

Savant Abilities in Autism Spectrum Disorder: A Systematic Literature Review and Meta-Analysis

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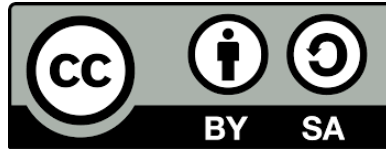
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ABSTRACT

Introduction: Autism Spectrum Disorder (ASD) is a neurodevelopmental condition marked by social-communication difficulties and restricted, repetitive behaviors. Despite these challenges, some individuals with ASD demonstrate exceptional abilities in one or more area, which is known as Savant. Until now, factors linked to savant abilities are still poorly understood. This research compared cognitive, social, and behavioral functioning between savant and non-savant individuals diagnosed with ASD. **Methods:** A comprehensive search was conducted to identify studies comparing cognitive, social, or behavioral characteristics between the two groups. Thirteen studies met the inclusion criteria and were included in the quantitative synthesis. Statistical analyses were performed using R software. **Results:** Savant individuals with ASD showed significantly higher cognitive functioning than non-savant peers (SMD = 0.73, 95% CI: 0.59–0.87). Social functioning differences were negligible and non-significant (SMD = -0.03, 95% CI: -0.22–0.16). Behavioral traits, including repetitive behaviors, were slightly more pronounced among savants but were not statistically significant (SMD = 0.17, 95% CI: -0.07–0.40). **Conclusions:** Savants with ASD exhibit higher cognitive functioning but do not show significant differences in social or behavioral functioning compared to their non-savant peers, highlighting that enhanced abilities are not necessarily accompanied by corresponding deficits.

1. INTRODUCTION

Autism Spectrum Disorder (ASD) is a lifelong neurodevelopmental disorder characterized by deficits in social communication and restricted, repetitive patterns of behavior, with a global prevalence estimated at approximately 1 in 100 children.¹ Although research on autism spectrum disorders (ASD) has predominantly focused on the social and communicative impairments characteristic of the condition, the presence of unusual or commonly known as savant abilities within this population has also received increasing scholarly attention. Individuals with savant abilities exhibit exceptional skills in areas such as calendar calculation, music, art, or memory, which are collectively described as savant syndrome.²

Savant abilities refer to the presence of extraordinary skills in individuals with developmental conditions, most frequently autism. These skills can be either congenital or acquired, and are often accompanied by cognitive or social limitations.³ The prevalence of savant abilities among autistic individuals has been estimated at approximately 10%, which is significantly higher than in the general population.⁴ Considerable research has been devoted to examining the relationship between savant syndrome and autism, with particular interest in understanding how these two conditions coexist and persist within affected individuals.⁵

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Until now, research regarding savant abilities in ASD are still limited. However, there are several hypotheses that have been proposed to explain the neurodevelopmental mechanisms behind savant skills in ASD. One prominent theory is that savant abilities arise from enhanced perceptual functioning and local processing bias, common features in ASD, which may support high-detail focus and pattern recognition.^{6,7} Neuroimaging studies also suggest the presence of atypical connectivity patterns, particularly reduced integration across brain hemispheres with hyperconnectivity in specific cortical areas involved in memory or perception.⁶ Additionally, theories involving left-hemisphere dysfunction and compensatory right-hemisphere processing have been advanced to explain the concentration of literal and visuospatial talents in savants.⁷

Despite increasing research interest, it remains unclear whether the presence of savant abilities in ASD is associated with trade-offs in other functional domains. Some studies suggest that cognitive advantages in savants might come at the expense of social or behavioral functioning, while others propose that savant traits may offer adaptive pathways for communication or self-regulation.^{8,9} However, the findings across the literature are inconsistent, with some studies reporting superior cognitive profiles in savants without differences in social ability,¹⁰ and others reporting worse social outcomes.¹¹

This systematic review and meta-analysis aim to synthesize the current evidence comparing cognitive, behavioral, and social traits in autistic individuals with and without savant syndrome. By clarifying the functional profiles of savants, this study may provide insights into neurocognitive diversity in ASD. Furthermore, the findings could contribute to a deeper understanding of the mechanisms underlying savant abilities and inform tailored approaches to support the strengths and needs of individuals on the spectrum.

2. METHODS

This systematic review was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Prior to initiation, the study protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) under the reference number CRD420251041272.

