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The Effectiveness of Safety Flour Clay Therapy on Fine Motor Skills of Children with Autism

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ABSTRACT
Data from the World Health Organization indicate a high prevalence of autism-related disabilities, with many children experiencing developmental delays of over five years and limited fine motor skills typically seen at the level of children aged 3 to 4. This study aims to support children with autism by enhancing their fine motor development through Safety Flour Clay therapy. The research was conducted to examine the effect of this therapy on improving fine motor skills in children with autism at SLB C and C1 Yakut Purwokerto and SLB Negeri Banjarnegara. A quantitative approach was employed using a pre-experimental design with a one-group pretest-posttest format without a control group. A total of 30 participants were selected through total sampling. Data were collected through observation using standardized instruments and analyzed with the Wilcoxon Signed Ranks Test. The results showed a significance value of 0.000 ($p < 0.05$), indicating a significant effect of Safety Flour Clay therapy on the improvement of fine motor skills in children with autism. This therapy presents a promising alternative to support physical development, particularly in the area of fine motor coordination.

Keywords: Autis, Fine Motor Skills, Safety Flour Clay

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INTRODUCTION

The term autism originates from the Greek word autos, meaning "self," which describes children with autism who appear to live in their own world. Rather than general tendencies such as preferring solitude or showing minimal responses, autism is characterized by identifiable differences in reciprocal social communication as well as restricted or repetitive patterns of behaviors, interests, or activities. A diagnosis of autism can be established as early as 18–24 months of age, based on observable behavioral patterns aligned with DSM-5 diagnostic criteria, at which point characteristic symptoms can be distinguished from typical development and from other developmental delays or conditions (21). Recognizing these clinical characteristics and early diagnostic indicators highlights the importance of understanding autism within a broader public health context.

According to data from the World Health Organization (WHO), the global prevalence of autism continues to increase, with approximately one in every 100 children worldwide diagnosed with autism. This prevalence varies across studies, and the figures represent the average across multiple research findings (18). Recent studies indicate that the global prevalence of Autism Spectrum Disorder (ASD) has reached 0.6%, which reflects a more recent meta-analytic estimate and may differ from the broader global average reported by WHO, showing a rapid increase in recent years. The prevalence rate in Southeast Asia is also recorded at 0.6%, mirroring

the global figure. A recent meta-analysis of 23 studies revealed that the estimated incidence of ASD in various Asian countries and regions including China, Japan, Iran, Indonesia, Israel, and Taiwan ranges from 1.1 to 21.8 per 10,000 individuals (13).

Despite this growing prevalence, many children with ASD continue to experience significant delays in fine motor development, and effective therapeutic nursing interventions remain limited in educational and clinical settings in Indonesia. Therefore, this study aims to examine the effectiveness of Safety Flour Clay therapy as a supportive intervention to improve fine motor skills in children with autism.

At present, there is no definitive survey regarding the exact number of children with autism in Indonesia. Between 2012 and 2021, it was estimated that 147 children were diagnosed with autism, and within the next ten years, the number of individuals with autism is projected to reach approximately 529,200, or around 2.4 million people (2). According to data from the Center for Data and Information (Pusdatin, 2021) of the Ministry of Education and Culture, there are 530 children with autism in Central Java (15). Disability data from Banyumas Regency between 2020 and 2024 show that there are 2,630 individuals diagnosed with intellectual disability, while Banjarnegara Regency recorded 1,250 individuals within the same period (14).

Based on the findings of the Denver Developmental Screening Test (DDST), one of the tools used to identify developmental disorders in children, autistic children experience developmental delays of more than five years, and their fine motor skills are typically limited to the equivalent of those of three- to four-year-old children (20). Children with autism who experience fine motor delays may find it difficult to control their hands when writing, sketching, grasping, clapping, playing, pointing, or performing daily tasks. They may also struggle to carry objects, squeeze clothing, or use scissors effectively (3). Considering this situation, various strategies are needed to help children with autism improve their fine motor abilities. A child's fine motor skills can be developed through basic games and play materials such as clay, building blocks, newspapers, and balls (19).

