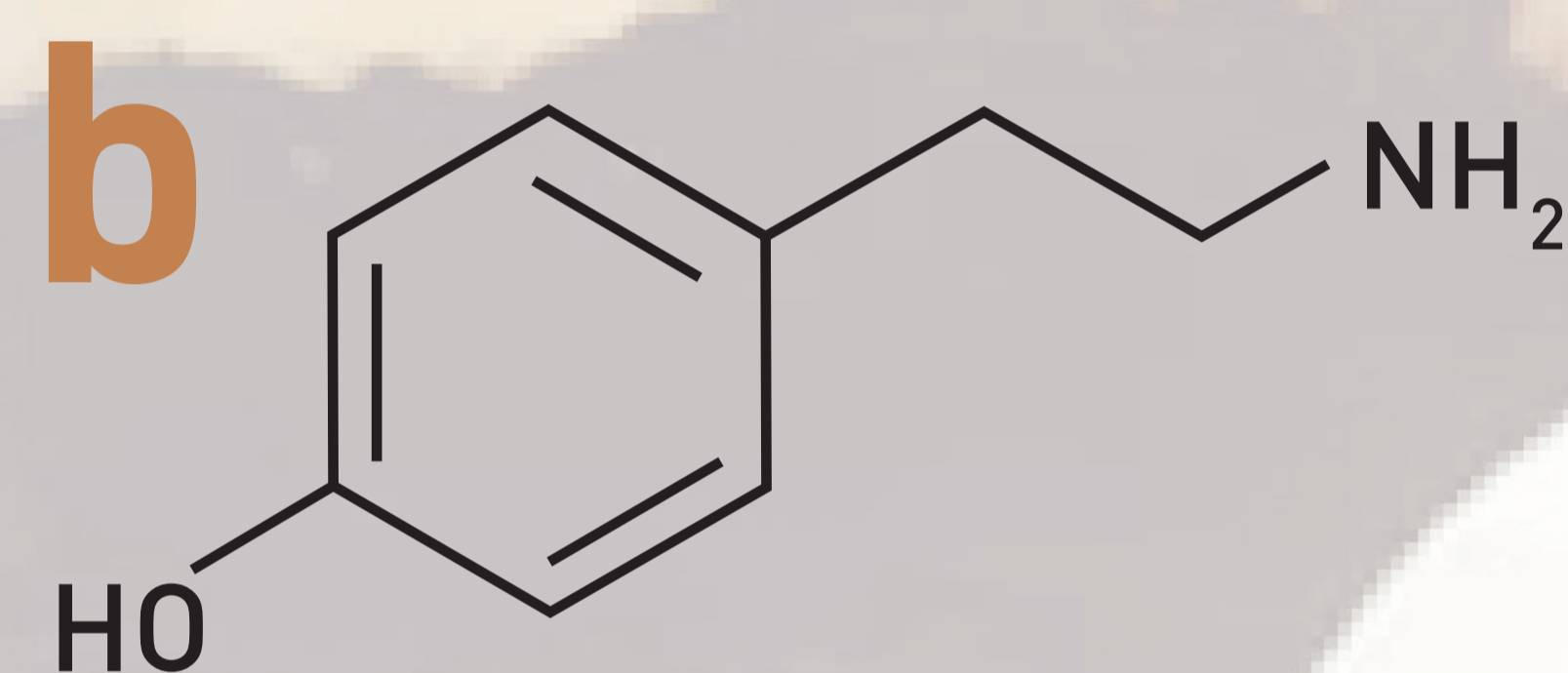


FIGURE 1 | Histamine (a) and tyramine (b) molecules:



Health effects: Mainly headaches, nasal secretions bronchospasm, tachycardia, hypotension, urticaria and asthma.⁽¹⁾ They are symptoms like allergic reactions.⁽²⁾



Health effects: Hypertension, headaches and vomiting ⁽¹⁾.

