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Association between cognitive impairments and dissociation: a PRISMA systematic review

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Abstract

Introduction: It has been suggested for a long time that dissociation creates cognitive difficulties. However, the relationship between dissociation and cognitive abilities is unclear as many incongruent results have been identified among the literature. Therefore, the aim of this study is to evaluate the relationship between cognitive functioning and dissociative manifestations, and to distinguish the results based on the method used.

Method: We performed a PRISMA systematic review with one key word related to cognitive functioning and one key word related to dissociation. The extracted study characteristics included: being an empirical study, containing at least one keyword from each category within the title, and assessing the relationship between cognitive functioning and dissociative manifestations. The research was performed with EMBASE, Pubmed and PsycInfo.

Results: 60 studies were included in the systematic review. We found highly congruent results among studies that used self-report measures of cognition, and poorly congruent results in studies that used cognitive tasks. We identified the use of emotional material and the use of inductive procedures all as potential explanations for the incongruence.

Conclusions: Even though the relationship between dissociation and cognitive complaints is now clearly established, the association between dissociation and cognitive tasks remains unclear. Further studies focusing on emotional tasks or inductive methods should be performed.

Keywords: dissociation; PRISMA; systematic review; cognitive abilities; psychopathology

1. Introduction

Dissociation is defined as a “disruption of the usually integrated functions of consciousness, memory, identity, or perception of the environment” (American Psychiatric Association, 2013). Dissociation is present in multiple psychiatric disorders such as dissociative disorders, PostTraumatic Stress Disorder (PTSD) or anxiety disorders (Bernstein & Putnam, 1986).

A cognitive behavioral conceptualization for dissociation has recently been put forward (Vancappel & El-Hage, 2023). In this model, the authors suggested five factors which are key within the field of dissociation, namely beliefs about emotions, beliefs about dissociation, difficulties in emotion regulation, mindfulness skills and attentional control. However, the authors highlighted an imbalance between the level of proof related to the different factors. Specifically, they mentioned that the findings regarding attentional control were inconsistent. Indeed, multiple research has been performed on the cognitive impairments related to dissociation, among the general population (e.g. de Ruiter et al., 2004), among PTSD patients (e.g. Fani et al., 2018) and among patients suffering from dissociative disorders (e.g. Adler et al., 2014). Studies have used questionnaires (e.g. Ozdemir et al., 2015) and/or cognitive tasks (e.g. Elzinga et al., 2000). The results of the studies are controversial. Some results indicated a positive association between dissociation and cognitive impairments (e.g. Brewin et al., 2013), others demonstrated a negative association (e.g. de Ruiter et al., 2004), while others did not find any relationships at all (e.g. Brandes et al., 2002) or indeed, mixed results (e.g. Fani et al., 2018). One particular review suggested that the difference in the results may be partly due to the sporadic characteristics of dissociation (McKinnon et al., 2016). Indeed, dissociation is a transient phenomenon; therefore, it is reasonable to believe that its effect on cognitive functions may also be transient. This in turn means that if participants or patients do not present with dissociative symptoms during the cognitive task, the task may not detect any cognitive impairments. Consequently, this would suggest that studies which do not use dissociative induction may not be able to track the cognitive disruption because dissociation was not present during the evaluation. Vancappel and El-Hage (2023) explored this further and proposed a double relationship between attentional impairments and dissociation. Firstly, latent attentional control may be predictive of dissociative reactions. In that sense, patients would need cognitive resources to counteract these dissociative reactions when they occur. Secondly, when dissociation occurs, it may momentarily disrupt attention. This could alter daily functioning, thus creating anticipatory anxiety that consequently reinforces the apparition of dissociation. For instance, a patient who presents dissociative symptoms because they have just seen

someone that looks like their aggressor at work, may not be able to focus on their task. This is congruent with previous works which found an association between dissociation and altered daily functioning (Boyd et al., 2018, 2020) and other studies which highlighted the mediating role of cognitive impairments between psychiatric symptoms and altered daily functioning in other mental disorders (Brewster et al., 2017; McIntyre et al., 2013).

Up to now, no systematic review using gold standard criteria has been performed on the relationship between dissociation and cognitive functioning. Therefore, the aim of this study is to perform such an analysis. The systematic review will include studies performed among the general and psychiatric population that measure cognitive functioning and dissociation. This analysis will help us (i) to identify existing conclusions regarding the relationships between dissociation and cognitive performance and (ii) to distinguish the results based on the method used.

2. Method

Search strategy

This review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Guidances (Moher et al., 2009)) reporting guidelines to ensure the transparent and complete reporting of systematic reviews. Three online databases were searched : EMBASE, Pubmed and PsycInfo. We used two categories of key search terms. The first category was related to cognitive functioning and included the key words: “cognitive” “cognition” “executive function” “executive control” “memory” “working memory” “executive dysfunction” “inhibition” “switching” “planning” “prefrontal dysfunction” “neuropsychological” “attention” “updating” and “shifting”. The second category was related to dissociation and included the key words “dissociation” “derealization” “depersonalization” “dissociative manifestations” “dissociative symptoms” “dissociative symptomatology” “dissociative disorder”.