Previous research conducted by Boediono (2019) found that playing with clay has a positive impact on the fine motor skills of children with developmental disorders, particularly in improving their ability to coordinate finger movements such as pinching, squeezing, and grasping (4). Boediono (2019) also explained that playing with clay provides an enjoyable and engaging activity for children, allowing them to stay motivated and receive continuous guidance throughout the process (4). This approach helps children with autism achieve better progress in developing their fine motor skills. Furthermore, Boediono (2019) emphasized that playing with clay positively influences the hand and finger coordination of children with autism, such as pinching, squeezing, and holding objects. These findings can serve as a reference for related or future studies (4).

A preliminary study conducted through interviews with the principals of SLB N Banjarnegara and SLB C and C1 Yakut Purwokerto revealed that clay therapy has never been implemented to support fine motor development in children with autism. Based on an initial survey, there were 30 autistic students aged 7–16 years, from elementary to high school levels, all of whom were male: 5

students from grade 1, 2 students from grade 2, 6 students from grade 3, 1 student from grade 5, 5 students from grade 6, 4 students from grade 7, 2 students from grade 8, and 5 students from grade 10. Interviews with teachers indicated that the learning activities follow a modified Merdeka Curriculum through an Individual Education Program (IEP), incorporating non-academic assessments, including physical aspects such as fine motor coordination. These activities include classroom learning (writing and arithmetic), extracurricular programs, and self-development tasks related to basic classroom and daily activities (writing, cutting, coloring, etc.), as well as self-care skills (buttoning clothes, tying shoelaces, brushing teeth, etc.).

The results showed that 6.67% (5 students) could hold a pencil properly during learning activities, 66.67% (20 students) had weak pencil grip, and 23.33% (7 students) held pencils too tightly. Additionally, 16.67% (5 students) were able to button clothes independently, while 83.33% could not, 16.67% (5 students) could tie their shoelaces with assistance, whereas 83.33% could not and 23.33% (7 students) were able to brush their teeth with assistance, while 76.67% (23 students) were unable to do so. These findings indicate that most students have not yet developed adequate fine motor skills, which directly affect their academic performance and physical activity capacity.

In a study conducted by Wulandari et al (2018), it was noted that the prevalence of disabilities related to intellectual impairment (autism) remains significantly high (20). The study found that children with autism generally experience developmental delays of more than five years, and their fine motor abilities are typically limited to those of children aged approximately three to four years. Based on previous research and preliminary studies, experts have shown a strong interest in helping children with autism enhance their fine motor abilities through the use of clay-based therapy and developmental assessment tools. Traditionally, the base material for clay often includes lem fox (adhesive glue) to soften its texture; however, the increasing incidence of pica has raised safety concerns regarding its use. The prevalence of pica among individuals with autism is notably high. According to the Autism Research Institute, approximately 23.2% of autistic children and up to 60% of autistic adults exhibit pica behavior, emphasizing its widespread occurrence within the autistic population (9). To address this concern, the present study introduces a novel approach by substituting the adhesive component with salt as an activator, creating Safety Flour Clay that is safer for autistic children and reduces the risk of pica behavior.

This study aims to identify the effect of Safety Flour Clay therapy on fine-motor development in children with autism at SLB C and C1 Yakut Purwokerto and SLB Negeri Banjarnegara. It further seeks to describe respondent characteristics such as age, gender, and autism category; to examine the fine-motor development of autistic children before the implementation of Safety Flour Clay therapy; and to analyze their fine-motor progress after the intervention while determining the significance of the differences observed between pre- and post-therapy stages.

METHODS

This study employed a quantitative approach with a pre-experimental design using a *one-group pretest–posttest* format without a control group. The

research was conducted over a two-week period in December. The study population consisted of all elementary to high school students with autism at SLB Negeri Banjarnegara (20 students) and SLB C and C1 Yakut Purwokerto (10 students). The sampling technique applied was non-probability total sampling, resulting in a total of 30 respondents. The inclusion criteria covered all students with special needs (autism) from elementary to high school levels in both schools.

The research instrument utilized the standardized Autism Child Module Score Sheet developed from the Learning Module by Daniel & Sukamto (2021), which was used during both the pre-test and post-test to assess fine motor skills through specific indicators such as grasping, squeezing, rolling, shaping large and small balls, and placing clay into molds (5). The module was applied directly within each intervention session, where researchers observed the children's performance while completing structured Safety Flour Clay activities.

