Validation of the Spanish version of the multifaceted empathy test: comparison between cannabis use effects and controls in social cognition

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Objective While social cognition is shown to be impaired in several mental disorders, the effects of cannabis on social cognition are still not clear. Past studies have used the multifaceted empathy test (MET) to study social cognition. This study aims to test the validity of the MET Spanish version and to evaluate the effects of cannabis use on social cognition.

Methods In total 116 participants from a Cannabis Social Club (CSC) completed the MET and the reading the mind in the eyes test (RMET) under the effects of cannabis and were compared to 86 university students (control group). Internal consistency and convergent validity were assessed. Cognitive empathy (CE) and emotional empathy (EE) were tested in both groups.

Results The MET CE scale shows low internal consistency, while the EE scale shows high internal consistency. Items showed similar difficulty for both groups. Cannabis users showed deficient overall emotional recognition, with reduced scores associated with positive stimuli. Overall scores for EE were similar for both groups, but the experimental group scored lower with negative stimuli when compared to controls.

Conclusion This study validates the MET Spanish version for its use in future studies. Results confirmed deficient emotional recognition in cannabis users and a dampened reaction to negative stimuli for the first time.
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Introduction

Over the last few decades, changes in policy and public opinion resulted in an increased debate over the medical and recreational use of cannabis. While many studies have researched the potential acute and long-term harmful effects of it (Ford *et al*., 2017), other studies have focused on the therapeutic effects of cannabis (Montero-Oleas *et al*., 2020), causing a notable controversy. The increasing popularity of both recreational and medical cannabis has raised the need to conduct scientific studies on its neurobehavioral and physiological effects.

One of the areas of study that is still significantly underreported (especially considering the increasing use of cannabis for anxiety disorders) is related to the effects of cannabis on social cognition, which is known to be sensitive to drug use as well as to other psychosocial factors. Social cognition refers to the cognitive skills related to social abilities such as recognizing and understanding others' emotions, processing social information and understanding the intentions and thoughts of other people (Green *et al*. 2015; Poulin-Dubois, 2020). Studies investigating this construct have often relied on self-report questionnaires, like the one by Galanter *et al*. (1974), where cannabis users report higher levels of empathy under the acute effects. Interestingly, Vigil *et al*. (2022) found that urine levels of delta-9 tetrahydrocannabinol (THC), which is the main psychoactive compound of the cannabis plant, correlated positively to self-reported measures of empathy, benevolence and fairness. However, other studies found the opposite results. Platt *et al*. (2010) investigated the long-term effects of cannabis use on emotional recognition, finding that cannabis users took longer to identify subtle emotions than nonusers. Also, studies by Hindocha *et al*. (2014, 2015) identified impaired emotional recognition under the

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acute effects of cannabis as well as in chronic cannabis users. In addition, previous studies indicate potential psychological and neurobehavioral differences when processing unpleasant and pleasant stimuli (Lang *et al.*, 1997), and the acute effects of cannabis itself might also exert an additional influence on this. In fact, a study by Bossong *et al.* (2013) used an emotional matching task with subjects under the effects of THC and identified decreased accuracy in negative emotions but not in positive emotions. Since prosocial behaviors are linked to greater physical health, feelings of happiness and greater overall quality of life (Caprara and Steca, 2005), assessing the effects of cannabis on them can provide a better picture of its potential risks and benefits in mood disorders.

The aim of this study was to validate, in a naturalistic context, a Spanish version of the multifaceted empathy test (MET) (Dziobek *et al.*, 2008), which uses complex and realistic emotional stimuli to assess both cognitive empathy (CE) and emotional empathy (EE). We assessed the convergent validity of the MET using the reading the mind in the eyes test (RMET) (Baron-Cohen *et al.*, 2001), a widely used and validated test measuring emotional recognition. We expected that the RMET showed a moderate to high correlation with the CE subscale of the MET but not with the EE subscale. In addition, we used the MET to investigate the effects of cannabis in social cognition. We expected that the division of the MET into cognitive and emotional subscales was useful to determine if the acute effects of cannabis impair emotional recognition, as demonstrated by Platt *et al.* (2010) and Hindocha *et al.* (2015). Furthermore, we investigated differential processing for negative and positive images under the acute effects of cannabis.

Methods

This article is the second publication of a larger naturalistic study published in this journal. More detailed methodology, as well as results from other tests, can be found in Sainz-Cort *et al.* (2023).

Study design

We designed a validation study for the MET using the RMET to assess convergent validity in an experimental group and in a control group. The experimental group included cannabis users under the acute effects of cannabis. The control group included participants who were not regular cannabis users and were not under the influence of cannabis. An additional between-group comparison study was designed to compare the scores of MET between cannabis users under the acute effects of cannabis and a group of noncannabis users.

