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Original Article

Preparation and Validation of Persian Version of Behavior Rating Inventory of Executive Function (BRIEF-SR) in 11-18 Year Old Normal Adolescence

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ABSTRACT

Background and Objective: Executive function includes a set of cognitive processes that are essential for controlling behaviors. Executive function helps manage and control thoughts and actions and refers to complex cognitive processes that require coordination with other subprojects. Measuring executive functions is associated with challenges, however, the most authoritative way to evaluate executive function is to use the report of executive functionof teenagers in the natural environment of life. The purpose of this study was to provide and validate a Persian Version of Behavior Rating Inventory of Executive Function (BRIEF-SR) of 11-18 years old normal adolescence.

Methods: In this psychometric study, at first English version of the BRIEF-SR questionnaire was translated in Persian and the reliability of each scale was evaluated. The content validity of this questionnaire was determined through a survey of 10 to 15 experienced occupational therapists. The second step was assessing the test-retest reliability of the Persian version of the BRIEF-SR questionnaire.

Results: Content validity results showed that almost all items of the BRIEF-SR questionnaire in the Content Validity Index scored above 0.79, and in the content validity ratio, all items except 5 items scored above 49.9. The internal consistency of the Persian version of the BRIEF-SR questionnaire was also obtained by Cronbach's alpha of 0.9, which indicates a good reliability. Moreover, the Pearson correlation coefficient was above 0.8, which indicates a high correlation.

Conclusion: The Persian version of the BRIEF-SR questionnaire showed that this questionnaire is a valid and reliable tool for assessing executive function in children and adolescents aged 11-18 years old.

Keywords: Persian version, Behavior Rating Inventory of Executive Function, Adolescent, Validation

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Introduction

Executive functions are a set of higher orders and self-regulating cognitive processes that help people control their thoughts and actions. Such skills include initiation, planning, attention flexibility, inhibition of inappropriate behavior or thinking, and error correction and detection (Abdollahipour F et al., 2016, Berthelsen D et al., 2017, Best J R., and Miller p H., 2010). The term "executive function" has different meanings such as will, planning, targeted activity, effective function, executive center, attention monitor system, simultaneous manipulation of information and cognitive flexibility. Our environment is constantly changing; executive processes are adapting us to different environments and situations, and also helps control inappropriate behaviors and plan to initiate an activity, and apply required management until we finish the activity, and follow life goals in a constructive path (Blakemore S J, and Choudhury S, 2006, Zelazo P D., and Carlson S M., 2012). Executive function plays an important role in cognitive functioning, emotional control and social interactions of an individual. In principle, executive function involves the creation and implementation of an approach to doing a task other than the routine of the individual (Byerley A K., and Donders J, 2013)). In 2004, Lezak described executive function as the criterion of human behavior that deals with how someone behaves, and that these behaviors are all necessary for the response to appropriate social and adult behaviors (Carlson S M, (2005)). Exercise developmental periods start from childhood and begin between birth to 2, 7 to 9, and the last period in the late adolescence between the ages of 16 and 19.Executive function is supported by a wide nerve network with cortical and subcortical components. This network determines how and when functions are performed from simple to complex. The integrity of these functions helps to compensate for defects in other areas, such as language or spatial-sight skills (Ciszewski S et al, 2014)). It should be noted that inhibit control and working memory are two essential parts of the executive function.

Executive function deficiencies often reduce the person's capacity for successful participation in important day-to-day activities, including academic, social, and self-care activities. Failure to take into account the consequences of the practice and ignoring social laws and customs may also indicate a malfunction of the executive. Most people with executive functional impairment, experience poor interpersonal skills and also experience significant problems in maintaining meaningful social relationships (Duku E, and Vaillancourt T, 2014, Wåhlstedt C., Thorell L B., and Bohlin G., 2008).

Adolescence is a dynamic period with significant changes in the level of behavior, cognition, and brain. Adolescence is characterized by physical and hormonal changes, and the period from childhood to adulthood is associated with changes in identity, cognitive flexibility, and self-awareness (Gioia G A., Andrwes K, and Isquith P K, 1996). Brain imagesshow that in this course the total brain volume rises, and brain function continues to grow, brain processing becomes more efficient and effective, and more complex skills emerge. Specific vulnerability in adolescence is associated with emotional control of high-risk behaviors. The adolescence period is also very sensitive to the types of cognitive impairments, including executive functions. During this period, many behavioral manifestations of executive dysfunction that result from neuropsychiatric problems appear.(Hughes C., and Graham A., 2002 , Isquith P K et al, 2005 9). Therefore, in this period, evaluation of how executive functions affect behavior is important in people with normal development and in people with a disorder (Crone E A., 2009).