The intervention consisted of four sessions, each involving sequential fine-motor tasks designed to stimulate hand strength, bilateral coordination, and hand–eye precision. Special materials used in this study included Safety Flour Clay, shaping molds, containers, and a standardized observation sheet that provided detailed scoring criteria for each indicator. An Interrater Reliability test was conducted to evaluate the level of agreement between experts and raters in scoring the instrument indicators. Data collection was performed directly through observation sheets completed by the researchers for each respondent.

Data processing involved nominal and ordinal data in "before and after" formats, which did not follow a normal distribution; therefore, a non-parametric analysis was employed. The data were analyzed using the Wilcoxon Signed-Rank Test to determine the relationship between two related variables, with a 95% confidence level used for decision-making. All research procedures adhered to the ethical standards approved by the Muhammadiyah Health Research Ethics Committee (KEPK/UMP/46/VII/2024).

RESULTS AND DISCUSSION

Table 1 presents the characteristics of the 30 students who participated in this study. The age distribution shows that most respondents were between 7 and 10 years old, accounting for 13 students (43.33%). Based on gender, all respondents were male (100%). This homogeneous sample reflects the

Table 1. Distribution of Respondent Characteristics

Characteristics	Frequency	Percentage (%)
1. Age (year)		
7-10	13	43.3
Above 10-13	7	23.3
Above 13-16	10	33.3
Total	30	100
2. Gender		
Male	30	100
3. Autism Category		
Mild	20	66,7
Moderate	10	33,3
Total	30	100

demographic profile of autistic students enrolled in the participating schools, where the majority of diagnosed children were boys. This pattern is consistent with existing epidemiological evidence, including Shrestha et al., (2024), which reports that ASD is significantly more prevalent in boys than in girls (13).

Nonetheless, the absence of female participants represents a limitation, as the intervention outcomes cannot be fully generalized to girls with ASD.Regarding the autism classification, 20 students (66.7%) were categorized as having mild autism, while 10 students (33.3%) were classified as having moderate autism. These classifications were determined based on the diagnostic categories documented in each student's Individual Education Program (IEP), which follows school-based clinical assessments referencing DSM-5 criteria. However, no standardized classification instruments such as CARS or ADOS were used, which should be considered when interpreting the findings.

The Inter-Rater Reliability (IRR) analysis provided an overview of the level of agreement among experts and raters in assigning scores. The Cohen's Kappa coefficient obtained was 0.783, indicating a good level of agreement. These results demonstrate that the module instrument used to assess autism, fine motor skills, and cognitive abilities can be considered reliable with good consistency. Of the total 12 items included in the instrument, nine were found to be valid, as their calculated r-values exceeded the r-table value of 0.312. The remaining three items, which did not meet the validity threshold, were revised and refined prior to their use in the intervention to ensure clarity and measurement accuracy.

The material and media validity assessments conducted by two raters showed that the material validity score reached 81.81, categorized as "highly feasible," and the media validity score was 83.33, also categorized as "highly feasible." These results suggest that both the material and media are appropriate and feasible to be used as therapeutic tools for children with autism. These findings strengthen the methodological rigor of the study, indicating that both the instrument and the therapeutic materials were appropriate, feasible, and supported by strong statistical evidence.

Table 2 describes the improvement in fine motor skills observed among students after the intervention. At SLB C and C1 Yakut Purwokerto, before the intervention all respondents (10 students = 100%) had not yet achieved fine motor proficiency. After the intervention, fine motor development was achieved by 7 students (70%), while 3 students (30%)

Table 2. Fine Motor Skill Development Through Safety Flour Clay Therapy

Fine motor skill development	**Before**		**After**	
	f	**%**	**f**	**%**
Slb C and C1 Yakut Purwokerto				
Achieved	0	0	7	70
Not Achieved	10	100	3	30
Total	10	100	30	100
Slb Negeri Banjarnegara				
Achieved	3	15	13	65
Not Achieved	17	85	7	35
Total	20	100	20	100

still did not reach the expected level. Similarly, at SLB Negeri Banjarnegara, before the intervention fine motor skills were not achieved in 17 respondents (85%), with only 3 respondents (15%) achieving the expected criteria. However, following the Safety Flour Clay therapy, fine motor skills were achieved by 13 students (65%), while 7 students (35%) still had not reached the targeted development level.