Participants

Several cannabis social clubs (CSCs) from Barcelona (Spain) were called to participate in this study to evaluate the psychological effects of the use of cannabis in a naturalistic setting. After receiving their acceptance, we scheduled a visit with each of the CSCs to run the study. On the day of the study, members of the CSC who were going to smoke their own cannabis at the CSC were informed about the study, and they were called to participate. A total of 116 members from the CSCs were recruited for the experimental group in a total of five CSCs. After providing their informed consent, participants completed sociodemographic data. Once they reported to be under the effects of cannabis they completed a visual analog scale (VAS), a series of questionnaires about the psychological effects of cannabis, and then the RMET and the MET using a laptop. The description of the questionnaires and their validation results can be found in Sainz-Cort *et al.* (2023).

Students from the Universitat Rovira i Virgili were called to participate in the study for the control group. A total of 86 students were recruited for this group. After providing informed consent, participants completed the MET and RMET on a laptop in the research laboratory at the Universitat Rovira i Virgili.

The inclusion criteria for the experimental group (regular cannabis users) included: (1) being under the acute effects of cannabis and (2) frequent cannabis use (minimum use of 3 days per week). Exclusion criteria included (1) being under the influence of other drugs or alcohol and (2) having a current diagnosis of neurological or psychiatric disorder. The inclusion criteria for the control group (nonregular cannabis users) included: (1) not using cannabis more than once per week. Exclusion criteria included: (1) being under the effects of cannabis, alcohol or other drugs during the study and (2) having a current diagnosis of neurological or psychiatric disorder. The information used for the inclusion and exclusion criteria was based on participant reports. All participants signed the informed consent before participation. The Research Ethical Committee of the Universitat Oberta de Catalunya approved all the study procedures and the study was completed in accordance with Helsinki Declaration.

Measures

Sociodemographic questionnaire

A sociodemographic questionnaire was provided for all the participants of the study, including questions about age, gender, marital status, place of residence, education level, past or current health issues and history of use of cannabis and other drugs.

Visual analog scale

The VAS used for this study was a Spanish version of the VAS designed by Kleinloog *et al.* (2014), which has been validated with psychometric tools to measure subjective cannabis effects. This VAS contains 12 items divided into four subscales: perception, relaxation, dysphoria and appetite. A 100 mm line is presented to the subjects along with a word describing their subjective feeling (e.g. 'High'). Subjects are instructed to mark with an 'X' the location on the line that best represents their current feeling. For this study and to determine that the experimental group is under the effects of cannabis, only the item High will be reported.

Multifaceted empathy test

The MET was developed by Dziobek *et al.* (2008) in German language and translated to English by (Foell *et al.*, 2018) and to Brazilian Portuguese by (Lima *et al.*, 2023). Professor Isabel Dziobek kindly donated the English version for this study. MET is a computer-based test and has two subscales; CE and EE. Each subscale shows 20 positive (CE+ and EE+) and 20 negative stimuli (CE− and EE−) pictures. The CE subscale asks which emotion is related to each picture among four possible options. Participants have to use the computer keyboard to press the number associated with the option they consider correct. The scoring of CE subscales corresponds to the percentage of correct responses, ranging from 0 (all answers were wrong) to 1 (all answers were correct). The EE subscale asks for the engagement of the participant with the emotion they perceive in the picture, from 0 (no engagement) to 9 (full engagement). Participants have to use the computer keyboard to press one key from 0 to 9 to indicate their engagement. MET has been previously used to evaluate the effects of drugs in prosocial behavior (Hysek *et al.*, 2014). The test was translated into Spanish for this study using the back translation technique (Douglas and Craig, 2007). A laptop with E-Prime software was used to run the MET.

Reading the mind in the eyes test

The RMET was first developed by Baron-Cohen *et al.* (2001) to assess the theory of mind abilities, although since then this has been revised to specifically measure emotional recognition abilities. The test consists of 37 images showing people's eyes depicting an emotional state. Participants are asked to choose from four different emotions that best represent each item. A laptop with the Spanish version of the RMET was used to evaluate the participants of the study. This test has been extensively used in previous experiments and has been translated to several languages, showing adequate reliability and psychometric properties (Redondo and Herrero-Fernández, 2018). Since RMET is a well-established measure of empathy, it was included in our study to assess convergent validity with the MET.

Statistical analysis

All statistical analyses were performed using R software (R Core Team, 2020). Data was first analyzed for normality using the Shapiro-Wilk test, including sociodemographic data, MET and RMET results. All data was non-normal. Mann–Whitney tests were then conducted to test for differences between demographic variables in our samples.