Data for this review were gathered through comprehensive searches of five major biomedical databases PubMed, ProQuest, Embase, PsycNet, and ScienceDirect. The search covered each database from up to July 10, 2025. The search strategy used keywords such as autism spectrum disorder, savant syndrome, and extraordinary ability along with related terms and synonyms to ensure thorough coverage of relevant literature. Both controlled vocabulary terms (for example, MeSH terms in PubMed) and free-text terms were used to maximize the retrieval of pertinent studies. No restrictions were placed on language or publication year. Full search strategies are provided in the Supplementary Materials (**Table S1**).

Two reviewers (TCC and PNTYM) independently screened titles, abstracts, and full texts. Discrepancies were resolved through consultation with an independent reviewer. Reasons for exclusion were documented during full-text screening. Additionally, reference lists of included articles were manually searched to identify any additional relevant studies. Data extraction was performed by PNTYM and TCC and verified by an independent reviewer. Any inconsistencies were jointly reviewed and resolved to ensure the accuracy of the final dataset.

Studies were eligible for inclusion if they investigated extraordinary abilities, savant syndrome, or acquired exceptional skills in individuals diagnosed with ASD. Individuals with ASD that has savant abilities must show presence of extraordinary skills in one or more area. Eligible studies could include any age group and any clinical or community setting. Studies needed to report factors associated with the presence, development, or characteristics of savant skills or acquired special abilities in individuals with ASD.

Studies were excluded if they focused on other neurodevelopmental or psychiatric conditions without specific analysis of ASD, or if they did not report original data (such as reviews, meta-analyses, editorials, or commentaries). Studies conducted in animals or published in languages other than English were also excluded. Moreover, reference lists of relevant reviews and meta-analyses were screened to identify additional eligible primary studies.

Two reviewers (TCC and PNTYM) independently assessed the risk of bias, and any disagreements were revisited and resolved collaboratively, with input from an independent reviewer when needed. The risk of bias was evaluated using the JBI (Joanna Briggs Institute's) Critical Appraisal Tools' checklist, which includes five key domains: patient selection, index test, reference standard, flow and timing, and data management. Each domain was rated as having low, high, or unclear risk of bias. If any question within a domain indicated a potential bias, that domain was classified as high risk. If only one domain was rated as unclear, the overall risk of bias for that study was considered unclear. Publication bias was assessed visually using a funnel plot and statistically evaluated using Egger's test.

The meta-analysis was performed using R software. Heterogeneity among the included studies was evaluated with the I^2 statistic and the Chi-square test. A fixed-effect model was used when the data showed low heterogeneity ($I^2 < 50\%$), while a random-effects model was applied for data with substantial heterogeneity.

3. RESULTS

A total of 13 studies met the inclusion criteria, encompassing data from diverse geographical and clinical settings, as shown in PRISMA figure in Supplementary Materials (**Figure S1**). The included studies varied in design but consistently compared individuals with ASD who possess savant abilities to their non-savant counterparts across cognitive, behavioral, and social domains (**Table 1**). Methodological quality was assessed using the JBI Critical Appraisal Checklist and is summarized in (**Table S2**). All studies met the predefined quality and methodological criteria and were deemed eligible for inclusion in the final quantitative synthesis.

Cognitive Functioning

Meta-analysis of 22 cognitive outcomes revealed that individuals with savant syndrome demonstrated significantly higher cognitive performance than non-savant individuals with ASD. The pooled standardized mean difference (SMD) was 0.73 (95% CI: 0.59 to 0.87, $p < 0.001$), indicating a moderate to large effect size in favor of the savant group (Figure 1). Heterogeneity was moderate ($I^2 = 44.8\%$, $p = 0.0126$), suggesting relatively consistent findings across studies