Eligibility criteria

To be eligible for the systematic review, studies were required to contain at least one word from each category within their titles and had to assess the relationship between cognitive functioning and dissociation. We did not consider non-empirical articles. 2 419 articles were identified for abstract review within Pubmed, PsycInfo and EMBASE. From those articles, 2 207 were discounted based on the title and/or the abstract because they did not meet the criteria for inclusion. A lot of articles were removed because dissociation does not only mean

dissociative symptoms but also refers to the idea of separation in a common language. After removing duplicates, we selected 49 articles that met the criteria for inclusion. We then added 11 supplementary articles based on the authors' previous knowledge. These articles were not present during the first analysis either because they used another key word to mention dissociation from those we used in our research (e.g., dissociative tendency) or because their title did not contain keywords related to dissociation but instead used a keyword related to a non-dissociative disorder. Ultimately, from a total of 2,419 original search results, 60 studies were selected for final inclusion (See Fig. 1 for the PRISMA flow diagram). We distinguished the different studies based on the results they found. Studies were said to find a “negative effect” when the research established a negative association between dissociation and at least one measure of cognitive performance. In these studies, the more the people/patients presented with high levels of dissociation, the poorer were their cognitive abilities. Studies were said to find a “positive effect” when the research found a positive association between dissociation and at least one measure of cognitive performance. In these studies, the more the people/patients presented with high levels of dissociation, the better were their cognitive abilities. Studies were said to find “both positive and negative effects” when the results indicated a positive association between dissociation and at least one measure of cognitive performance and at least one negative association with another measure of cognitive performance. Finally, some studies found “no association”, when the results did not establish any association. We consider there to be presence of association if at least one test reached statistical significance ($p < 0.05$) using either correlation analysis, t tests or ANOVA. Because the observed effects on cognitive functioning depend on the one hand on the nature of the measurement (i.e., objective or subjective) and, on the other hand, on the condition of the subject (i.e., patients or healthy subjects), we distinguished four different methods used to capture cognitive functioning: (1) studies that rely upon questionnaires to assess cognitive functioning within a non-clinical sample, (2) studies that use questionnaires to assess cognitive functioning within a clinical sample, (3) studies that contain at least one cognitive task to assess cognitive functioning within a non-clinical population and (4) studies that use at least one cognitive task to assess cognitive functioning within at least one psychiatric sample or one sample of patients exposed to stressful events. For each category, detailed characteristics of the studies with its main results are displayed respectively in Table 1, 2, 3 and 4.

-Insert Figure 1-

3. Results

3.1. Summary of the studies

- *Studies that used questionnaires within a non-clinical sample*

Among studies that used self-report questionnaires within a non-clinical sample (N=4), two studies used the Cognitive Failure Questionnaire (Bruce et al., 2007; Giesbrecht, Merckelbach, et al., 2007), one used the Wienberger Repressive Restraint Scale (Melchert, 1999) and one used the Adult ADHD self-report Scale (Ozdemir et al., 2015). All of them found a positive association between dissociation and cognitive complaints.

- *Studies that used questionnaires within a clinical sample*

Among studies that used self-report questionnaires within a clinical sample (N=8), three studies used the Revised Self-conscious Scale (Perona-Garcelán et al., 2008, 2011, 2020), two studies used the Cognitive Failure Questionnaire (Simeon et al., 2009; Van Heugten - Van Der Kloet et al., 2014a), two used non-validated Likert scales (Becker-Blease & Freyd, 2007; Buck et al., 2006) and one used the Wender Utah Rating Scale (Matsumoto & Imamura, 2007). All of them also found a positive association between dissociation and cognitive complaints.

Within every study, the strength of the association appeared moderate to strong with correlations going from .27 to .79.

-Insert Table 1 and 2-

- *Studies that used at least one cognitive task within a non-clinical sample*

Regarding the studies performed among a non-clinical population and using at least one cognitive task (N=21), 12 of them revealed a negative association between dissociation and cognition functioning (Brewin et al., 2013; Brewin & Mersaditabari, 2013; Freyd et al., 1998; Giesbrecht, Geraerts, et al., 2007; Kindt et al., 2005; Kindt & van den Hout, 2003; Merckelbach et al., 2007; Olsen & Beck, 2012a; Van Heugten - Van Der Kloet et al., 2014; Wright & Osborne, 2005). However, within these 12 studies, 3 did not find any association between cognitive abilities and dissociation through cognitive tasks but they did through subjective assessment (Kindt et al., 2005; Kindt & van den Hout, 2003; Wright & Osborne, 2005). Four studies found a positive association between dissociation and cognition (de Ruiter et al., 2003a,

2004; Elzinga et al., 2000; D. Veltman et al., 2005). Three found both a positive and a negative association between dissociation and cognitive tasks (DePrince & Freyd, 1999; Ozdemir et al., 2015; Saidel-Goley et al., 2012). Two studies did not find any association between dissociation and cognitive functioning (Devilly et al., 2007; Huntjens et al., 2015).

-Insert Table 3-

- ***Studies that used at least one cognitive task within a clinical sample***

Among the studies that used at least one cognitive task among psychiatric samples (N=27), 18 studies established a negative association between cognitive functioning and dissociative manifestations (Adler et al., 2014; Cima et al., 2001; Dorahy et al., 2005, 2006; Giesbrecht et al., 2010a; Guralnik et al., 2000, 2007; Haaland & Landrø, 2009; Jones et al., 1999; Krause-Utz et al., 2018; Lemche et al., 2016; Minshew & D'Andrea, 2015a; Montagne et al., 2007; Parlar et al., 2016; Renard et al., 2012; Rivera-Vélez et al., 2014a; Roca et al., 2006; Winter et al., 2015). One study identified a positive association between dissociative manifestations and cognitive functioning (Walker et al., 1996) and one study reported mixed results (Fani et al., 2018). Finally, 7 studies did not reveal any association between cognitive functioning and dissociation (Brandes et al., 2002; Dimitrova et al., 2020; Elzinga et al., 2007; Latalova et al., 2010a; Lemche et al., 2016; Medford et al., 2006; Papageorgiou et al., 2002; Rossini et al., 1996).

-Insert table 4-

3.2. Distinguishing studies based on methodological aspects

Furthermore, we distinguished some studies based on methodological aspects.