To evaluate the validity and reliability of the newly translated MET items, several measures were calculated. First, item-total correlations were reported, following Streiner *et al.* (2015) correlation magnitudes: low (0–0.25), moderate (0.26–0.5), strong (0.51–0.7) and very strong (over 0.7). Item difficulty was also calculated and reported. As additional measures of internal consistency, both Cronbach's alpha (α) and the greatest-lowest-bound (glb) estimate are included. Following Cortina (1993) recommendations, a score of 0.6 and above was considered adequate. The glb has been shown to be a better measure of reliability than Cronbach's alpha due to the latter's vulnerability to violated assumptions (Trizano-Hermosilla and Alvarado, 2016). As the sample size in this study is under 500, factor-based glb was used instead of algebraic glb.

Spearman correlations were calculated to assess the convergent validity of the MET (including both CE and EE subscales) and RMET scores. Additionally, tetrachoric correlations were also assessed between the CE subscale of the MET and the RMET, as items in both of these tests are measured in a dichotomous scale. These correlations were only calculated for the results of the control group due to problems encountered in the codification of subjects belonging to the experimental group. Participant IDs for MET scores were not paired with RMET scores, so we were unable to conduct this correlation analysis with the experimental group.

Finally, to assess group differences between the experimental group and the control group in the MET, two-way analysis of variance (ANOVA) was conducted for both the CE scale and the EE scale. Tukey test was included as a post hoc measure. All Tukey test graphs were obtained using the statistical software Jamovi (The Jamovi project, 2021). Mann–Whitney test was used to test for differences between the RMET scores for the experimental and the control groups. In addition, the paired samples Wilcoxon test was used to test for in-group differences between RMET and MET CE scores for the control group. Mann–Whitney U test was used for the experimental group due to the aforementioned issue with participants' IDs. All analyses were two-tailed, and the alpha level was set at $P < 0.05$.

Results

Participants

From the 116 participants recruited from the CSCs, a total of 101 completed the MET, 92 completed the VAS High and 77 completed the RMET. No participants were excluded due to neurological or psychiatric diagnosis. Eighty-seven participants were recruited for the control group, with one dropout during the process, resulting in

86 complete questionnaires for the RMET and MET. None were excluded due to cannabis consumption or neurological or psychiatric disorders. Relevant sociodemographic and cannabis use information is shown in Table 1.

There was a significant difference in age between the experimental group and the control group (U = 6476.5; P < 0.001). There was also a significant difference in education level between the groups (U = 1172.5; P < 0.001). Finally, there was a significant difference in gender between the experimental group and the control group (U = 3315, P < 0.001).

Scale validity, reliability and correlations

Item difficulty, item-total correlation and alpha without item can be found in Table 2 (control group) and Table 3 (experimental group). Item difficulty for the control group ranged from 0.128 to 0.988, with a mean of 0.55. For the experimental group, item difficulty ranged from 0.059 to 0.96, with a mean of 0.57. Most of the items followed a similar pattern of difficulty when comparing the experimental group to the controls, with the exception of item 3, which was harder for the experimental group. Item-total correlation scores were very low for the CE subscale of the MET in both groups.

Cronbach's alpha for the CE subscale of the MET was very low (0.25); α was re-calculated after deleting all items, and reliability increased by 0.2 (items 6, 19, 23, 29, 32, 38 and 40). The resulting α was still inadequate (0.44), but further item deletion would result in an extremely shortened scale, which could negatively influence reliability (Nunnally and Bernstein, 1994). The factor-based glb estimate, which controls for variations in the accuracy of items within a test, resulted in a better reliability estimate (0.65). The EE subscale of the MET obtained a high Cronbach's alpha (0.94) and glb estimate (0.98).

Cronbach's alpha for the CE subscale of the MET with the experimental group was 0.5. The glb obtained was 0.76, showing adequate reliability. As with the control group, the EE subscale of the MET obtained good reliability results, with α at 0.95 and glb at 0.98.

Table 1 **Sociodemographic data and visual analog scale High**

	Experimental (N = 101)	Control (N = 86)
Age (SD)	26.57 (7.38)	22.37 (7.57)
Gender (% male)	88.57	15.12
Studies (% high school degree)	60%	100%
Frequency of cannabis use (%)		
Every day	91	–
More than once per week	7	–
Several times per month	2	–
Grams consumed per day (SD)	1.26 (0.94)	–
VAS High (SD)	5.46 (2.32)	–

Only two participants from the control group reported ever using cannabis, and these did not report frequent use. The remaining participants from the control group reported never having used cannabis.
VAS, visual analog scale.