Graham and Hughes (2002) argue that obstacles to obtaining reliable and durable tools in evaluating executive function are difficult to distinguish between automated and controlled actions (Lezak M D et al, 2004). When a person performs a new task, the smallest change in task requirements leads to the decomposition of the automated process into a controlled one. Another problem is the stimulus being new; according to Salthouse, these tools are designed to assess the ability to adapt to new problems, but problems are not new after a single run (Mahone E M et al, 2002). Most evaluations, methods, and psychometric tools were

Table 1. CVI score for the items of the BRIEF-SR questionnaire

Items	R-CVI	S-CVI	C-CVI	Items	R-CVI	S-CVI	C-CVI	Items	R-CVI	S-CVI	C-CVI	Items	R-CVI	S-CVI	C-CVI
1	0.85	0.89	0.95	21	0.96	1	0.92	41	0.94	1	0.84	61	0.76	1	0.84
2	0.84	0.88	0.91	22	0.92	0.89	1	42	0.87	1	1	62	0.87	0.99	0.83
3	0.83	0.92	0.89	23	0.81	0.88	0.86	43	0.72	0.84	1	63	0.89	0.89	0.8
4	0.8	1	0.81	24	0.97	0.94	0.75	44	0.98	0.83	0.96	64	0.95	0.94	0.91
5	0.91	0.83	0.92	25	0.93	1	1	45	0.91	0.8	0.89	65	0.98	0.85	0.99
6	0.82	1	1	26	1	1	0.89	46	0.82	0.91	0.82	66	1	1	1
7	0.87	1	0.86	27	0.88	0.89	0.85	47	0.86	1	0.9	67	1	1	0.89
8	0.84	1	0.75	28	0.97	0.97	0.92	48	0.97	0.89	0.89	68	0.87	0.96	0.85
9	0.89	1	0.89	29	0.89	0.93	1	49	0.92	0.88	0.97	69	0.84	0.95	0.92
10	0.86	0.89	0.97	30	0.91	1	0.84	50	1	0.94	0.93	70	1	0.91	1
11	0.87	0.88	0.93	31	0.84	1	1	51	0.86	0.96	1	71	0.96	0.89	0.84
12	0.85	0.94	1	32	0.83	1	1	52	0.75	0.91	0.88	72	0.85	0.81	1
13	0.82	0.8	0.84	33	0.98	0.93	0.93	53	0.85	0.85	0.84	73	0.88	0.96	0.98
14	0.92	0.84	1	34	0.84	0.88	0.88	54	1	0.88	1	74	0.93	0.89	0.84
15	0.91	0.83	1	35	1	0.9	0.9	55	0.8	0.97	1	75	0.67	0.85	1
16	0.82	0.97	0.96	36	1	1	0.89	56	0.93	0.84	0.96	76	0.82	0.93	1
17	0.9	0.94	0.89	37	0.96	0.93	0.85	57	0.88	1	0.89	77	0.96	1	0.85
18	0.89	1	0.93	38	0.89	0.95	0.95	58	0.9	1	0.82	78	1	0.82	0.88
19	0.85	1	0.88	39	0.85	0.99	0.84	59	1	0.98	0.9	79	0.86	0.96	0.97
20	0.85	0.9	0.9	40	0.95	0.92	0.83	60	1	0.95	0.89	80	1	0.89	0.99

first developed for adults to evaluate executive function, and then a modified or tentative adult version was used for adolescents and, ultimately, for children based on a "top-down" approach. It is important to know the nature of the functional impairment and its severity for planning health care (Martel M., Nikolas M., and Nigg J T, 2007).

Behavior Rating Inventory of Executive Function is an appropriate tool for evaluating the executive function of the person in the natural environment and there is good evidence for its reliability and validity in the clinical field. This tool was developed by Gioia, Guy and Isquith in 2000 and is one of the first tools used to measure adolescent executive functions (Salthouse T A., Atkinson T M., and Berish D E., 2003). Zabel et al. (2011) performed the validity and reliability of this tool in Spinafifida adolescents (Zabel, T A et al 2011).