Table 1.
Characteristic of included studies

Author (year)	Country	ASD definition	Savant definition	Type of Savant Skill					Total Savant	Total Sample	Results
				Memory	Visuospatial	Music	Drawing	Reading			
Kim et al (2011) ¹²	Korea	DSM-IV	ADI	47 (78.3%)	8 (13.3%)	13 (21.67%)	8 (13.3%)	14 (23.3%)	60 (52,6%)	141	<ul style="list-style-type: none"> • 141 ASD participants were divided into savant and nonsavant groups to assess ASD symptoms using the domain and total scores of the K-ADI-R, K-ASDS, and SRS. • Higher mean age and IQ score in savant group (p<0.05) • Higher restricted, repetitive and stereotype behavior in savant group (p <0.05) • Higher language and cognitive scores in savant group (p <0.05)
Hughes et al (2017) ¹³	UK	Formal diagnosis from physician	Parent-reported	23 (57.5%)	N/A	27 (67.5%)	14 (35%)	11 (27.5%)	40 (54%)	74	<ul style="list-style-type: none"> • This study investigated the link between synaesthesia and savant skills in autism by testing three groups, individuals with autism and savant skills (n=40), individuals with autism without savant skills (n=34), and non-autistic controls (n=29) — using a validated test for grapheme-colour synaesthesia • Higher prevalence of synaesthesia in savant group (p <0.05)
Daniel and Menashe (2020) ¹⁴	USA	Formal diagnosis from physician	ADI	N/A	N/A	N/A	N/A	N/A	711 (35%)	2740	<ul style="list-style-type: none"> • 2,740 autistic children divided into savant and non-savant groups based on ADI-R criteria, and assessed autistic traits using the SRS for both children and their parents, applying statistical tests (chi-square, t-tests, Mann-Whitney U, ANOVA, and regression models) to examine group differences and familial correlation • Higher social responsiveness in savant group (p<0.05)
Howlin et al (2004) ⁴	UK	Lifetime diagnosis confirmed on ADI	Parent-reported	3 (13%)	3 (13%)	2 (8.6%)	N/A	N/A	23 (16,78%)	137	<ul style="list-style-type: none"> • 137 individuals with autism (mean age 24) were evaluated using parental reports and Wechsler subtest performance • Higher cognitive skill in savant group (p<0.05)

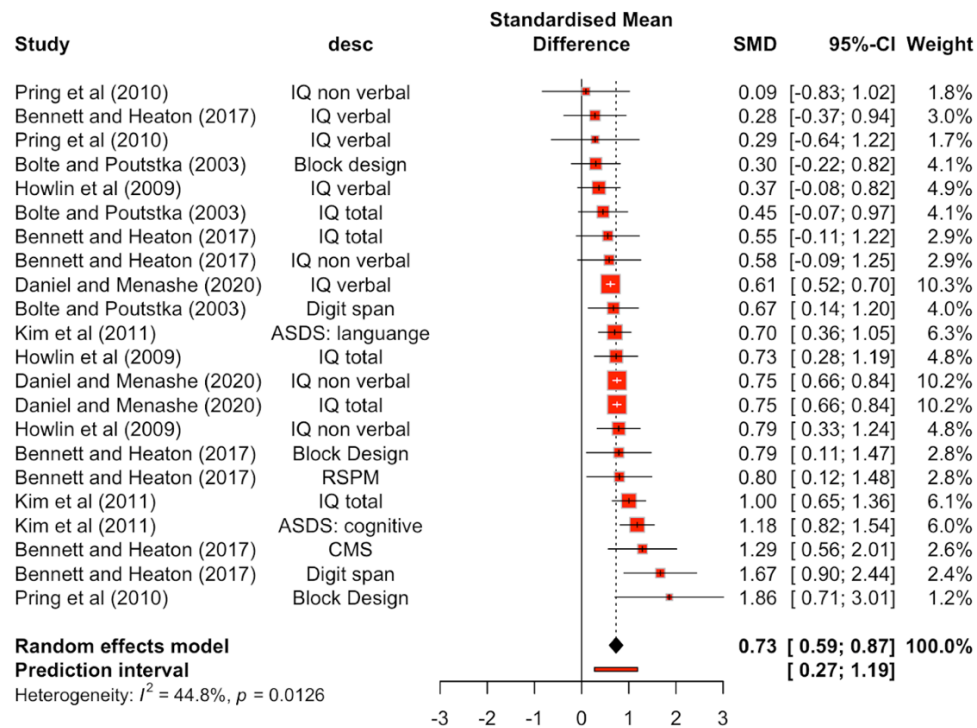
Bal et al (2023) ¹⁵	USA	Formal diagnosis from physician	Parent-reported	403 (60.2%)	137 (20.4%)	119 (17.7%)	87 (13%)	228 (34%)	669 (45,5%)	1470	<ul style="list-style-type: none"> • This study analyzed 1,470 autistic children (ages 4–18, IQ > 70). • Nearly half had at least one parent-reported talent and another 23% had personal strengths, with distinct cognitive profiles across domains such as visuospatial, drawing, computation, music, and memory, highlighting the need to examine strengths separately by domain for a more nuanced understanding. • Higher overall cognitive levels (p<0.05)
Bennett and Heaton (2012) ¹⁰	UK	Formal diagnosis from physician	Parent-reported	35 (67.3%)	11 (21.1%)	12 (23%)	12 (23%)	12 (23%)	52 (41,6%)	125	<ul style="list-style-type: none"> • This study surveyed parents of 125 individuals with autism and conducted case studies of three with exceptional music, art, or math skills • Higher working memory in savant group • Savant abilities were linked to superior working memory and highly focused attention, but not to increased obsessiveness, intellectual impairment, or local processing bias.
Bennett and Heaton (2017) ¹⁶	UK	Formal diagnosis from physician	Parent-reported	N/A	N/A	N/A	N/A	N/A	17 (47,2 %)	36	<ul style="list-style-type: none"> • This study compared intellectually able children with ASD who had validated savant skills to matched non-savants, finding few clinical differences but significantly superior working memory, focused attention, and analytic skills in the savant group, suggesting these cognitive strengths may underlie the pattern perception and veridical mapping abilities associated with savant syndrome. • Higher working memory and analytic skills (p<0.05) in the savant group
Pring et al (2010) ¹⁷	UK	Formal diagnosis from physician	Parent-reported	N/A	N/A	N/A	N/A	N/A	9 (50%)	18	<ul style="list-style-type: none"> • Compared local and global processing in savant artists with ASD compared to non-talented individuals with ASD or mild/moderate learning difficulties and artistically talented or non-talented students • While all groups showed similar local perceptual processing on the embedded figures test, savant artists outperformed others on the block-design task, suggesting that enhanced local processing combined with strong motor control supports savant artistic talent.