Convergent analysis with reading the mind in the eyes test

No correlation was found between the MET EE subscale and RMET [r(84) = 0.06; P = 0.6], nor between the MET CE and EE subscales [r(84) = −0.002; P = 0.9]. Only a weak positive correlation was found between the MET CE subscale and RMET, r(84) = 0.33; P = 0.002. A tetrachoric correlation yielded a much higher result (ρ = 0.92).

Group comparisons and ANOVA

Descriptive data for the MET and RMET scores can be found in Table 4.

RMET scores were lower for the experimental group than for the control group (U = 2365.5; P = 0.0016). Additionally, using the Mann–Whitney U (for the experimental group) and the paired samples Wilcoxon test (for the control group), both groups obtained significantly lower overall scores in the MET CE subscale when compared to the RMET (experimental; U = 5779; P = 2.772e-8; control; Z = 3501; P = 2.28e-13).

MET CE scores were lower for the experimental group than for the control group [F(1370) = 17.5; P < 0.001]. Also, accuracy for positive images was higher than for negative images in both the experimental and control groups [F(1370) = 48.64; P < 0.001]. However, the experimental group showed lower accuracy for positive images than the control group [F(1370) = 4.69; P = 0.031]. No significant difference was found for negative images. Figure 1 presents these results through estimated marginal means.

In the case of the MET EE scores, there were no significant differences between groups [F(1370) = 2.48; P = 0.12]. However, MET EE scores were significantly lower for negative images than for positive images in the experimental group [F(1370) = 7.79; P = 0.005], while there were no significant differences in the control group. Also, the scores of negative images were lower for the experimental group than for the control group [F(1370) = 24.47; P < 0.001], while there were no significant differences between both groups for the scores of positive images. Figure 2 presents these results through estimated marginal means.

Discussion

The aim of this study was to validate the Spanish version of the MET by studying its internal consistency and using the RMET for convergent validity in two groups of participants: cannabis users under the acute effects of cannabis and a control group. We hypothesized that only the MET CE, and not the MET EE, would show a correlation with RMET. In addition, we tested the effects of cannabis use on empathy using the MET. We hypothesized that the experimental group would score lower than the control group for the MET CE and the RMET.

Table 2 Item difficulty, item-total correlation and Cronbach's alpha without item for cognitive empathy and emotional empathy subscales of the multifaceted empathy test—control group

Controls (*N* = 86)			Cognitive empathy		Emotional empathy	
Item	Valence	Item difficulty	Item total	Alpha without	Item total	Alpha without
1	P	0.244	0.16	0.21	0.48	0.94
2	P	0.826	−0.06	0.26	0.53	0.94
3	N	0.895	−0.07	0.26	0.64	0.94
4	P	0.930	0.06	0.24	0.53	0.94
5	P	0.744	−0.06	0.26	0.34	0.94
6	N	0.174	−0.1	0.27	0.63	0.94
7	P	0.988	−0.07	0.25	0.46	0.94
8	N	0.942	0.06	0.24	0.68	0.94
9	P	0.942	0.15	0.23	0.64	0.94
10	P	0.919	0.02	0.24	0.41	0.94
11	P	0.872	0.16	0.22	0.51	0.94
12	N	0.407	0.03	0.24	0.52	0.94
13	N	0.837	0.03	0.24	0.55	0.94
14	P	0.407	0.16	0.21	0.5	0.94
15	P	0.919	0.05	0.24	0.45	0.94
16	N	0.791	0.18	0.21	0.65	0.94
17	N	0.5	0.24	0.19	0.54	0.94
18	N	0.151	0.11	0.23	0.68	0.94
19	P	0.593	−0.08	0.27	0.39	0.94
20	N	0.547	0.07	0.23	0.63	0.94
21	P	0.314	0.01	0.25	0.48	0.94
22	N	0.919	0.004	0.25	0.63	0.94
23	P	0.140	−0.15	0.28	0.37	0.94
24	P	0.767	−0.004	0.25	0.32	0.94
25	P	0.291	0.12	0.22	0.48	0.94
26	N	0.419	0.23	0.19	0.65	0.94
27	P	0.477	0.29	0.17	0.36	0.94
28	N	0.477	0.04	0.24	0.42	0.94
29	N	0.605	−0.08	0.27	0.62	0.94
30	N	0.977	0.2	0.23	0.54	0.94
31	P	0.884	−0.01	0.25	0.54	0.94
32	P	0.837	−0.11	0.27	0.5	0.94
33	N	0.57	0.07	0.23	0.63	0.94
34	N	0.663	0.01	0.25	0.62	0.94
35	N	0.558	0.17	0.21	0.68	0.94
36	P	0.756	0.05	0.24	0.41	0.94
37	N	0.244	0.13	0.22	0.57	0.94
38	P	0.837	−0.11	0.27	0.51	0.94
39	N	0.128	−0.04	0.26	0.60	0.94
40	*N*	0.744	−0.15	0.28	0.38	0.94

Item difficulty ranges from 0 to 1, with higher scores representing an easier item, and vice versa.
N, negative valence; P, positive valence.