- ***Distinction based on the measure of trait-dissociation used***

Two different scales were mainly used to assess trait-dissociation, namely the DIS-Q and the DES. While every study using the DIS-Q found a positive association between dissociative manifestations and cognitive functioning (N=4) (de Ruiter et al., 2003, 2004; Elzinga et al., 2000; Veltman et al., 2005), studies using the DES found every kind of result, positive (N=1) (Walker et al., 1996), negative (N=22) (Brewin & Mersaditabari, 2013; Cima et al., 2001; Dorahy et al., 2005, 2006; Freyd et al., 1998b; Giesbrecht, Geraerts, et al., 2007; Giesbrecht et

al., 2010a; Guralnik et al., 2000; Haaland & Landrø, 2009a; Jones et al., 1999; Kindt et al., 2005; Kindt & van den Hout, 2003; Merckelbach et al., 2007b; Minshew & D'Andrea, 2015a; Montagne et al., 2007; Morgan et al., 2006a; Olsen & Beck, 2012b; Renard et al., 2012; Roca et al., 2006; Van Heugten - Van Der Kloet et al., 2014a; Winter et al., 2015; Wright & Osborne, 2005a), positive and negative association (N=3) (DePrince & Freyd, 1999a; Ozdemir et al., 2015; Saidel-Goley et al., 2012) and no associations (N=5) (Deville et al., 2007; Dimitrova et al., 2020; Elzinga et al., 2007; Huntjens et al., 2015; Latalova et al., 2010).

- ***Distinction based on the use of emotional versus non-emotional tasks***

We distinguished studies that used strictly neutral tasks versus those that used at least one emotional task. Among studies that used an emotional cognitive task (N=11) 8 studies found a negative association between cognitive abilities and dissociation (DePrince & Freyd, 1999; Dorahy et al., 2005, 2006; Fani et al., 2018; Giesbrecht, Merckelbach, et al., 2007; Minshew & D'Andrea, 2015; Olsen & Beck, 2012; Winter et al., 2015). Three studies did not succeed in establishing any association (Kindt et al., 2005; Kindt & van den Hout, 2003; Montagne et al., 2007). However, we noticed that all three of them assessed cognitive functioning through the recall of a movie, suggesting that using a movie to investigate the relationship between cognitive abilities and dissociation might be less efficient.

- ***Distinction based on the use of induction versus cross-sectional studies***

We distinguished the studies that used induction (experimental manipulation) versus the studies that used a strictly cross-sectional method. Among studies that used at least one cognitive task, five used an experimental manipulation of dissociation. To induce dissociation, one study used a stressful exercise (Morgan et al., 2006), one used a script-driven induction (Krause-Utz et al., 2018) and three used mirror gazing (Brewin et al., 2013; Brewin & Mersaditabari, 2013). They all found a negative impact of dissociation on cognitive abilities. However, this effect was not significant on every cognitive task carried out. Cross-sectional studies produced contradictory results regarding the association between dissociation and cognitive abilities: 27 found a negative association (Adler et al., 2014; Cima et al., 2001; Dorahy et al., 2005, 2006; Freyd et al., 1998; Giesbrecht et al., 2010; Giesbrecht, Geraerts, et al., 2007; Guralnik et al., 2000, 2007; Haaland & Landrø, 2009; Jones et al., 1999; Kindt et al., 2005; Kindt & van den Hout, 2003; Lemche et al., 2016; Merckelbach et al., 2007; Minshew & D'Andrea, 2015; Montagne et al., 2007; Olsen & Beck, 2012; Parlar et al., 2016; Renard et al., 2012; Rivera-Vélez et al., 2014b; Roca et al., 2006; Van Heugten - Van Der Kloet et al., 2014b; Wright & Osborne, 2005b, 2005a), 5 found a positive association (de Ruiter et al., 2003,

2004; Elzinga et al., 2000; D. J. Veltman et al., 2005; Walker et al., 1996), 4 found both a positive and negative association (DePrince & Freyd, 1999b; Fani et al., 2018; Ozdemir et al., 2015; Saidel-Goley et al., 2012b) and 8 did not find any association at all (Brandes et al., 2002; Devilly et al., 2007; Dimitrova et al., 2020; Elzinga et al., 2007; Huntjens et al., 2015; Latalova et al., 2010; Medford et al., 2006; Papageorgiou et al., 2002; Rossini et al., 1996).

4. Discussion

The aim of the study was (i) to identify the conclusions that could be drawn about the relationship between dissociation and cognitive performance and (ii) to distinguish the results based on the method used.

We systematically reviewed 60 articles. From these articles 42 (70%) found at least a negative association between dissociation and cognitive abilities; 5 (8,33%) found at least a positive association between dissociation and cognitive abilities; 4 (6,67%) found both a positive and a negative association between dissociation and cognitive abilities and 9 (15%) did not find any association at all between dissociation and cognitive function. When focusing on specific kinds of studies, we found that every study that used only self-report measures of cognition found a negative association between dissociation and cognitive abilities. However, only 12 studies out of 21 (57,14%) of the studies that used at least one cognitive task to assess cognitive abilities within a non-clinical population found a negative association between dissociation and cognitive abilities. The ratio was 18 over 27 (66,67%) for the same kind of study performed on a clinical population. Then, when we focused on other methodological aspects, we found that every study that used the DIS-Q to measure dissociation found a positive association between dissociation and cognitive abilities. We found that 8 studies out of 11 (72,73%) that used emotional material within the cognitive tasks, found a negative association between dissociation and cognitive abilities. The three studies that did not find such results used an emotional film instead of emotional material within the task. Finally, every study that used dissociative induction found a negative effect of induction on cognitive abilities.