These findings demonstrate a clear improvement in the fine motor abilities of children with autism following the implementation of Safety Flour Clay therapy. The increase in post-intervention achievement rates indicates that engaging, tactile-based play can effectively stimulate hand eye coordination, grasping control, and sensory-motor integration among autistic children.

Based on Table 3, it can be concluded that all research data were not normally distributed, as indicated by a significance value of less than 0.05. Therefore, the appropriate statistical test used in this study was the Wilcoxon Signed-Rank Test, which analyzes paired data before and after the intervention.

Table 4 presents the results of the Wilcoxon Signed-Rank Test, which yielded a Z value of 4.123 and a corresponding p-value of 0.000. These results indicate a statistically significant difference in fine motor skills before and after the intervention, leading to the rejection of the null hypothesis (H_0) and acceptance of the alternative hypothesis (H_a). This finding demonstrates that Safety Flour Clay therapy has a significant effect on improving fine motor development in children with autism at SLB C and C1 Yakut Purwokerto as well as SLB Negeri Banjarnegara.

This study was conducted among students with autism enrolled at SLB C and C1 Yakut Purwokerto and SLB Negeri Banjarnegara. The prominence of children within the 7–10-year age range in this study is noteworthy, as this developmental period is recognized as a critical stage for the emergence and intensification of autism-related symptoms. During these years, fine motor deficits tend to become more apparent, making early therapeutic intervention especially important.

This finding is consistent with the study conducted by Heri (2021), which stated that autism can cause serious health problems that require early intervention and prevention, particularly among children aged 6 to 12 years who are at higher risk. In this age group, symptoms of autism tend to manifest more visibly (7). Based on the prevalence data of

Table 3. Normality Test

Category	**Saphiro Wilk**		
	Statistic	**Df**	**Sig**
Pretest Fine Motor Skills	0.347	30	0.000
Posttest Fine Motor Skills	0.597	30	0.000

Table 4. The Effect of Safety Flour Clay Therapy on Fine Motor Development in Children with Autism at SLB C and C1 Yakut Purwokerto and SLB Negeri Banjarnegara

Category	***Z***	***p-value***
Fine Motor Skills Before and After The Intervention	-4.123	0.000

autism among children under 19 years old, which reaches 1.68 per 1,000 children, it is estimated that approximately 154,480 children in this age group are diagnosed with autism.

Children with autism aged 6 to 12 years generally experience more significant delays in fine motor development. In comparison, non-autistic children of the same age group typically demonstrate more optimal fine motor skill development and better performance (6). Children with autism often face challenges in controlling hand movements when writing or drawing, grasping objects, clapping, playing, pointing, and performing various behavioral or daily activities. Such developmental delays can also affect their ability to use hand muscles effectively, leading to difficulties in holding objects, buttoning clothes, cutting with scissors, or writing (3).

This finding is further supported by research conducted by Agustina (2022), which revealed that children aged 6 to 12 years generally achieve optimal fine motor development (1). However, among children with autism, this development tends to lag behind, indicating the need for specific interventions or therapeutic programs to support their progress. These persistent delays highlight the importance of implementing targeted therapeutic strategies such as the Safety Flour Clay intervention used in this study to help enhance fine motor development in children with autism.

The results of this study show that all respondents (100%) were male. This finding aligns with the study conducted by Heri (2021), which also reported that male participants constituted the majority of respondents (7). According to that study, boys are more likely to experience genetic abnormalities that affect brain cell function. Since females possess two X chromosomes, if one is damaged, the other can compensate for the defect. Autism is often associated with abnormalities in the X chromosome, which may explain the higher prevalence among males.

Similarly, Shrestha et al (2024) found that the prevalence of Autism Spectrum Disorder (ASD) was higher among males (64.4%) compared to females (35.6%) (13). Female children are less likely to be diagnosed with ASD because they tend to exhibit fewer overtly atypical behaviors, which may contribute to this gender disparity. Compared to boys, girls with ASD generally demonstrate stronger verbal abilities and fewer challenges in social interaction and communication. These traits may mask some of the core symptoms of autism, leading to delayed or even inaccurate diagnoses in females.

