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Letter to the Editor

Cross-sectional study of diet patterns in early and chronic schizophrenia

One of the most complex comorbidities to treat in schizophrenia is obesity and overweight. This multifactorial condition is estimated to affect over 60% of the patients and is linked to a shorter lifespan. Genetic, developmental, psychopathological, and pharmacological factors associated with obesity have been extensively described in the context of schizophrenia. Some external factors have also been attributed to contribute to weight gain in the disorder. However, diet, which has modifiable characteristics and is probably the major external contributor to obesity, has gained less attention in the field of biology and treatment in schizophrenia. The literature on nutrition in the early phases of the illness is relatively scarce and often inconclusive (Williamson et al., 2015). Diet in chronic schizophrenia has been more consistently described and highlights a diet rich in carbohydrates and saturated fat, and poor in fruit and fibre (Bobes et al., 2008; Heald et al., 2015; Nunes et al., 2014). However, there are no studies, to our knowledge, that have directly compared diet habits between patients in the early and chronic phases of the illness in the same population. This type of information would be valuable to assess the progress of obesity and the main factors responsible for it in schizophrenia.

Thus, we conducted a research to answer three main questions: 1) How healthy is the diet of patients with schizophrenia when compared to the WHO international food consumption recommendations (WHO-IFCR)? 2) are there differences in food intake patterns between patients with a first episode of psychosis (FEP), patients with chronic schizophrenia, and healthy controls? and 3) What is the impact of the illness phase (chronic *vs.* early phase), BMI and medication on food consumption in schizophrenia? For this purpose, we compared diet habits in a group of patients that represented the two extremes of the course of the illness: patients with FEP and treatment resistant schizophrenia (TRS) patients, and a group of healthy controls (HC). We used the Food Frequency Questionnaire (FFQ), a comprehensive diet self-evaluation adapted to local population diet habits that gives information for 58 products, an estimation of total energy intake, and the percentage of food intake against the WHO-IFCR. The study was ethically approved (REC 12/EE/0373 and REC 08/H0308/5).

A total of 84 patients (30 FEP and 54 TRS) and 84 HC participated in the study. Patients with TRS were generally older than patients with FEP and controls and they presented with higher heart rate and BMI. Surprisingly, we found no significant differences in the amount of medication (chlorpromazine equivalents) between patients with FEP and TRS (Table 1 supplement).

The analysis of the three groups compliance with the WHO-IFCR showed that the TRS group had the worst overall compliance rates (24.34%), followed by the FEP group (27.11%), and the HC group had the best compliance rates (41.71%). Compared with HC, patients had worse compliance for fibre, fruits, vegetables, and cholesterol intake. Surprisingly, patients had a better compliance for saturated fat, although all three groups showed very low compliance rates, suggesting this is a global issue, rather than a specific aspect of the illness. We found no differences between the two schizophrenia groups for any of the food recommendations compliance (Fig. 1A).

With regards to specific diet differences between HC and patients with schizophrenia, we observed that the TRS group consumed more non-alcoholic beverages and less alcoholic beverages, vegetables and β-carotene compared to FEP and HC groups. Patients with FEP showed patterns in between TRS and HC for non-alcoholic beverage and β-carotene consumption (Fig. 1B).

Multiple regression models were performed using the four food differences found above (alcoholic beverages, non-alcoholic beverages, vegetables, and β-carotene) and included age, BMI and medication as independent variables. The models confirmed the differences found previously and suggested that the BMI was associated with a decreased consumption of vegetables and an increased consumption of alcoholic beverages. We also found an effect of medication for non-alcoholic beverage consumption. There were no differences in diet attributed to age and, surprisingly, we found no significant differences in total energy intake between the three groups. The lack of difference in the total energy intake between patients and controls indicates that patients, who had higher BMI compared with controls, have low energy expenditure. This may be related to factors commonly found in this population group, such as unemployment, social isolation and antipsychotics induced sedation.

These results confirm that patients with schizophrenia do have a very unhealthy diet in both the early and the chronic phases of the illness. Some of these unhealthy diet habits suggest a progressive worsening over the course of the illness, in particular for the excessive intake of non-alcoholic beverage and the lack of β-carotene intake, with FEP patients showing patterns in between TRS and HC. The non-alcoholic beverages increased intake is directly related to an increase in sugar levels, which may be related to the search for immediate reward, *via* the brain hedonic pathways in the striatum. This hypothesis is supported by a recent report that associate greater increase in reward response in the putamen with greater weight gain in schizophrenia patients (Nielsen et al., 2016). Additionally, our group has shown that clozapine-treated patients with higher BMI had preserved hedonic experiences (Mezquida et al., 2018). Thus, we could speculate that drinking sugary beverages might compensate the limited rewarding experiences patients have. On the other hand, the lack of β-carotene and its antioxidant properties may accelerate oxidative damage associated with the pathophysiology of schizophrenia (Souza and Souza, 2003).