Overall, such results suggest that (i) the relationship between self-report measures of cognitive abilities and dissociation is clearly established; (ii) dissociative induction disrupts cognitive performance and (iii) the association between cognitive abilities and dissociation is more obvious when it involves emotional material. For these last two points, the number of studies performed is still weak and further experimentations are required. The results are too

controversial to conclude that cognitive abilities measured through neutral cognitive tasks are associated with dissociation. Overall, we found that the negative association between dissociation and cognitive tasks reaches different cognitive functions, namely memory, attention and executive function.

Different hypotheses are possible to explain these results. In congruence with McKinnon et al.'s (2016) proposal, it is possible that the results may be explained by the transient aspect of dissociation. The first hypothesis is that cognitive disruption appears only during the presence of state-dissociation. This would explain most of our results. Firstly, cognitive disruption would overall be associated with trait-dissociation through subjective evaluation, as it measures general difficulties instead of a picture of an ability at a given time. Secondly, compared with cognition within a neutral context, cognition within an emotional context would be more consistently associated with dissociation because aversive emotions are known to trigger dissociation (Vancappel et al., 2022). Finally, the induction of dissociation would disrupt cognitive functions. The second hypothesis is that the active state of dissociation would primarily disrupt dissociation (same as the first hypothesis) and emotional dysregulation would secondly be involved in the difficulties observed in emotional cognitive tasks. Contrary to the first hypothesis, the results of the association between dissociation and cognitive abilities within an emotional context would not be due to the activation of dissociation but would result from the failure to regulate the emotion triggered by emotional material (Cavicchioli et al., 2021). In that sense, people with high levels of dissociation would not be able to regulate themselves during emotional cognitive tasks, resulting in poorer cognitive performances. This is congruent with previous suggestions that cognitive functioning and emotion regulation abilities interact (Hofmann et al., 2012; Schmeichel & Tang, 2015). A third hypothesis is that the relationship between cognitive abilities and dissociation would be more complex than a simple linear relationship. As proposed by Vancappel and El Hage (2023), emotional context, by promoting state dissociation, would firstly disrupt attention (same as the first hypothesis). However other processes would moderate the relationship between dissociation and cognitive abilities. In that sense, cognitive abilities may be used by patients without positive beliefs about dissociation (e.g., "Dissociation is a relief") to stop counteracting dissociation. In other words, an absence of relationship between dissociation and cognitive abilities might occur in patients with positive beliefs because they would not use their cognitive abilities to stop dissociation (Vancappel et al., 2023).

The study presents several perspectives. Further studies may prefer to use neutral, emotional tasks and dissociative induction to explore the relationship between dissociation and cognitive

abilities. Additional variables such as emotion regulation and the beliefs about dissociation should be integrated into the study protocol to explore their potential mediation/moderation role.

Limits

This study has a few limits. Some studies included in the systematic review were low in sample size. This may explain the absence of certain relationships identified. We did not review the quality of the studies included or investigate the research methods for potential bias; thus, we are limited in the conclusions we can draw. Equally, we did not control the comorbidities included in the different studies. The presence of depressive symptoms for instance may highly influence patients' cognitive abilities.

Conclusion

Even though the relationship between dissociation and cognitive complaints is now clearly established, the mechanism underlying the relationship between a dissociative state and cognitive disruption remains unclear. The use of emotional material and dissociative induction seem to be determinant in the results. Further studies measuring emotion regulation abilities and beliefs about dissociation may help to control for the confounding effect of such variables on the relationship between cognitive function and dissociation.

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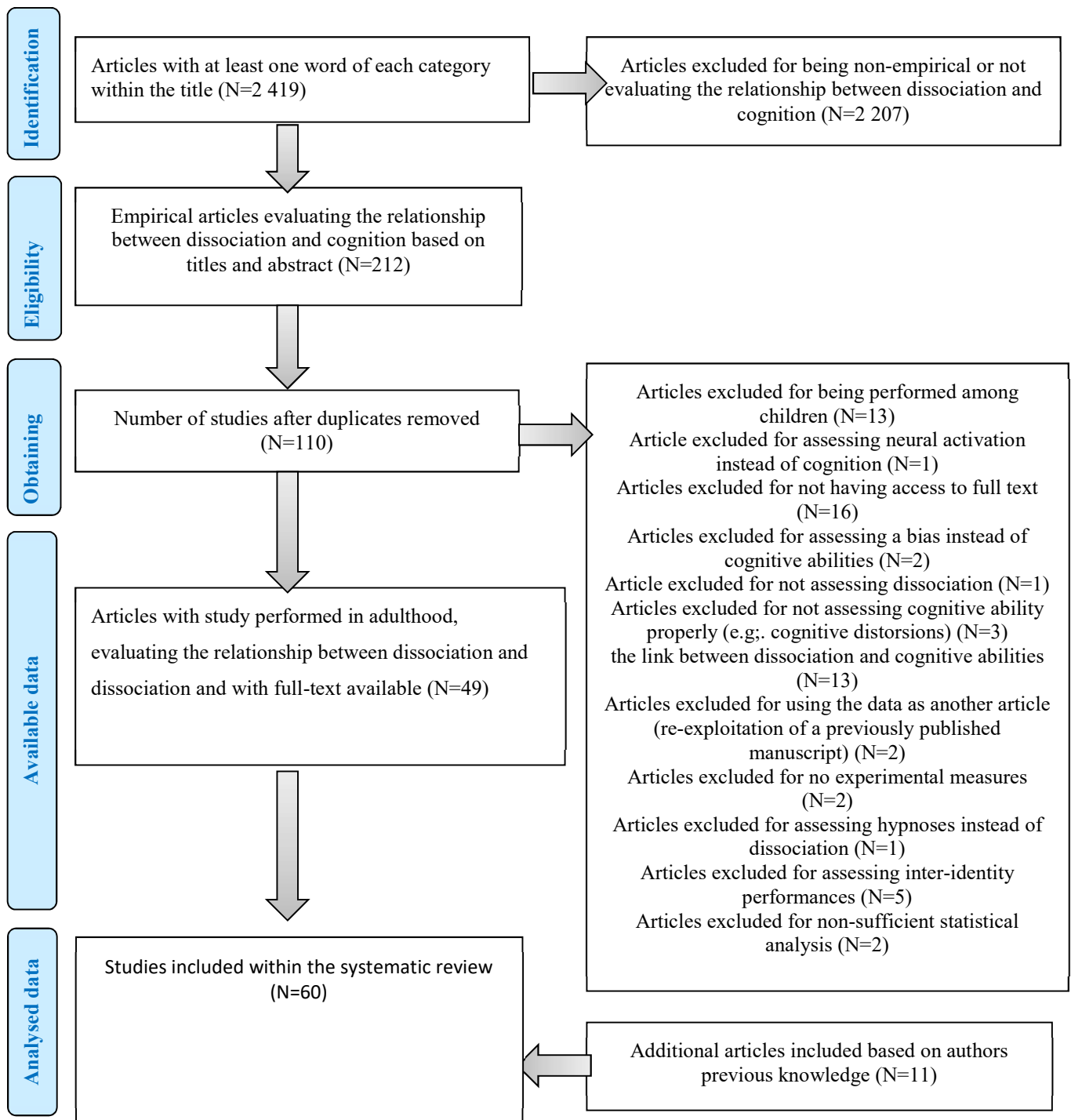