Meilleur (2015) ⁸	Canada	Formal diagnosis from physician	ADI	127 (79.8%)	77 (48.4%)	39 (24.5%)	32 (20.1%)	49 (30.8%)	159 (62.5%)	254	<ul style="list-style-type: none"> • High prevalence of special isolated skills (62.5%) and perceptual peaks (58%, compared to 13% in controls), with SIS increasing with intelligence and age, and no direct link between SIS and PP in the same modality, suggesting that autistic talents are shaped by both genetic factors and experience-dependent influences. • Higher cognitive functioning in savant group (p<0.05)
Bolte and Poustka (2004) ¹⁸	Germany	Clinical diagnosis from ADI-R and ADOS	ADI	16 (48.4%)	1 (3%)	6 (18.1%)	1 (3%)	4 (12.1%)	33 (55,9%)	59	<ul style="list-style-type: none"> • Compared the Wechsler intelligence profiles of 33 autistic individuals with savant abilities and 26 without, finding minimal overall cognitive differences but significantly higher Digit Span scores in the savant group, suggesting relatively stronger working memory or rote memory processes as a potential core component of savant skills. • Higher working memory and executive function in savant group (p<0.05)
Vital et al (2009) ⁹	UK	Formal diagnosis from physician using CAST	Parent-reported	441 (41%)	N/A	173 (16%)	410 (38.1%)	N/A	1075 (16,7%)	6426	<ul style="list-style-type: none"> • Compared 6,426 eight-year-olds with and without parent-reported special abilities, examining ASD-like traits in social interaction, communication, and restricted and repetitive behaviors, along with IQ, sex, and socioeconomic status. • Higher IQ score in savant group (p<0.05) • Higher restricted and repetitive characteristics in savant group (p<0.05), suggesting a link between special abilities and a featural, detail-focused processing style often described as “weak central coherence.”
Clark et al (2023) ¹⁹	Australia	Formal diagnosis from physician	Parent-reported confirmed by psychologists	N/A	N/A	N/A	N/A	N/A	22 (28,9%)	76	<ul style="list-style-type: none"> • In 76 autistic sample, 53% of parents, 21% of teachers, and 29% of clinical psychologist assessments identified at least one exceptional skill, with low agreement between parent and teacher reports (κ = .03) • No meaningful relationship between savant and autism severity

Itzhak (2013) ²⁰	Israel	Formal diagnosis from physician	ADI	45 (40.1%)	24 (21.4%)	27 (24.1%)	3 (2.6%)	22 (19.6%)	112 (28,1%)	398	<ul style="list-style-type: none"> • Savant potentially linked to enhanced local connectivity supporting detailed information processing. • Higher adaptive skills in savant group (p<0.05) • Lower social and communication impairment in savant group (p<0.05) • Lower stereotyped behavior in savant group (p<0.05)
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Abbreviation: ADI: Autism Diagnostic Interview; DSM-IV: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; CAST: Childhood Autism Spectrum Test; ADI-R: Autism Diagnostic Interview-Revised; ADOS: Autism Diagnostic Observation Schedule; IQ: Intelligence Quotient.