When evaluating the internal consistency of the MET, Cronbach's alpha, item-total correlations and the glb estimate were used. The latter has been found to be a better estimate of reliability when both tau-equivalence and normality are violated (Chakraborty, 2020). Cronbach's alpha revealed low internal consistency for the MET CE subscale for both the experimental and control groups, although the control group showed much lower reliability (0.25 vs. 0.5). Item-total correlations were also in the low range for most items for both groups. This might indicate that several items showed inconsistent results in relation to the average behavior of other items, thus affecting reliability (Churchill, 1979). However, there have been highly divergent results in previous studies evaluating internal consistency in the MET CE subscale. The studies from Dziobek *et al.* (2008) and Lemme (2012) showed satisfactory results, while Foell *et al.* (2018) and Müller (2021) showed low results. Müller (2021) suggested that low reliability is due to the dichotomous nature of the scale, while Foell *et al.* (2018) refer to a possible ceiling effect restricting inter-individual accuracy. The use of the glb estimate yielded much higher results, suggesting that reliability scores might lie somewhere in between the two estimates. Finally, item difficulty was also reported, showing similar patterns in accuracy for both groups. The only exception to this was item 3, which is a negative valence image and showed drastically opposite results for the two groups. However, as this pattern was not identified for any other items, this was not explored any further. Regarding the internal consistency of the MET EE subscale, results for Cronbach's alpha and the glb estimate were good for both the experimental and control groups (alpha was 0.95 and 0.94, respectively). This is consistent with the results in the studies previously mentioned, all of which obtained alpha's above 0.90 for the MET EE subscale. Item-total correlation was also moderate to high for most of the items in both groups, showing consistency in empathy ratings.

The RMET was included to assess the convergent validity of the MET CE subscale, as both tasks require the

Table 3 Item difficulty, item-total correlation and Cronbach's alpha without item for cognitive empathy and emotional empathy subscales of the multifaceted empathy test–experimental group

Experimental group (*N* = 101)			Cognitive empathy		Emotional empathy	
Item	Valence	Item difficulty	Item total	Alpha without	Item total	Alpha without
1	P	0.248	–0.087	0.52	0.43	0.95
2	P	0.644	0.03	0.51	0.53	0.95
3	N	0.188	0.23	0.48	0.67	0.95
4	P	0.851	0.19	0.49	0.25	0.95
5	P	0.703	0.12	0.49	0.48	0.95
6	N	0.059	0.02	0.5	0.74	0.95
7	P	0.891	0.15	0.49	0.43	0.95
8	N	0.802	0.08	0.5	0.63	0.95
9	P	0.861	0.21	0.49	0.35	0.95
10	P	0.871	0.02	0.5	0.51	0.95
11	P	0.832	0.16	0.49	0.2	0.95
12	N	0.396	–0.1	0.52	0.65	0.95
13	N	0.842	0.06	0.5	0.74	0.95
14	P	0.426	0.11	0.5	0.42	0.95
15	P	0.733	0.28	0.47	0.48	0.95
16	N	0.772	0.29	0.47	0.72	0.95
17	N	0.584	0.06	0.5	0.64	0.95
18	N	0.129	–0.002	0.5	0.69	0.95
19	P	0.505	0.17	0.49	0.41	0.95
20	N	0 594	0.03	0.5	0.75	0.95
21	P	0.356	0.26	0.48	0.3	0.95
22	N	0.772	0.14	0.49	0.65	0.95
23	P	0.198	0.03	0.5	0.29	0.95
24	P	0.673	0.29	0.47	0.51	0.95
25	P	0.208	–0.03	0.51	0.37	0.95
26	N	0.416	0.18	0.49	0.6	0.95
27	P	0.485	0.06	0.5	0.44	0.95
28	N	0.485	–0.06	0.52	0.64	0.95
29	N	0.614	0.07	0.5	0.66	0.95
30	N	0.96	0.32	0.49	0.64	0.95
31	P	0.713	0.34	0.47	0.3	0.95
32	P	0.653	0.21	0.48	0.47	0.95
33	N	0.703	0.28	0.47	0.52	0.95
34	N	0.663	0.39	0.46	0.72	0.95
35	N	0.554	–0.1	0.52	0.64	0.95
36	P	0.624	0.2	0.48	0.5	0.95
37	N	0.218	0.08	0.5	0.75	0.95
38	P	0.752	0.08	0.5	0.7	0.95
39	N	0.168	–0.1	0.52	0.72	0.95
40	N	0.535	–0.004	0.51	0.59	0.95

N, negative valence; P, positive valence.