A range of behavioural and nutritional interventions have been effective in reducing weight gain in patients with schizophrenia, but they generally fail to maintain their effectiveness in the long term (Speyer et al., 2016). These findings have important implications for intervention programs, as they may help to find better strategies such as focusing on a healthy diet rather than weight loss. Such strategies would help patients drink less sugary beverages and eat more

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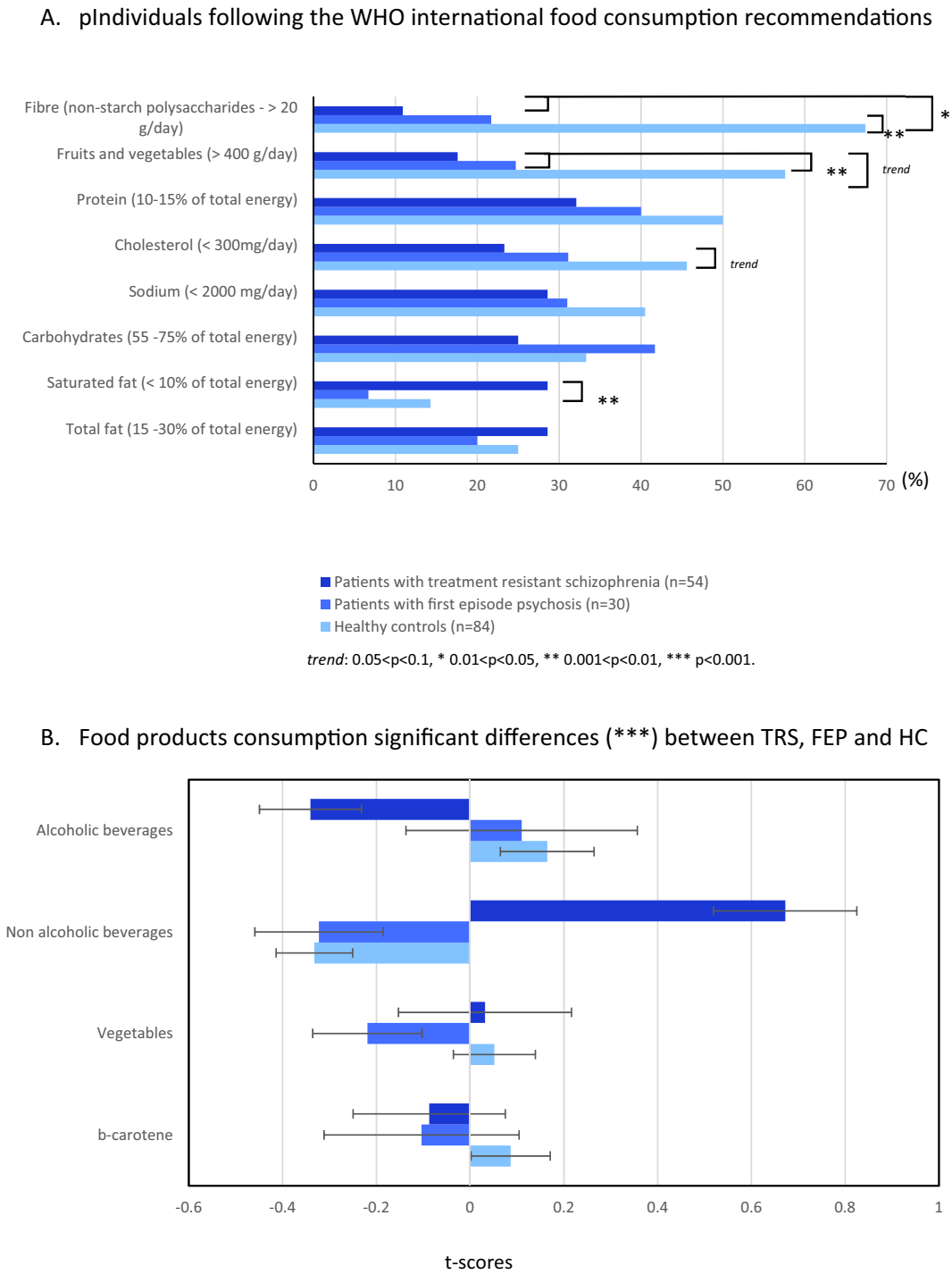

Fig. 1. A. Individuals following the WHO international food consumption recommendations. B. Food products consumption significant differences (***) between TRS, FEP and HC.

vegetables, hence improving their physical, and consequently their mental health. These findings also suggest that because diet changes are observed over the course of the illness, an early preventive intervention should be prioritized.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.schres.2019.03.029.

Conflicts of interest

Linda Scoriels, Jorge Zimbron, Nuria Garcia-Leon, Montse Coll-Negre and Maria Giro have no conflict of interest. Prof. Perez has received honoraria for academic presentations from Eli Lilly, Janssen-Cilag, AstraZeneca, Lundbeck, Otsuka and Bristol-Myers Squibb. He has also taken part in advisory panels for Eli Lilly, Lundbeck, Otsuka and Roche. Prof. Jones has no conflict of interests in this manuscript. Dr. Fernandez-Egea has received consultant fees from Recordati and Angelini.

Contributors

Emilio Fernandez-Egea, Jorge Zimbron, and Peter Brian Jones designed the study and wrote the protocol. Emilio Fernandez-Egea, Jorge Zimbron, Linda Scoriels, Nuria Garcia León, Montse Coll-Negre, and Maria Giro collected the data. Linda Scoriels, Emilio Fernandez-Egea, and Nuria Garcia León undertook the statistical analysis. Linda Scoriels, Emilio Fernandez-Egea, Peter Brian Jones, and Jesus Perez wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

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