AIMS:

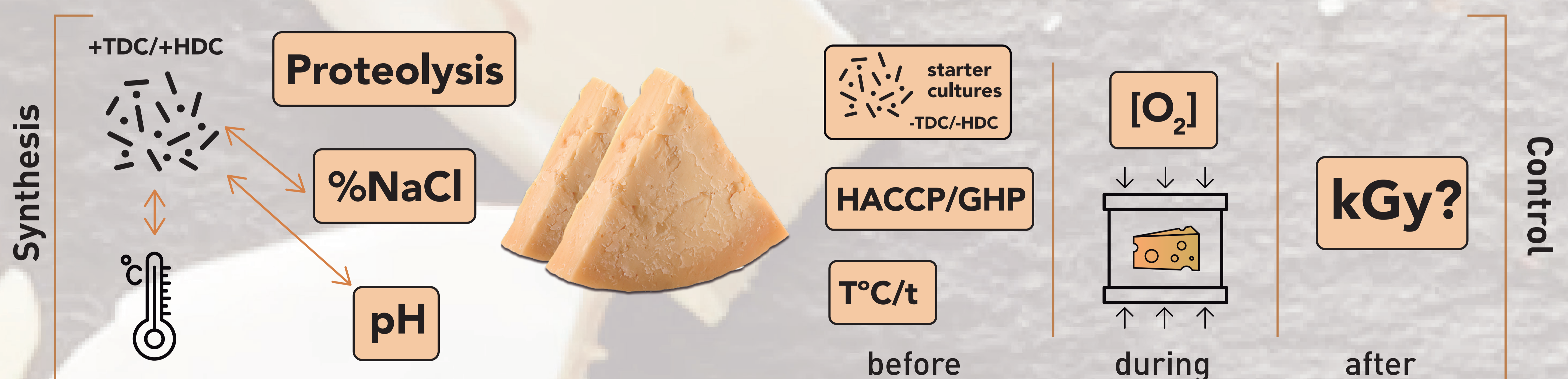
- 1 Describe chemical and microbiological factors involved in histamine and tyramine synthesis in cheese.
- 2 Describe histamine and tyramine toxicological aspects in cheese.
- 3 Define control methods of histamine and tyramine synthesis before, during and after the elaboration process.
- 4 Discuss aspects which condition the establishment of maximum legislative concentrations of histamine and tyramine in cheese.

TABLE 1 ^(1,3,4) | Amounts of tyramine and histamine that don't present adverse effects on health, depending on the type of population in which they are found. It's also presented the % of exposure, calculated with the maximum concentration found of each biogenic amine in cheese:

Biogenic amine	Population group	Amount that not show adverse effects on health	Maximum concentration found	Exposure (21g/day)
Tyramine	Under non-specific MAOI drugs	6 mg/person and meal	2130 mg/kg	750%
	Under RIMA drugs	50 - 150 mg/person and meal		30-90%
	Healthy population	600 - 2000 mg/person and meal		2-8%
Histamine*	Intolerant population	< to detectable values	1850 mg/kg	-
	Healthy population	50 mg/person and meal		78%

*Current maximum legislated concentration

→ particular fishery products (enzyme maturation) n=9, c=2, m=200 mg/kg and M=400mg/kg



CONCLUSIONS:

- 1 During ripening increases the proteolytic activity in cheese. Consequently, histidine and tyrosine amino acids become free, being able to be decarboxylated forming histamine and tyramine due to microbiologic activity.
- 2 These biogenic amines are a hazard. The risk depends on the population group.
- 3 Several methods could be applied to control and prevent the formation of histamine and tyramine, being the most effective the properly selection of the starter cultures.
- 4 More data are necessary to perform a risk assessment and to evaluate the significance of histamine and tyramine in cheese.

¹ Collins, D., Noerrung, J.B., Budka, H., Andreoletti, O., Buncic, Griffin, J., Hald, T., Havelaar, A., Hope, J., Klein, G., Koutsoumanis, K., McLauchlin, J., Müller-Graf, C., Nguyen-The, C., Peixe, L., Prieto Maradona, M., Ricci, A., Sofos, J., Threlfall, T., Vågsholm, I., and E. Vanopdenbosch. 2011. Scientific Opinion on risk based control of biogenic amine formation in fermented foods. *EFSA Journal*. 9(10):1-93. doi:10.2903/j.efsa.2011.2393.

² Latorre-Moratalla, M.L., O. Comas-Basté, S. Bover-Cid, and M.C. Vidal-Carou. 2017. Tyramine and histamine risk assessment related to consumption of dry fermented sausages by the Spanish population. *Food and Chemical Toxicology*. 99:78-85. doi:10.1016/J.FCT.2016.11.011

³ MAPAM (Ministerio de Agricultura y Pesca, Alimentación y Medioambiente). 2017. Base de datos de consumo en hogares. [accessed 2019 January 2]. Available in <https://www.mapa.gob.es/app/consumo-en-hogares/consulta.asp>

⁴ Reglamento (CE) No 2073/2005. 2005. Relativo a los criterios microbiológicos aplicables a los productos alimenticios. *Diario Oficial de la Unión Europea (DOUE)*. L 338/1 - L 338/26 pp.