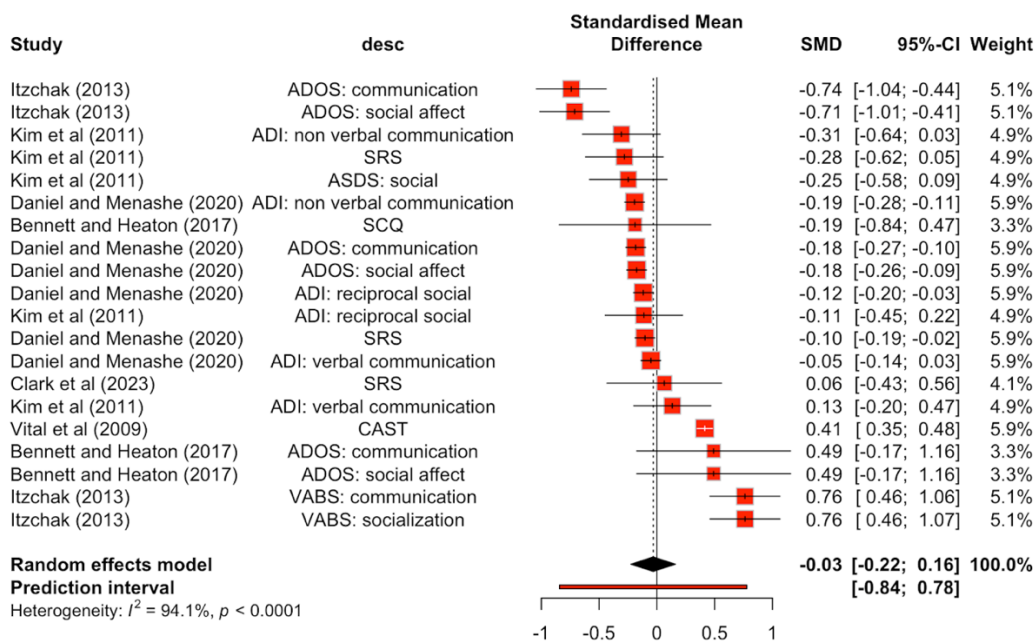
Figure 1.
Forest plot of cognitive domain



Social Functioning

Data from 20 social domain measures, including ADOS, SCQ, SRS, and VABS subscales, showed no significant difference in social abilities between savant and non-savant individuals. The overall SMD was -0.03 (95% CI: -0.22 to 0.16, [$I^2 = 94.1\%$, $p < 0.0001$]) (Figure 2).

