IVES Technical Reviews vigne & vin

https://doi.org/10.20870/IVES-TR.2019.3987

The origin of olfactory disorders related to COVID-19

Sourced from the article "Récupération des capacités olfactives : un entraînement particulier est possible chez les professionnels du vin !" (Revue Française d'Œnologie, 2020).

>>> According to studies, 34 % to 86 % of people suffering from COVID-19 describe a loss of their sense of smell. This loss of smell is not irreversible and it is possible to strengthen or help its recovery through daily exercise. However, the exercise protocols must be suited to the way in which the virus acts on the olfactory system, which appears to be indirectly affected in the case of COVID-19. In fact, tissue inflammation leads to the obstruction of the nasal cavities, affecting the ability to detect and identify odorant sources. <<<

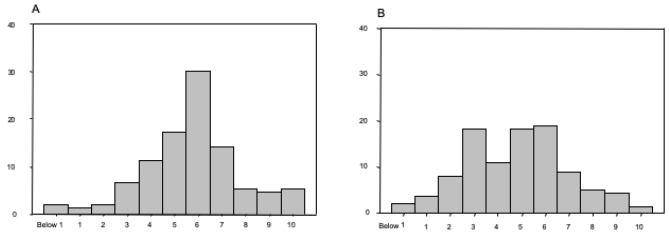

Figure 1. A/ Breakdown of geosmin detection thresholds (concentration from which a subject detects a smell) for 150 professional tasters. B/ Breakdown of isoamyl acetate detection thresholds (degree of concentration from which a subject detects a smell) for 137 professional tasters. Here, 10 represents low concentrations, meaning sensitive subjects; below 1 represents high concentrations, meaning not very sensitive subjects (suffering from specific hyposmia). The most sensitive subjects were able to detect concentrations over 1,000 times lower than the least sensitive subjects[3].

According to a study by Moein *et al.* (2020)[1], 59 % of patients with an olfactory disorder related to COVID-19 are anosmic (total loss of smell) and 41 % hyposmic (partial loss of smell, with a decrease in the intensity of smells perceived).

With the exception of the current pandemic, olfactory disorders are relatively infrequent; however an estimated 5 % of the population may have anosmia and 15 % may have hyposmia[2]. These general olfactory disorders should not be confused with specific anosmia or hyposmia (disorders in subjects with a seemingly normal sense of smell, but who cannot – or with difficulty – detect certain specific odorous substances). Their occurrence is such that we probably all have some gaps in our olfactory perception, whether we are an expert (Figure 1) or a novice.

There are also general disorders of a qualitative nature, distortions in perception or hallucinations, that may occur following an anosmia. A survey carried out by the review *Nez* (https://www.nez-larevue.fr/magazine/actualites/covid-19-le-jour-ou-le-monde-perdit-lodorat/) indicates that following an anosmia related to COVID-19, 8 % of subjects report a parosmia (the subject smells lemon when presented with coffee), while 7 % also mention incidences of phantosmia (the subject smells something that does not exist in their environment - olfactory hallucinations). These figures are close to those reported by the survey from the Chemosensory Research Consortium[4].

These testimonies show that, for some subjects, complete functional recovery is not achieved, which means that the processing of olfactory information is not always easily restored to the processing areas, the olfactory bulb or cortex.

General impairment to olfactory perception may have various causes, such as infection of the nasal mucosa, lesion of the olfactory nerve caused by head injury, or even medication. In these different cases, olfactory recovery is possible (although not always), unlike in congenital anosmia, or age-related anosmia, which are both permanent conditions.

Le LabEx COTE soutient la création et le lancement de la revue IVES Technical Reviews dans le cadre de son appel à projets Transfert et valorisation.

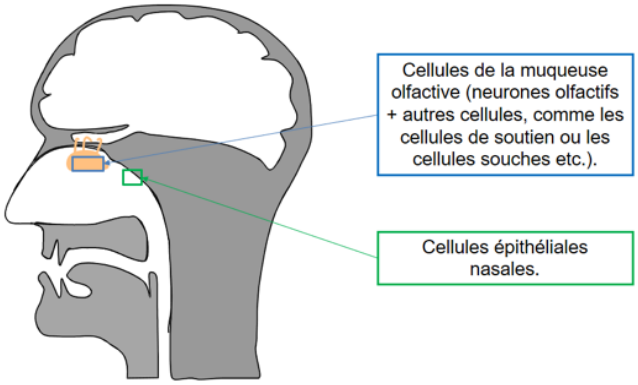

Figure 2. Représentation schématique de la cavité nasale et des zones cibles du COVID-19.

In the case of COVID-19, olfactory neurons without ACE2 and TMPRSS2 receptors – viral entry points to cells – are not altered by it from the outset. However, SARS-CoV-2 entry factors are strongly expressed in other olfactory mucosa cells[5] and nasal epithelial cells[6] (Figure 2).

The causes of olfactory disorders related to COVID-19 have been clearly identified. So, we can assume that the olfactory system is indirectly affected by the inflammation of these tissues, which leads to the occlusion of these narrow olfactory tracts, whilst the lower portion of the nasal cavity, which is less narrow, remains permeable, meaning that respiratory air circulates freely.

Such an obstruction has an impact on the subjects' ability to detect and identify smells by hindering access to receptive cells, the olfactory neurons[7] which are consequently underused.
Exercise protocols need to be adapted to the virus's infection method on the olfactory system. ■

Sophie Tempere[1], *Gilles Sicard*[2], *Gilles de Revel*[1]
1 Univ. Bordeaux, Unité de recherche Œnologie, EA 4577, USC 1366 INRAE, ISVV, 33882 Villenave d'Ornon, France
2 Aix-Marseille Université, CNRS, UMR 7259, Marseille, France

1 Moein S.T., Hashemian S.M.R., Mansourafshar B., Khorram-Tousi A., Tabarsi, P., Doty R.L. (2020). Smell Dysfunction: A Biomarker for COVID-19. *International Forum of Allergy & Rhinology*.
2 Landis B.N. (2007). Les troubles de l'odorat. *Revue Médicale Suisse*, 127, p. 2221-2224.
3 Tempere S., Cuzange E., Malak J., Bougeant J.C., de Revel G., Sicard G. (2011). The training level of experts influences their ability to detect some wine key compounds. *Chemosensory Perception*, 4, 3, pp. 99-115.
4 Parma et al. (2020). More than just smell - COVID-19 is associated with severe impairment of smell, taste, and chemesthesis. MedRxiv.
5 Brann et al. (2020). Non-neuronal expression of SARS-CoV-2 entry genes in the olfactory system suggests mechanisms underlying COVID-19-associated anosmia. BioRxiv.
6 Sungnak et al. (2020). SARS-CoV-2 entry factors are highly expressed in nasal epithelial cells together with innate immune genes. Nature Medecine, Brief communication.
7 Eliezer M, Hautefort C, Hamel A, et al. Sudden and Complete Olfactory Loss Function as a Possible Symptom of COVID-19. JAMA Otolaryngol Head Neck Surg. doi:10.1001/jamaoto.2020.0832