Table 4 Mean and SD for multifaceted empathy test and reading the mind in the eyes test scores

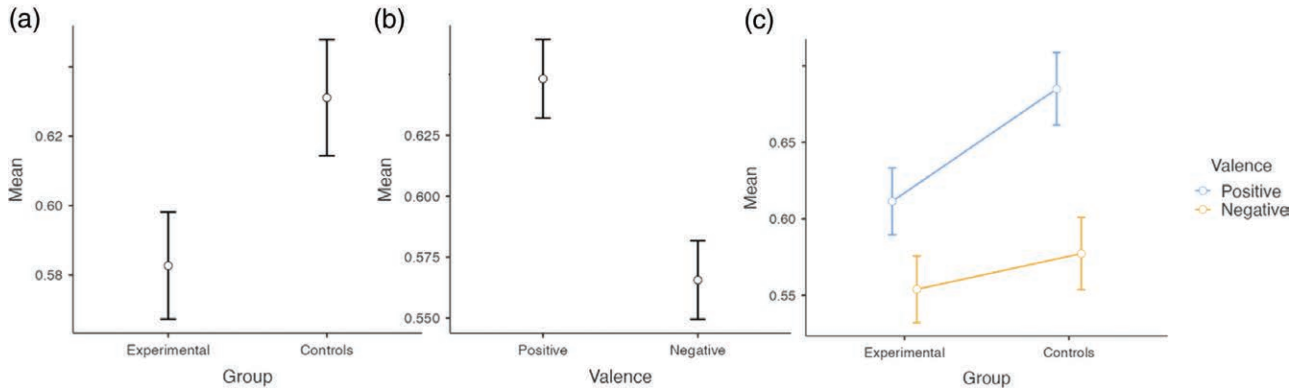
	Experimental group (*N* = 101)	Control group (*N* = 86)
	Mean (SD)	Mean (SD)
MET CE	0.58 (0.1)	0.63 (0.07)
MET CE(+)	0.61 (0.13)	0.68 (0.09)
MET CE(–)	0.55 (0.11)	0.58 (0.1)
MET EE	5.31 (1.35)	5.57 (1.28)
MET EE(+)	5.92 (1.27)	5.36 (1.4)
MET EE(–)	4.7 (1.94)	5.78 (1.71)
RMET (*N* = 77)	0.67 (0.14)	0.74 (0.09)

(+), positive valence images only; (–), negative valence images only; CE, cognitive empathy scale; EE, emotional empathy scale; MET, multifaceted empathy test; RMET, reading the mind in the eyes test.

participants to identify an emotion shown through a photo-realistic image. Spearman correlation analysis showed a weak positive correlation between these scales (.33) for the control group, although tetrachoric correlation analysis resulted in a much higher correlation (.92). The weak result obtained using Spearman correlation is probably due to the dichotomous nature of the scales, but it might also be due to high individual variability in response accuracy between the MET CE subscale and the RMET, with higher overall scores obtained in the RMET. RMET images only show the eyes, while the MET images are more varied and show contextual clues, which could be the reason for differences in the range of scores. It would be beneficial to have expert and consensus ratings to review MET items and ensure the target words selected are adequate and culturally appropriate in future studies (Lyusin and Ovsyannikova, 2016). As expected, there was no correlation between the MET CE and EE subscales or between the MET EE and RMET, which supports the differentiation of empathy into its cognitive and emotional factors.

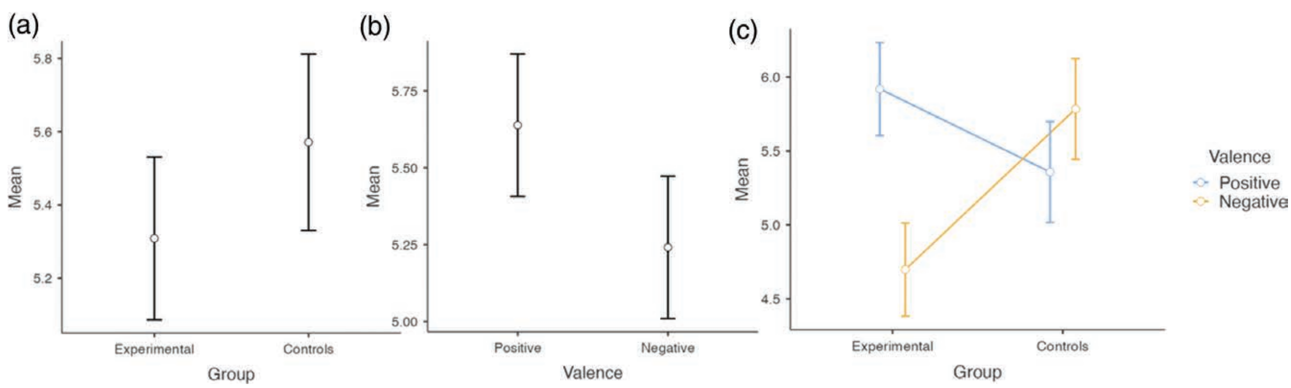
Regarding the effects of cannabis use in empathy scales, MET CE scores were significantly lower for the experimental group when compared to the control group. According to our expectations, the RMET showed similar results, indicating that the effects of cannabis use impair CE. Since cannabis users were only tested under the acute effects of cannabis without any baseline data, we are unable to conclude that our results are due to