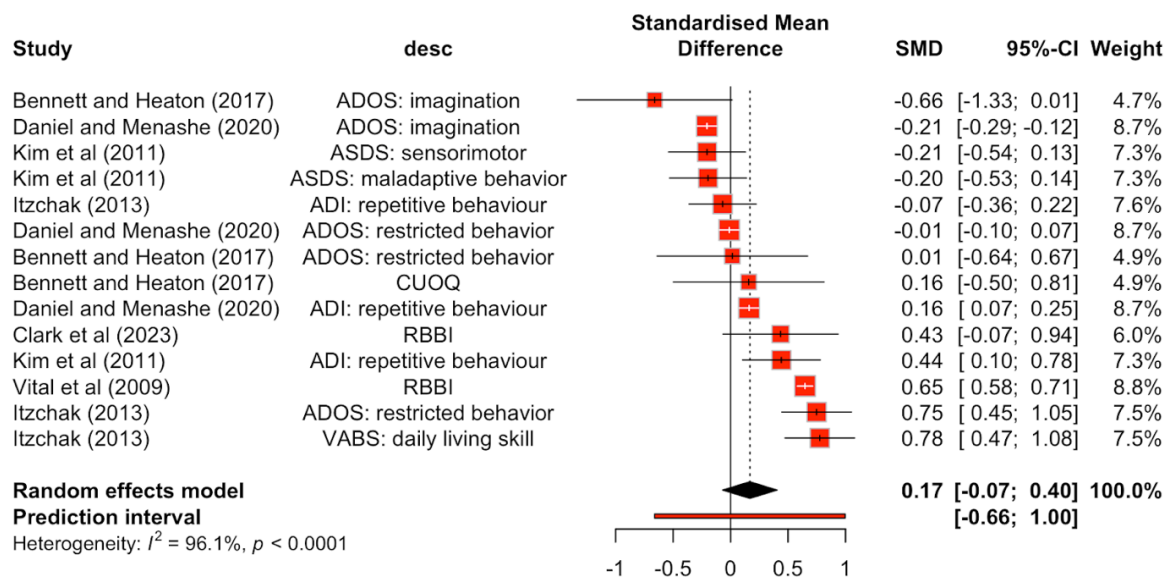
Figure 2.
Forest plot of social domain



Non-Social Behavioral Traits

Analysis of 14 outcomes assessing non-social domains—primarily repetitive behaviors, imagination, and sensorimotor features—showed a small, non-significant difference favoring the savant group. The pooled SMD was 0.17 (95% CI: -0.07 to 0.40, $p > 0.05$, $I^2 = 96.1\%$, $p < 0.0001$) (Figure 3).

Figure 3.
Forest plot of non-social domain



Age

Eight studies reported age comparisons. The meta-analysis indicated that individuals in the savant group were, on average, older than non-savant participants, but the difference was not statistically significant. The pooled SMD was 0.33 (95% CI: -0.16 to 0.83, $p > 0.05$, $I^2 = 90.2\%$, $p < 0.0001$). The forest plot is provided in Supplementary Materials (Figure S4).

Sex Differences

Male participants: The pooled relative risk (RR) of being identified as a savant among males with ASD was 1.18 (95% CI: 0.61 to 2.26, $p > 0.05$), indicating no significant association. The forest plot is provided in Supplementary Materials (Figure S5).

Sensitivity Analysis

Table 2.

Leave-one-out analysis

Outcomes	n	Meta-analysis		Influential cases removed		
		SMD (95% CI)	I^2	SMD (95% CI)	I^2	n
Cognitive	22	0.73 (0.59; 0.87)	44.8%	-	-	-
Non-social	14	0.31 (-0.10; 0.73)	96.1%	0.03 (-0.16; 0.22)	64.0%	10
Social	20	-0.03 (-0.22; 0.16)	94.1%	-0.13 (-0.19; -0.07)	30.9%	15
Age	8	0.33 (- 0.16; 0.83)	90.2%	-	-	-
Sex	10	1.18 (0.61; 2.26)	78.5%	0.97 (0.68; 1.38)	39.6%	6

The leave-one-out (LOO) sensitivity analysis demonstrated that the cognitive domain findings were robust, with a stable pooled effect size (SMD = 0.73, 95% CI: 0.59–0.87) and moderate heterogeneity ($I^2 = 44.8\%$), indicating consistent cognitive advantages in individuals with savant skills (Table 2). The regression test for funnel plot asymmetry (Egger’s test) indicated no statistically significant evidence of publication bias ($z = 0.0025$, $p = 0.9980$), suggesting that

the distribution of studies in the funnel plot is symmetrical. The limit estimate ($b = 0.7391$, 95% CI: 0.5805–0.8976) closely matches the overall pooled effect size, confirming that the meta-analysis results are robust and unlikely to be influenced by small-study effects or selective reporting (Figure S6). In contrast, the non-social domain showed high initial heterogeneity ($I^2 = 96.1\%$) and a moderate positive effect (SMD = 0.31), which diminished to near zero (SMD = 0.03, 95% CI: -0.16 to 0.22) with reduced heterogeneity ($I^2 = 64.0\%$) after removing 10 influential studies, suggesting that initial results were driven by outliers. Egger's test showed no statistically significant evidence of publication bias ($z = -0.61$, $p = 0.54$), with a non-significant precision-limit estimate ($b = 0.26$, 95% CI: -0.13 to 0.66) (Figure S7).