Figure 1. Flow diagram

Article	Population	Sample Size	Age : Mean (SD)	Percentage of women	Cognitive fields evaluated	Tools for assessing cognition	Tools for assessing dissociation	Main results
Bruce et al. 2007	General population	N=140	18.8 (.82)	54%	General	CFQ	DES	Positive association between dissociation and cognitive complaints
Giesbretch et al. 2007	Students	N=185	20.5 (3.75)	78.92	General	CFQ	DES	Positive association between dissociation and cognitive complaints
Melchert 1999	Students	N=560	19.14 (2.7)	69%	Mnemonic repression	WRRS	DES	Positive association between dissociation and mnemonic repression
Ozdemir et al. 2015	General population	N=317	22.53 (2.27)	not mentioned	Attention	Adult ADHD self-report scale	DES	Positive association between dissociation and ADHD symptoms

ADHD : Attention Deficit Hyperactivity disorder ; CFQ : Cognitive Failure Questionnaire ; DES: Dissociative Experiences Scale ; WRRS: Weinberger Repressive Restraint Scale

Table 1. Synthesis of the studies using self-report questionnaires within a non-clinical sample

Article	Population	Sample Size	Age : Mean (SD)	Percentage of women	Cognitive fields evaluated	Tools for assessing cognition	Tools for assessing dissociation	Main results
Becker-Blease et Freyd 2007	Convicted of sexual abuse	N=17	43.3 (13.7)	0%	Memory	Likert scales evaluating the memory of the aggression	DES PDEQ	Positive association between dissociation and cognitive complaints
Buck et al. 2006	Arachnophobics	N=30	36.4 (14.5)	93.33	Memory	Self-report measure of the exposure to spiders and picture arrangement test	PDEQ	Positive association between dissociation and cognitive complaints about memory but no association between dissociation and objective measure of memory
Matsumoto et al. 2007	Prisoners	N=799	23.7 (2.4)	0%	Attention	WURS	ADES	Positive association between dissociation and ADHD symptoms
Peronà Garcelàn et al. 2008	Patients suffering from psychosis (with/without hallucinations or remission) and HC	N=68	38.65 (9.04)	29.41%	Consciousness/self-report attention	Revised self-consciousness scale	DES	Positive association between dissociation and cognitive complaints about attention
Peronà-Garcelan et al. 2011	Patients suffering from schizophrenia	N=59	38.36 (8.68)	24%	Consciousness/self-report attention	Revised self-consciousness scale	Cambridge Scale	Positive association between dissociation and cognitive complaints about attention
Peronà-Garcelàn et al. 2020	Patients suffering from schizophrenia	N=62	38.3 (10.27)	37%	Consciousness/self-report attention	Revised self-consciousness scale	Cambridge Scale	Positive association between dissociation and cognitive complaints
Simeon et al. 2009	Patients suffering from DDD or PTSD and HC	DDD, N=46 PTSD, N= 21	DDD: 30.59 (10.29) PTSD : 43.19 (11.75),	DDD 50%, PTSD 61.9%,	General	CFQ	DES, Cambridge Scale	DDD patients and PTSD patients have a greater level of cognitive complaints as compared to healthy controls

		HC, N=35	HC : 31.94 (11.43)	HC :45.7 1%					
van Heugten-van der Kloet	Patients suffering from DID or PTSD and HC	N=94	DID: 42 (11.8), PTSD: 42 (13.1), control : 42 (13.1)	100%	General	CFQ	DES	Positive association between dissociation and cognitive complaints	

ADES : Adolescent dissociative experience scale ; ADHD : Attention Deficit Hyperactivity disorder ; CFQ : Cognitive Failure Questionnaire; DDD : Depersonalization-Derealization Disorder; ; DES: Dissociative Experiences Scale ; DID : Dissociative identity Disorder ; PDEQ: Peri-traumatic Dissociative Experiences Questionnaire; PTSD : Post-traumatic stress disorder ; WURS: Wender Utah Rating Scale