Fig. 1



Estimated marginal mean for group (a), Valence (b) and interaction (c) for the CE subscale of the MET. Note. Error bars: 95% CI. CE, cognitive empathy; MET, multifaceted empathy test.

Fig. 2



Estimated marginal mean for the group (a), Valence (b), and (c) for the EE subscale of the MET. Note. Error bars: 95% CI. EE, emotional empathy; MET, multifaceted empathy test.

the acute effects of cannabis, to their chronic use or a combination of both. In any case, these results would be in line with previous literature of chronic users, where Platt *et al.* (2010) showed decreased emotional recognition for subtle emotions in heavy cannabis users. In addition, Hindocha *et al.* (2014) follow-up study showed decreased emotional recognition for all emotions despite their intensity levels. Regarding the acute effects of cannabis, a recent study published by our group (Sainz-Cort *et al.*, 2022) found a trend of acute THC effects impairing MET CE scores compared to placebo, but our sample size was much lower (n = 18), which might explain why we did not find statistically significant differences. An impairment in emotion recognition was also reported in people with cannabis use disorder during abstinence (Bayrakçı *et al.*, 2015), suggesting either the long-term effects of chronic cannabis use or the presence of these impairments before the start of cannabis use. Following this approach, some authors suggested that the deficiencies in emotion regulation could represent a risk factor for cannabis abuse (Zimmermann *et al.*, 2017). Remarkably, a recently published systematic review of clinical trials could not report conclusive evidence on the effects of THC or Cannabidiol (CBD) on facial emotion recognition (Rossi *et al.*, 2020). Poor emotional recognition is also likely to be related to the cognitive deficits caused by the acute effects of cannabis, such as decreased attention span and working memory capacity (Crane *et al.*, 2013a,b), as the cognitive decline has been linked to worsened emotional recognition (Virtanen *et al.*, 2017). However, this link should be further studied with long-term heavy cannabis users, as long-term cognitive deficits seem to partially differ from acute effects and are usually improved after periods of abstinence (Kroon *et al.*, 2021).

Interestingly, when we studied the effects of cannabis use, taking into account the positive and negative valence of the images presented in the MET CE, the experimental group only` showed decreased accuracy for positive images when compared to the control group. These results are in contrast to the findings of Bossong *et al*. (2013) or Bayrakçı *et al*. (2015) since both studies found decreased accuracy for negative images. This might be due to the nature of the task employed, as their studies involved an emotional matching task while we used an emotional recognition task. It is also important to note that both studies identified decreased accuracy for fearful and angry faces (threatening stimuli), while our study included a larger range of negative emotions, many involving sadness. Ballard *et al*. (2012) study also investigated the effects of THC on an emotional recognition task performance and found decreased accuracy for threatening stimuli but not for happy or sad faces, while Hindocha *et al*. (2014) found a deficit for all the emotions measured, with the exception of surprise.

In the case of the MET EE, we did not find differences between groups, which support previous findings on the effects of cannabis use in EE (Ballard *et al*., 2012; Sainz-Cort *et al*., 2022). However, we found that the experimental group rated the negative images lower than the control group, and the control group rated negative images higher than the positive ones. This dampened reaction to negative images in the experimental group might be a direct effect of the effects of cannabis use, perhaps due to an aversion towards negative stimuli. In the studies of Ballard *et al*. (2012) and Sainz-Cort *et al*. (2022), there were no differences in the emotional rating of images across valence or arousal. However, sample sizes were smaller in both studies, and results were not compared to a control group. No other studies have investigated EE under the effects of cannabis, although previous neuroimaging studies have identified several differences in the activity of certain brain regions between consumers and controls, such as decreased amygdala activity during emotional perception of fearful stimuli, and increased activity for nonthreatening signals (Phan *et al*., 2008).