Social outcomes, initially showing no clear difference (SMD = -0.03, $I^2 = 94.1\%$), stabilized after removing 15 influential studies, revealing a statistically significant but clinically small effect (SMD = -0.13, 95% CI: -0.19 to -0.07) and substantially reduced heterogeneity ($I^2 = 30.9\%$), indicating slightly lower social functioning among savants. Egger's test indicated no statistically significant evidence of publication bias ($z = 0.72$, $p = 0.47$), with a non-significant precision-limit estimate ($b = -0.13$, 95% CI: -0.45 to 0.19) (Figure S8). The age-related results remained imprecise with high heterogeneity (SMD = 0.33, 95% CI: -0.16 to 0.83; $I^2 = 90.2\%$), while the sex-related effects, though slightly attenuated after removing six influential studies, remained not statistically significant (SMD = 0.97, 95% CI: 0.68–1.38) with heterogeneity dropping from 78.5% to 39.6%, suggesting a robust but slightly overestimated initial sex effect. Egger's test showed no evidence of funnel plot asymmetry in the age domain ($z = -0.48$, $p = 0.63$), with a non-significant precision-limit estimate ($b = 0.52$, 95% CI: -0.35 to 1.40), indicating no statistically significant evidence of publication bias and stable pooled effect estimates (Figure S9). Similarly, in the sex domain, no statistically significant evidence of publication bias was found ($z = 1.22$, $p = 0.22$), with a non-significant precision-limit estimate ($b = 0.0087$, 95% CI: -0.0281 to 0.0455), suggesting the pooled effect is stable and not influenced by small-study effects (Figure S10).

4. DISCUSSION

This systematic review and meta-analysis provide a comprehensive synthesis of the cognitive, behavioral, and social characteristics of individuals with Autism Spectrum Disorder (ASD) who exhibit savant abilities compared to those who do not. The findings suggest that savant individuals demonstrate significantly higher cognitive functioning, while differences in social and non-social domains were small and statistically non-significant.

The most prominent and consistent finding of this meta-analysis is the enhanced cognitive functioning among savant individuals, with a pooled SMD of 0.73 (95% CI: 0.59 to 0.87). This supports previous literature suggesting that savant syndrome may represent a distinct cognitive phenotype within the autism spectrum.^{2,5} Studies have proposed that these enhanced abilities may stem from superior working memory, heightened perceptual discrimination, or atypical neural processing, particularly within right-hemispheric regions in ASD.²⁴ Neurobiological models further propose that left-hemisphere dysfunction, coupled with compensatory right-hemisphere activity, fosters a bias toward literal, detail-focused, and non-symbolic processing, which may underlie superior visual discrimination and other savant talents. In this context, the left hemisphere's role in hypothesis formation and pattern-matching appears disrupted, enabling the right hemisphere to dominate and facilitate highly specialized abilities that distinguish savant cognition from general cognitive profiles in autism. It is also possible that savants benefit from more targeted educational support or environmental stimulation related to their area of expertise, which may indirectly support general cognitive development.⁸

However, most studies investigating cognitive ability in autistic individuals with savant syndrome have relied heavily on the Wechsler Intelligence Scales (WISC/WAIS) to derive Full-Scale IQ scores.^{4,14,17,18} As reported, many savants demonstrate exceptional memory-related abilities, thus their performance on memory subtests within these scales can elevate overall IQ scores. This may create the impression of higher general cognitive functioning, even though the heightened scores may largely reflect domain-specific memory strengths rather than uniformly enhanced intellectual ability across all areas.²² Although many studies demonstrate a link between

IQ and functional outcomes, it is important to note that high IQ does not necessarily translate into adaptive competence. Consequently, interventions should not be narrowly focused on raising IQ per se, but rather on enhancing the underlying cognitive and learning processes that contribute to intellectual development.²³

Empirical research consistently highlights a striking dissociation in savants: remarkable domain-specific abilities often coexist with impaired adaptive functioning. Studies using the Vineland Adaptive Behavior Scales demonstrate substantial gaps between IQ and real-world functioning, with socialization skills being particularly weak. Such findings illustrate the “islands of genius in a sea of disability” phenomenon: while savants may excel in narrow cognitive domains, broader adaptive, executive, and social capacities frequently remain underdeveloped.¹⁷ However, contrary to some theoretical frameworks that propose a trade-off between specialized talent and social ability, our analysis did not find significant differences in social functioning between savant and non-savant individuals (SMD = -0.03, 95% CI: -0.22 to 0.16). Although some individual studies have reported poorer social skills among savants,¹¹ others indicate no disadvantage or even minor strengths in adaptive communication.¹⁰ These inconsistencies may reflect variations in the types of savant abilities examined, diagnostic tools used, or the presence of co-occurring intellectual disabilities. Furthermore, the wide prediction interval and high heterogeneity suggest that the relationship between savant skills and social ability is not uniform across individuals.²⁴