Based on the results of the study, the majority of respondents were classified as having mild autism, totaling 20 individuals (66.7%), while the remaining 10 respondents (33.3%) were categorized as having moderate autism. This classification was based on diagnostic information recorded in each student's Individual Education Program (IEP), which follows DSM-5 diagnostic levels to distinguish mild and moderate presentations. This study specifically included respondents within the mild and moderate categories as part of the inclusion criteria, whereas those with severe autism were excluded. This approach aligns with the findings of Rahma & Salsabila (2024), who explained that children with mild to moderate autism tend to exhibit a more structured learning pattern, in contrast to those with severe autism who generally require a less systematic and more individualized learning approach (12).

The structured nature of the Safety Flour Clay intervention requiring sequential, guided fine-motor tasks aligns well with the learning characteristics of children in the mild to moderate severity range. This alignment is important because the intervention results revealed a significant improvement between pre-test and post-test scores, indicating that children within these severity categories were able to benefit from the structured therapeutic activities provided.

The severity level of the disorder directly influences the degree of success achieved in administering therapy to individuals with autism. As the level of autism severity increases, it becomes more challenging to ensure that therapeutic interventions are effective (17).

The results of this study showed that at SLB C and C1 Yakut Purwokerto, before the intervention, fine motor skills had not yet been achieved by all respondents (10 students = 100%). After the intervention, improvement was observed, with 7 respondents (70%) achieving fine motor proficiency, while 3 respondents (30%) had not yet reached the expected level. Similarly, at SLB Negeri Banjarnegara, before the intervention, fine motor skills were not achieved in 17 respondents (85%), and only 3 respondents (15%) achieved the target. However, following the intervention, 13 respondents (65%) successfully achieved fine motor development, whereas 7 respondents (35%) remained below the target.

These findings align with Agustina (2022), who reported that prior to intervention, children's fine motor abilities were in a very low category with an average score of 48.5, indicating that their skills had not developed optimally (1). Likewise, a study by Lestari (2018) showed that after receiving playdough therapy, the average fine motor ability of children with autism increased to 71.8, categorized as good (8). However, about 33.3% of respondents showed no improvement comprising six children with moderate autism and four with mild autism.

This reinforces Werdini (2024), who emphasized that the severity of autism affects the effectiveness of intervention outcomes (17). One of the most common challenges identified was the ability to roll clay into large and small balls, which requires consistent and controlled hand pressure—an ability that remains difficult for some autistic children.

Fine motor skills must be nurtured and stimulated because they play an essential role in a child's overall development. From a neurological perspective, the process of neural maturation which involves brain development and the regulation of neuromuscular systems leads to noticeable improvement in fine motor categories after children with autism receive Safety Flour Clay therapy. The development of age-appropriate motor skills involves the coordination of small muscles throughout the body, as well as the integration of the fine muscles, nerves, and brain. This process is influenced by the fundamental principles of motor development, including sequence, motivation, experience, and practice (11).

In this study, Safety Flour Clay functioned as an educational play medium. The clay was prepared in various colors such red, green, blue, and yellow to attract the respondents attention. This aligns with Putri et al (2021), who stated that educational play materials, such as origami paper, plasticine, and colored blocks, have distinctive and appealing visual features that can be used to engage children and

facilitate learning (10). The use of Safety Flour Clay as a learning medium increased students interest because they are often easily bored with monotonous activities. Through Safety Flour Clay play, children can train their fine motor skills in multiple ways, including touching and manipulating the material, squeezing, rolling, forming large and small balls, and using molds creatively.

This finding is also consistent with Werdini (2024), who explained that using Safety Flour Clay as a learning medium can be both enjoyable and engaging. In reality, most classroom activities rarely incorporate such media, causing children to lose interest quickly (17). When lessons involve hands-on and creative materials, children become more enthusiastic and motivated to participate. Consequently, fine motor skills improve when the media used are enjoyable and stimulating.

The analysis showed that Safety Flour Clay therapy had a significant effect on improving fine motor skills among children with autism at SLB C and C1 Yakut Purwokerto as well as SLB Negeri Banjarnegara. These findings demonstrate that the intervention was effective in enhancing fine motor development within this population.