Table 2. Synthesis of the studies using self-report questionnaires within a clinical sample

Article	Population	Sample Size	Age : Mean (SD)	Percentage of women	Cognitive fields evaluated	Tools for assessing cognition	Tools for assessing dissociation	Experimental manipulation (Yes/No)	Use of emotional material (Yes/No)	Main results
Studies that found a negative effect of dissociation on cognition										
Brewin et al. 2013 study 1	Students	N=60 (30 received dissociative induction and 30 did not)	20.05 (1.61)	68.33%	Attention and short term memory	Perceptual attention task; Weschler's digit span et Corci blocks	CADSS DES	Yes	No	Negative effect of dissociative induction on digit Span
Brewin et al. 2013 study 2	Students	N=40	20.42 (2.02)	87.5%	Verbal memory	Weschler memory scale	CADSS	Yes	No	Negative effect of dissociative induction on delayed recall memory
Brewin & Mersaditabri 2013	HC	N=60 (40 received dissociative induction and 20 did not)	25.41 (1.96)	80%	Visual memory	Reys' Figures	CADSS	Yes	No	Negative effect of dissociative induction on visual memory
Freyd et al. 1998	General population	N=155	21	49.68%	Inhibition	Stroop	DES	No	No	HD participants have a greater level of inhibition difficulties as compared to LD
Giesbretch et al. 2007	Students	N=62	19.03 (1.56)	72.58%	Episodic Memory and WM	Weschler's digit span and recall of an emotional film	DES	No	Yes	Positive association between dissociation and errors within a fil recall
Kindt & Van den Hout 2003	Students	N=20 HD and 20 LD	20.9 (2.4)	70%	Episodic Memory	Recall of an emotional film	DES PDEQ	No	Yes	Positive association between dissociation and perception of a fragmentized memory
Kindt et al. 2005	General Population	N= 25 HD and LD	20.7 (2.5)	70%	Objective and Subjective Memory	Recall of a film and mnemonic fragmentation	DES PDEQ	No	Yes	Positive association between dissociation and perception of a fragmentized memory
Merckelbach et al. 2007	Students	N=36	19.7 (2.03)	83.33%	Memory	Recall of an emotional film	DES	No	No	Positive association between dissociation and mnemonic errors
Morgan et al. 2006	Military (before, after and during a	N=184	23 (4.1)	9.78%	Visual Memory	Rey's figures	CADSS	Yes	No	Positive association between dissociation and difficulties in working memory

	stressful training session)									
Olsen & Beck 2012	General Population	N=27 HD and 27 LD	LD: 18.74 (1.06), HD : 19.19 (1.75)	100%	Attention and Memory	Simultaneous observation of a film and interfering callouts (evaluation of attention and recall of the stimuli)	DES	No	Yes	HD participants have worse attentional abilities and memory performances to trauma related stimuli as compared to LD
Van Heugten-van der Kloet	Students	N=56	20.7 (2.33)	76.79%	Memory	Recall of a film with/without sleep deprivation	Cambridge Scale, CADSS DES	No	No	HD participants have worse memory performances as compared to LD, after sleep deprivation
Wright & Osborne 2005	Students	N=80	Not mentioned	Not mentioned	WM	Digit Span, visual pattern test, Corci Blocks and CFQ	DES	No	No	Positive association between dissociation and cognitive complaints

Studies that found a positive effect of dissociation on cognition

De Ruiter et al. 2003	Students	N=32	HD : 23.4 (3.72); LD 22.6 (5.5)	40.62%	Attention	Detection task and semantic decision task	DIS-Q	No	No	HD participants greater performances as compared to LD
De ruiter et al. 2004	General population	N=119	LD : 22.7(6.2), MD: 23.4 (7.1), HD : 22.5 (6.6)	73.11%	WM	Words span	DIS-Q	No	No	HD participants greater verbal span as compared to LD
Elzinga et al. 2000	General population	Subsample 1 N=37, Subsample 2 N=46	Subsample 1 22 (6.2); Subsample 2: 20.81 (2.61)	Subsample 1 62.16%; Subsample 2: 80.43%	Memory	directed forgetting task	DIS-Q	No	No	HD participants greater mnemonic abilities and abilities to ban a material as compared to LD

Veltman et al. 2005	General Population	N=21	LD: 22.9 (1.27), HD: 22.6 (1.03)	LD: 70% HD: 63.64%	WM	N-back; Sternberg task	DIS-Q	No	No	HD participants greater performances in working memory as compared to LD
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Studies that found mix results

DePrince & Freyd 1999	General population	N=108	HD: 19.51, LD: 19.56	LD: 79.6%; HD: 61.1%	Attention and Memory	Emotional and non-emotional stroop (with/without interfering task) and recall of the word used for the stroop	DES	No	Yes	HD participants greater performances in divided attention but worse performances in selective attention as compared to LD
Ozdemir et al. 2015	General Population	N=60	27 (4.36)	55%	Inhibition and Memory	Revised Weschler's Scale, Additive learning test and stroop	DES	No	No	Positive association between dissociation and recognition and negative association between dissociation and all other cognitive tasks
Saidel-Goley et al. 2012	Students	N=45	18 to 21 years old	53.30%	Flexibility and Memory	Digit span, memory of a virtual relatiy experience and TMT	DES	No	No	Positive association between dissociation and visual memory and flexibility and negative association between dissociation and false memory

Studies that did not find any association

Devilly et al. 2007	General population	N=42	20.68 (3.22)	69.05%	Memory	directed forgetting task	DES	No	No	No relationship between dissociation and cognitive abilities
Huntjens et al. 2015	Students	N=60	19.57 (1.97)	79.60%	Temporal Binding	Ordination of emotional pictures	DES CADSS	No	No	No relationship between dissociation and cognitive abilities