However, cognitive specialization and social functioning still rely on largely distinct neural and developmental pathways. Savant abilities are often rooted in enhanced perceptual processing, memory, or detail-oriented cognition—functions typically linked to atypical hemispheric specialization and local neural connectivity. By contrast, social functioning depends more on integrative systems involving the social brain network (e.g., medial prefrontal cortex, temporoparietal junction, and amygdala). Because these systems are partially independent, the emergence of specialized cognitive skills does not automatically impair social ability.^{2,24}

The meta-analysis also found no significant differences in non-social behaviors, including repetitive movements and restricted interests (SMD = 0.17, 95% CI: -0.07 to 0.40). While these behaviors are core features of ASD, their intensity or manifestation may not differentiate savants from non-savants in a clinically meaningful way. Some researchers have argued that repetitive interests may, in fact, serve as a foundation for the development of savant skills by allowing deep and sustained focus on a narrow domain.^{7,9} Nonetheless, this study's findings do not support a strong behavioral divergence between the two groups.

Although repetitive behaviors and restricted interests are core diagnostic features of ASD, their severity and expression vary widely across individuals. Savants and non-savants alike may engage in repetitive movements and restricted interests, but these behaviors are not inherently predictive of whether specialized talents emerge. In other words, the presence of repetitive interests is necessary but not sufficient for savant skill development. Many autistic individuals without savant abilities also show high levels of repetitive movements and restricted interests, while some savants display only moderate levels. This reduces group-level differences in meta-analytic comparisons. Moreover, savant skills appear to depend less on the sheer intensity of repetitive behaviors and more on how those interests are channeled.²⁵ When repetitive focus is directed toward highly structured domains (e.g., music, numbers, or visual detail), it may facilitate the acquisition of savant abilities.^{7,9} In contrast, when repetitive movements and restricted interest involve self-stimulatory or less structured activities, they may not translate into specialized skills. Because standard behavioral measures do not capture these qualitative differences, they may underestimate the functional role of RRBs in skill development.²⁶

Finally, methodological factors contribute: diagnostic instruments like the ADOS and ADI-R measure repetitive movements and restricted interest categorically, focusing on frequency or severity, but they do not assess the content or focus of repetitive interests.²⁷ As a result, savants and non-savants often score similarly on behavioral metrics, even though the functional outcomes of those behaviors diverge.^{10, 12,14,20}

Although savant individuals tended to be older on average, the age difference was not statistically significant. This may reflect the developmental nature of savant abilities, which often become more apparent with time and environmental exposure.²⁴ Similarly, the analysis of sex-related differences did not reveal significant associations between savant syndrome and gender. Previous studies have noted a potential male predominance in savant skills,¹⁵ but this may be influenced by diagnostic biases or differences in symptom presentation between males and females with ASD.²⁸

This study is among the first to quantitatively compare multiple functional domains in savant versus non-savant individuals with ASD. The use of standardized effect sizes and registered protocol strengthens the validity of the results. Additionally, some domains (e.g., adaptive functioning, emotional regulation) remain under-investigated in this population. Interventions can simultaneously nurture savant strengths and address social challenges. Because these domains are not mutually exclusive, strength-based approaches (e.g., using music, art, or memory skills to scaffold communication and engagement) may enhance both cognitive and social outcomes. The absence of a necessary trade-off undermines deterministic views of autism as a zero-sum condition where gains in one area require losses in another. Instead, it underscores the heterogeneity of ASD and highlights the importance of neurocognitive diversity in shaping individual developmental trajectories. Between-study heterogeneity was assessed and controlled through a leave-one-out (LOO) sensitivity analysis, in which each study was sequentially excluded to evaluate its influence on the overall effect estimate.

5. CONCLUSION

This systematic review and meta-analysis suggest that individuals with ASD who possess savant abilities display significantly higher cognitive functioning than their non-savant peers, while differences in social and non-social behavioral traits remain negligible. These findings support the notion that savant abilities do not come at the cost of core ASD impairments. Rather, they may reflect a distinct cognitive subtype within the spectrum. Interventions and assessments should adopt a strength-based, individualized approach that nurtures savant abilities while addressing adaptive and social needs, supported by future research to clarify their developmental and neurocognitive underpinnings.

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