We believe that the distinction between emotional and CE is useful for analyzing the full impact of cannabis use on empathy. Past studies have focused mainly on emotional recognition tasks, as impairments in this ability can impair interpersonal relationships (Carton et al., 1999). Specifically, CE enables people to understand and predict the behavior of third persons (Smith, 2006), thereby facilitating their choices and conversations in response when engaging in social interactions. However, emotional arousal or reactivity to third-person emotions is also a vital part of social cognition and empathy. EE seems to be vital in the development of strong bonds between groups, thus creating increased in-group loyalty and cohesion (Smith, 2006). These factors are strongly linked to both group performance and happiness (Evans and Dion, 2012). It should be noted that the acute effects of cannabis on empathy could diverge from the mid- to long-term effects of cannabis use. Thus, collecting information regarding the acute effects, as it was performed in this study, restricts the discussion about acute and chronic cannabis use effects. Further studies should complement this information, including data obtained from large samples of chronic cannabis users.

Among the limitations of this study, it is worth mentioning that for the validation of the MET, both sample populations were relatively small (around 100 participants in each group), while common statistical advice recommends a minimum sample of 300–400 participants to adequately assess the reliability (Nunnally and Bernstein, 1994; Charter, 1999). The implementation of a computerized and online version of the MET would be useful in future studies, as a larger sample of participants could be collected to conduct adequate analysis for validation. Another limitation of the MET's validation is that it displays pictures of people showing different emotions, and cultural differences might influence the interpretation of these emotions. This can be especially relevant if the Spanish version of the MET is used in Latin American Spanish-speaking populations. Further studies should validate the MET in other Spanish-speaking populations to account for potential cultural differences in emotion interpretation. In the case of the study assessing the effects of cannabis use on empathy scales, one of the limitations was the lack of baseline data in the experimental group, and the results cannot be directly attributed to the acute effects of cannabis when compared to a control group. Also, potential confounding factors in CE, such as individual differences in personal life experiences, are not taken into account due to methodological limitations. Further studies should compare social cognition variables between regular cannabis users under both cannabis and placebo conditions, or at least take baseline data before cannabis use. Another limitation is the sample representation. To obtain naturalistic data outside of a laboratory, the experimental group was recruited from a CSC, while the control group was recruited from a university. Hence, there were differences in various sociodemographic variables between the two groups, such as gender, education level and age. These differences might be relevant, as previous studies found gender differences in event-related potential (ERPs) for emotional processing tasks under the effects of cannabis (Troup *et al*., 2019) and also in neurocognitive effects related to memory and decision-making tasks (Crane *et al*., 2013a,b). Additionally, due to the naturalistic/observational design of this study, participants were using their own cannabis, and we did not have the possibility to both analyze the exact cannabinoid content of their products and quantify cannabinoid levels in participant physiological samples (such as blood). This might be relevant as the ratios of THC and CBD seem to have an impact on subjective effects and emotional recognition (Sainz-Cort *et al*., 2021, 2022). It would be interesting if future studies were able to control cannabis content and dosage. Also, to adequately assess empathy in cannabis users, future studies should include the distinction between positive and negative stimuli, or even a full classification of the emotions related to each stimuli. Since mood disorders such as depression may induce a bias toward negative emotions (Zuroff and Colussy, 1986), specific screening measurements should also be included in these types of studies.

Conclusions

This study has translated into the Spanish language and validated the MET in a Spanish population. We found that the internal consistency of the new Spanish version of the MET was lower for the CE subscale than for the EE subscale, but enough to be considered reliable. As expected, we found a correlation between the RMET and the MET CE, indicating that both scales measure CE. The distinction between CE and EE facilitated by the MET, as well as the classification of emotional valence, are highly useful in the study of empathy. We found important differences in CE and EE in cannabis users. The CE empathy impairment related to cannabis use might be relevant for cannabis users and should be further investigated, as it is not clear if this impairment is chronic or only under the acute effects of cannabis. Also, it might have an impact on other commonly reported symptoms of cannabis use such as anxiety and paranoia (Crane *et al*., 2013a,b), and other psychological conditions related to social cognition. Meanwhile, we found for the first time that the EE of negative stimuli was impaired in cannabis users. However, we do not know if cannabis use would have the same effect on nonsmokers or if the baseline levels of EE were already lower. Ultimately, these results should be considered when using cannabis for medical purposes, as this could have an impact on mental health. Future studies should investigate these results and also reassess the validity of the Spanish language version of the MET in a larger population. The new validated Spanish version of the MET is available, upon request to the corresponding author, to anyone who needs to use it for further studies.

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Conflicts of interest

There are no conflicts of interest.

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