CADSS : Clinician Admistrated Dissociative State Scale; CFQ: Cognitive Failure Questionnaire; DES: Dissociative Experiences Scale ;DIS-Q: Dissociation Questionnaire; HC: Healthy Cuntrols; HD : High dissociators ; LD : Low Dissociators ; MD : Medium Dissociators; PDEQ: Peri-traumatic Dissociative Experiences Questionnaire ; TMT: Trail Making Test; Working Memory

Table 3. Synthesis of studies that used at least one cognitive task among non-psychiatric population

Article	Population	Sample Size	Age : Mean (SD)	Percent age of women	Cognitive fields evaluated	Tools for assessing cognition	Tools for assessing dissociation	Experimental manipulation (Yes/No)	Use of emotional material (Yes/No)	Main results
Studies that found a negative effect of dissociation on cognition										
Adler et al. 2014	Patients suffering from DDD vs HC	DDD, N=16; HC, N=17	DDD : 26.9 (4.7) HC : 25.8 (2.4)	DDD: 44% HC 47	Attention	Spatial cueing paradigm	Cambridge Depersonalization Scale	No	No	Patients have a worse performance on demanding tasks performances in selective attention as compared to HC
Cima et al. 2001	Psychiatric patients locked-up (no control group)	N=30	39	0.00%	Executive functions	Rules shift cards test, key search test, temporal judgment test, zoo test	DES	No	No	Negative association between dissociation and executive functions
Dorahy et al. 2005	Patients suffering from DID vs depression vs HC	11 in each group	DID : 33.7 (9.1), depressed : 39.0 (11.6); HC : 30.09 (13.7)	9.09% for each group	Inhibition and selective attention	Flanker task	DES	No	Yes	Patients have a worse performance performances in anxious context as compared to HC
Dorahy et al. 2006	Patients suffering from DID vs GAD vs HC	12 in each group	DID : 46.33(8.94) GAD : (46.34 (11.2)	100%	Inhibition and selective attention	selective visual attention task; negative priming task	DES	No	Yes	Patients suffering from DID have a worse inhibition performance in emotional context as compared to HC

Giesbretch et al. 2010	Patients suffering from DDD vs HC	14 in each group	HC : 39.5 (6.8) DDD 30.5 (6.7) HC : 28.36 (6.43)	DDD :5 0% HC : 64%	Memory	Recall of a movie and evaluation of the perceived fragmentation	DES, PDEQ and Cambridge Scale	No	No	Patients have a worse performance as compared to HC
Guralnik et al. 2000	Patients suffering from DDD vs HC	15 in each group	DDD : 32 (8.6), HC : 29 (7.4)	DDD : 60% HC : 75%	Memory, Executive function, emotional recognition and attention	WAIS, Weschler's memory Scale, stroop, TMT, emotional Stroop, wisconsin, emotional recognition, continuous performance test,	SCID	No	No	Patients have a worse performance in cubes, logic memory and attention as compared to HC
Guralnik et al. 2007	Patients suffering from DDD vs HC	DDD, N=21, HC, N=17	DDD: 31 (7.7), HC: 28.7 (10.3)	DDD : 47.61% HC: 58.82%	Intelligence and WM	WAIS, Weschler's memory Scale, addition test, digit span test with a distractor	SCID and DES	No	No	Patients have a worse performance in processing speed as compared to HC Negative association between dissociation and attentional and visual abilities
Haaland & Landro 2009	Patients suffering from BPD (with/without dissociation) vs HC	BPD with dissociation, N=10, BPD without dissociation, N=20, HC, N=30	BPD with Dissociation: 23.7 (4.8) BPD without dissociation: 25.5 (5.6) HC :	BPD without DI 80% Other group : 100%	Attention, WM, Executive function, verbal and visual Memory	WAIS-III, continuous performance test, N-back, Stroop, Tower of London, Controlled Oral Word association, TMT, Iowa Gambling task, Hopkins Verbal Learning test, Rey's complex figures, Kimura Recurring	DES-T	No	No	Negative association between dissociation and executive function, working memory and verbal memory

			25.9 (6.4)			Recognition Figures Test				
Jones et al. 1999	Patients suffering from BPD vs HC	23 in each group	BPD : 31.1 (7.7), HC : 31.2 (8.6) BPD with dissociative	78.26% for each group	Autobiographic memory	Autobiographic memory test	DES	No	No	Negative association between dissociation and autobiographical memory
Krause-Utz et al. 2018	Patients suffering from BPD vs HC	BPD with dissociation induction, N=17, BPD without induction, N=12, HC, N=18	induction: 27.41 (6.2) BPD without induction :25.17 (6.22) HC: 29.61 (8.61) DDD :	100%	WM	emotional working task	Dissociation Stress Scale	Yes	No	Negative effect of dissociative induction on emotional working task performance
Lemche et al. 2016	Patients suffering from DDD vs HC	DDD, N=9, HC, N=12	36.11 (2.34), HC : 27.25 (1.95)	DDD :4 4%, HC : 41%	Inhibition	Stroop	Not applicable	No	No	Patients have a worse performance in inhibition as compared to HC
Minshew & D'andrea 2015	Women victim from violence (no control group)	N=27	38.1 (13.4)	100.00 %	Attention and Memory	Detection and recall of neutral and trauma related words	DES	No	Yes	Negative association between dissociation and recall of trauma related words

