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Annals of Medicine

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/iann20

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To cite this article: M. E. Torres, A. Figueiredo, C. Família, I. M. Costa, D. P. Tavares & A. Quintas (2021) Information System for Tablets Identification (ISTI), Annals of Medicine, 53:sup1, S79-S79, DOI: 10.1080/07853890.2021.1897428

To link to this article: https://doi.org/10.1080/07853890.2021.1897428

Published online: 28 Sep 2021.

Acknowledgements

This study was funded by Cooperativa de Ensino Superior Egas Moniz.

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DOI: 10.1080/07853890.2021.1897427

Information System for Tablets Identification (ISTI)

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ABSTRACT

Introduction: This study aims to develop a software application (App) for the identification of drugs of abuse from visual information retrieved from pills: Information System for Tablets Identification (ISTI). The consumption of anxiolytics and hypnotics, in particular, benzodiazepines (BZD) and similar products, as reached record levels in Portugal, with 10.5 million packages of these products being sold in 2018 [1]. The high prescription of BZD presents a risk to public health [2,3]. An Information system like ISTI will provide an enormous importance on pills' identification at crime scenes (e.g. homicidal attempts) or premeditated intoxications [4,5].

Materials and methods: Tablets from benzodiazepine derivates (ATC codes: N05BA; national pharmacotherapeutic classification: 2.9.1. Anxiolytic, sedatives and hypnotics) were purchased from portuguese pharmacies.

In the database were introduced the commercial name, the active substance name, the dose and also photographs were taken from the front, back and side and several physical characteristics of each pill were determined, namely: shape, surface elevation, logo and imprint description, break line, colour, coating, diameter, thickness, weight, horizontal, vertical and side view.

The ISTI core is an identification algorithm targeted to matching results by score. The application is being prepared in a way that can either be accessed from a computer or from a mobile device. If economically viable, an image search and request by the users algorithm will be included, so that a photo can be an input, in a query which may prove particularly important to field in the future work. Furthermore, the system is being designed to be easily maintained, through a simple backoffice, and if necessary, agreements will be proposed to national regulatory authorities in order to assure that its data is effectively up to date.

Results: The prototype developed application allows us to identify pills that may possibly be lost or out of their original packaging. This identification is made through a wide range of tablet features. The person who wants to identify a pill can access the ISTI and through answers to simple questions can find correspondence with the concerning tablet.

Discussion and conclusions: The purpose of ISTI is to help health technicians, like doctors, nurses and pharmacists, and agents of authority to identify medicines pills which are not inside the original packaging. Although in the USA there are several Apps with the same objective, to the best of the authors knowledge, ISTI is the first App with this purpose in Portugal.

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DOI: 10.1080/07853890.2021.1897428

Saccharomyces cerevisiae as a model to study synthetic cannabinoids: the impact of using different carbon sources

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ABSTRACT

Introduction: Synthetic cannabinoids (SC) are potent agonists of cannabinoid receptors, that mime the psychoactive effect of Δ^9-tetrahydrocannabinol (Δ^9-THC), the principal psychoactive component of cannabis [1]. JWH-018 was the first novel psychoactive SC found in the recreational drug marketplace in 2008. A few years later, JWH-018 started to be controlled by authorities, so alternative molecules started to emerge. THJ-018 was designed to replace JWH-018, having a similar structural skeleton and also a naphthalene and pentyl chain connected *via* a middle core substructure. Eventually, THJ-018 was scheduled and alternatives emerged, such as EG-018 [2]. This practice makes almost impossible to characterise SC toxicological profiles on an acceptable time scale, mostly due to the time-consuming experiments that must be held in animal models or human cells by standard methods. The yeast *Saccharomyces cerevisiae* shares highly conserved molecular and cellular mechanisms with human cells and has been used before for synthetic cathinones [3]. The present work has studied the best carbon source (glucose or galactose) to measure the impact of synthetic cannabinoids on *S. cerevisiae* growth, aiming to develop a method able to profile synthetic cannabinoids toxicity in a short time scale. The difference between carbon sources is that in Crabtree-positive yeast strains, glucose induce a strong inhibition of mitochondrial oxidative phosphorylation [4].

Materials and methods: The effect of EG-018 was evaluated by its impact on *S. cerevisiae* BY4741 (WT) growth on minimal medium with 2% Glucose or 1% Galactose as sole carbon sources, in the presence and absence of the SC, followed at OD_{600nm}. Growth rates at each condition was fitted to a logistic equation.

Results: Figure 1 shows OD_{600max} obtained from the non-linear regression to the logistic equation in the presence of different concentrations of EG-018. While in galactose there is no effect, in 2% Glucose the results points to a growth decrease with EG-018.

Discussion and conclusions: Comparing the two carbon sources, yeast growth on glucose is more susceptible to EG-018. Recent studies points that JWH-018, a similar SC, exerts an effect on glycolytic and pentose phosphate pathway at high concentrations of glucose (personal communication). As yeast growth in galactose proceeds simultaneously *via* respiration and fermentation due to the "Crabtree effect" [4] an impact of EG-018 on glycolysis might be less effective. These results, suggest that glucose is the best carbon source to develop a yeast based toxicity sensor for SC.

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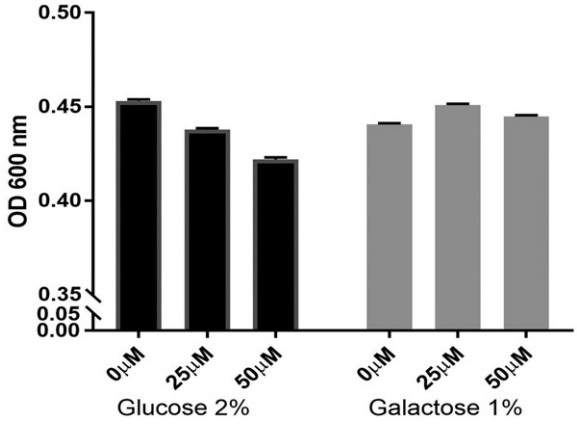

Figure 1. OD_{600max} results in S. cerevisiae BY4741 in the presence of 0, 25 and 50 µM of EG-018 in glucose and galactose.