The results of this study support the findings of Rahayuningrum & Wahyuni (2021) who reported that Safety Flour Clay play therapy effectively improves fine motor development in children with autism (11). The children were observed to be diligent in following the procedures and showed strong interest in the therapy medium, both of which contributed to the success of the intervention. t. Similar results were reported by Lestari (2018) in a study conducted at a special education school in Sidoarjo, which also yielded a p-value of 0.000, confirming the effectiveness of Safety Flour Clay therapy in improving fine motor skills among autistic children (8).

This research is consistent with Anggraini (2022), who found that fine motor abilities such as cutting, squeezing, shaping, and molding improved significantly after guided therapy sessions (1). At the Autism Therapy Center “Anak Manis,” Safety Flour Clay therapy was shown to have a positive impact on fine motor development among autistic children aged 6–12 years, reflected by an average score increase of 16.53 points. This improvement indicates enhanced control over hand movements and emotional regulation. As stated by Tauriana & Siwi (2023), motor skills not only support children’s independence but also contribute to their self-control and confidence, such as when playing musical instruments or performing other motor activities (16).

The present study revealed improvement in fine motor skills after four sessions of Safety Flour Clay therapy. Respondents showed progress in at least two fundamental competencies: sensory ability (touching and squeezing the dough), bilateral coordination (rolling the clay using different techniques), and hand stability (placing, pressing, and closing molds). These improvements were supported by the respondents’ active engagement through the Applied Behavior Analysis (ABA) approach and their attraction to the texture, color, and aroma of the clay. However, several children displayed resistance due to reluctance to touch the medium for extended periods. This challenge may be addressed through alternative approaches, such as using fruits as complementary tactile media.

This study also incorporated Jean Watson’s theory, which emphasizes the

importance of holistic and transpersonal caring approaches. By applying these principles alongside ABA techniques, nurses and educators can create a therapeutic environment that supports the optimal development of children with autism. Overall, Safety Flour Clay therapy proved to have a positive and significant effect on improving fine motor skills in children with autism at SLB C and C1 Yakut Purwokerto and SLB Negeri Banjarnegara.

Considering the therapy's demonstrated effectiveness, a follow-up plan will be implemented at both SLB C and C1 Yakut Purwokerto and SLB Negeri Banjarnegara. The follow-up activities will include presenting the research results, developing intellectual property rights (IPR) registration for the Safety Flour Clay medium and its Standard Operating Procedure (SOP), and creating a framed SOP as a guide for future implementation.

LIMITATIONS

This study has several limitations. First, some respondents were reluctant to touch the therapy medium, which required additional patience and longer time for implementation. Second, respondents with moderate autism were more easily distracted by their surroundings and had difficulty following instructions, resulting in slower progress toward achieving the targeted competencies. Third, the use of natural materials made the clay medium more prone to changes in odor and texture. When stored at room temperature for more than one week without refrigeration, the texture became softer and produced an unpleasant smell, necessitating repeated preparation of the clay for each session.

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CONCLUSION

Based on the findings of this study, Safety Flour Clay therapy proved to be effective in improving fine motor development among children with autism at SLB C and C1 Yakut Purwokerto and SLB Negeri Banjarnegara. This was evidenSced by the results of the Wilcoxon Signed-Rank Test, which showed a significance value of 0.000 ($p < 0.05$), indicating a statistically significant difference between pre- and post-intervention stages. The improvement was observed through enhanced performance across several fine motor indicators, including rolling, squeezing, and pressing the clay into molds. The effectiveness of the therapy was further supported by the application of the Applied Behavior Analysis (ABA) approach, which helped autistic children better understand and follow instructions during the sessions.

RECOMMENDATIONS

It is recommended that Safety Flour Clay therapy be implemented routinely as part of non-academic learning programs in special education schools, particularly to support fine motor development. Teachers and therapists are encouraged to modify and adapt therapy activities according to the characteristics and individual needs of each child.

Furthermore, when using natural materials as the clay medium, attention should be given to maintaining the durability of the texture and aroma to ensure that the medium remains appealing and safe for longer use. Future research is also suggested to examine the effectiveness of this therapy for children with severe autism and to evaluate outcomes over longer intervention periods.

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