Montagne et al. 2007	Patients suffering from DDD versus HC	DDD, N=13, HC, N=33	DDD : 33.2 (8.2) HC : (36 (11.7)	DDD : 30.77%, HC: 42.42%	Emotional recognition and memory	Emotional recognition, recall of an emotional story	DES Cambridge Scale	No	Yes	Patients have a worse performance in anger recognition as compared to HC
Parlar et al. 2016	Patients suffering from depression vs HC	Depression, N=23, HC, N=20	Depressed : 40.4 (14.2) HC : 35.3 (14.1)	Depressed : 52.17%, HC : 50%	Memory, Intelligence, Executive function and attention	WAIS, California Verbal Learning Test, Brief revised visual memory test, Winsconsin, Continuous Performance Test	MDI	No	No	Negative association between dissociation and processing speed, memory and attentional performance
Renard et al. 2012	Patients suffering from Schizophrenia	N=49	51.82 (9.75)	8.16%	Emotional recognition	Bell-Lysaker task	DES	No	No	Negative association between dissociation and emotional recognition
Rivéra-Vélez et al. 2014	Women victim and non victim of sexual violence	12 in each group	29.33 (4.75)	100%	Intelligence and Memory	WAIS-III, color trail test, rey auditory verbal learning test,	DES	No	No	Negative association between dissociation and memory span, picture arrangements, letter digit sequence, color trial and visual reproduction, rey's test, codes' performance and symbols' performance
Roca et al. 2006	Military suffering from PTSD with and without dissociation	10 with dissociation and 17 without dissociation	With dissociation : 48.2 (3.2) Without dissociation : 52.2 (3.7) HC : 28.74 (8.07)	0%	Intelligence, Visual and verbal Memory, attention and executive function	WAIS, wisconsin, Iowa Gambling Task, TMT, digit span distractibility, Hopkins verbal learning, Rey complex test,	DES	No	No	Negative association between dissociation and WM , flexibility, and verbal memory
Winter et al. 2015	Patients suffering from BPD	BPD with dissociation, N=19,	HC : 28.74 (8.07)	100.00 %	Attention	Emotional Stroop	DES, Dissociation Stress Scale	No	Yes	Patients with dissociation have a worse performance as compared

(with and without a DI) vs HC

BPD without dissociation, N=19, HC, N=20

BPD without dissociation: 28.05 (7.82)
BPD with dissociation: 27.51 (5.95)

to patients without dissociation and HC

Studies that found a positive effect of dissociation on cognition

Walker et al. 1996	General psychiatric population (no control group)	Young patients, N=32 Old patients, N=34,	Young patients: 41.99, Old patients: 71.84	Young patients: 53% Old patients: 71%	Global cognition	Mini Mental State Examination	DES	No	No	Negative association between dissociation and cognitive deficits
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Studies that found mixed results

Fani et al. 2018	Victims of a trauma	N=117	LD: 38.5 (11) HD: 38.2 (10.4)	100%	Attention, abstraction, flexibility, WM, visual memory and emotional facial recognition	Conditional exclusion task, continuous performance test, N-back, learning task, short visual object learning test, affective number stroop,	MDI	No	Yes	HD patients have a worse performance in verbal memory and emotional stroop but have greater performance on abstraction and flexibility as compared to LD patients.
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Studies that did not find any association

Brandes et al. 2002	Survivors of a traumatic event (no control group)	N=48	High PTSD: 34.8 (9.4), Low PTSD: 36 (8.3) DID: 43.86 (9.86), PTSD: 40.80 (12.1); HC : 43.59 (11.68)	58.33%	Memory, attention and learning	WAIS, Rey verbal learning test	PDEQ	No	No	No association between dissociation and cognitive abilities
Dimitrova et al. 2020	Patients suffering from PTSD vs DID vs HC	DID, N=17, PTSD, N=16, HC, N=16	DID and NOSD : 40.8 (10.7) HC : 34.6 (10.9)	100%	WM	N-back	DES	No	No	No difference between the groups
Elzinga et al. 2007	Patients suffering from DID vs NOSD vs HC	16 in each group		100%	WM	N-back	SCID, DES and CADSS	No	No	No difference between the groups
Latalova et al. 2010	Patients suffering from Bipolar Disorder	N=23	46.17 (14.11)	52.18%	Attention and executive function	TMT, D2, verbal fluencies	DES	No	No	No association between dissociation and cognitive abilities
Medford et al. 2006	Patients suffering from DDD vs HC	DDD, N=10, HC, N=12	HC : 27.8 (3.6), DDD : 31.2 (9.3)	HC : 0%, DDD : 10%	Verbal memory	Memorization and recall of neutral and emotional sentences	Not applicable	No	No	No difference between the groups

Papageorgiou et al. 2002	Patients suffering from DDD versus HC	15 in each group	DDD : 31.4 (7.46) HC : 30.13 (6.3)	DDD : 53%, HC : 60%	Memory	Digit Span	Dixon Depersonalization, Derealization questionnaire	No	No	No difference between the groups
Rossini et al. 1996	Patients suffering from DID vs DNOS	DID, N=50, DNOS, N=55	353.86 (7.6)	90.50%	Intelligence	WAIS	Not applicable	No	No	No difference between the groups

BPD: Borderline Personality Disorder; DES: Dissociative Experiences Scale ; DDD : Depersonalization-Derealization Disorder; DID : Dissociative identity Disorder ; DNOS: Disorder not otherwise specified; GAD : generalized anxiety disorder; HC : Healthy Controls; HD: High Dissociators;LD: Low dissociators; MDI : Multiscale Dissociation Inventory ; NOSD: Not Otherwise Specified Dissociation; PDEQ: Peri-traumatic Dissociative Experiences Questionnaire; PTSD : Post-traumatic stress disorder ; SCID: Structure Clinical Interview for Dissociation; TMT: Trail Making Test

Table 4. Synthesis of studies that used at least one cognitive task among at least one psychiatric sample