BRIEF content is a problem-based measurement that asks a person to determine the problem in a specific behavior is never, sometimes, or often (Salthouse T A., Atkinson T M., and Berish D E., 2003). According to what has been said, the need for tools that examine executive functions and measure their defects and problems is inevitable. This is especially important for occupational therapists who design their therapeutic and clinical goals based on the participation and quality of life of the individual. Accordingly, preparation of Persian version and determining the validity and reliability of the BRIEF questionnaire as an appropriate tool for evaluating the areas of executive function are the primary objective of the present study. Given the dearth of such a tool in Iran and the importance of executive functions as a basic cognitive function in adolescent functions, the main goal of this study is therefore, to assess the validity and reliability of BRIEF in adolescents between 11 and 18 years of age. In hopes of doing this, an important step in the treatment of prone adolescents can be achieved, and this can be beneficial in promoting clinical treatments.

Materials and Methods

At first, the license to use the BRIEF test was obtained from the designers and then it was translated to Persian with respect to Iranian language and culture. The content validity of this questionnaire was evalu-

Table 2. CVR score of the BRIEF-SR questionnaire

Item	CVR	Item	CVR	Item	CVR	Item	CVR	Item	CVR
1	0.75	17	0.92	33	0.65	49	0.79	65	0.78
2	0.84	18	0.86	34	0.83	50	0.84	66	0.86
3	0.92	19	0.76	35	0.92	51	0.68	67	1
4	0.78	20	0.79	36	1	52	0.91	68	0.65
5	0.69	21	0.84	37	1	53	0.98	69	0.83
6	0.74	22	0.68	38	0.84	54	1	70	0.92
7	0.88	23	0.91	39	0.34	55	1	71	1
8	0.92	24	0.98	40	1	56	1	72	0.73
9	0.69	25	1	41	0.82	57	0.86	73	0.68
10	0.87	26	0.83	42	0.86	58	0.65	74	0.74
11	0.75	27	0.4	43	0.74	59	0.84	75	0.43
12	0.79	28	0.92	44	0.78	60	1	76	0.93
13	0.84	29	0.69	45	0.93	61	0.29	77	0.99
14	0.68	30	0.78	46	0.99	62	1	78	0.78
15	0.91	31	1	47	1	63	0.84	79	1
16	0.98	32	1	48	0.39	64	0.79	80	0.83

ated by twenty occupational therapists with sufficient experience in evaluating and treating psychiatric disorders. who had a sufficient history of evaluating and treating the problems of executive functions.The second step was to determine the reliability of the Persian version of the BRIEF-SR questionnaire running a test-retest reliability method. After the approval of the research project at the university, a copy of it and the introduction of necessary letters to the schools were presented. After their consent, schoolchildren were randomly selected.After a description of the purpose of the research and obtaining the consent by the researchers and the consent of the parents, in the first session, the demographic information, was obtained from the adolescents through a demographic information form. In order to investigate themental healthh status and absence of psychiatric disorders, the Beck's behavioral self-reported questionnaire (the adolescent's version) was completed by the subjects.Then the BRIEF-SR questionnaire was completed in case of normalmental status and again two weeks later the evaluation was done by the questionnaire..

Results

Content Validity Index

To assess the content validity index, the CVI questionnaire was first provided to the expert panel. In the CVI questionnaire, three criteria of simplicity, relevance and clarity were studied separately in a 4-point Likert scale. The content validity index was rated for simplicity (S-CVI) and clarity (C-CVI) for all 80 items above 0.79 (the lowest score was 0.8 and the highest score was 1).For item relevance (R-CVI), 76 items obtained the score above 0.79 with the lowest score of 0.8 and the highest score of 1; however, 5 items (43, 52, 61 and 75) obtained the score less than 0.79 i.e. (0.68, 0.72, 0.75, 0.76, and 0.67 respectively) (Table 1).

Content validity ratio (CVR)

To assess the content validity ratio, the CVR form of the questionnaire was provided to the samples. Experts rated the items in the questionnaire as essential. The results of content validity ratio in Table 2 also showed that 7 terms (27, 39, 48, 61 and 75) scored less than 0.49. The other items scored higher than 0.49. It should be mentioned that the lowest score was 0.61whereas the highest score was 1.

Reliability

In the reliability study, 120 adolescents were present whose gender characteristics were examined.

The results in Table 3 show thatof the 120 adolescents,

Table 3: Gender and age statistical indices for the reliability of the BRIEF-SR questionnaire

Frequency of gender			Statistical indicators of teen age to age						
	Numbers	Percentage	Mean	Minimum age	Maximum age	.S.D	Range	Median	Mode
Girls	54	45٪	15.5	11	18				
Boys	66	55٪	15.2	11	18	1.77	6	15.5	17
Total	120	100	15.3	11	18				

Table 4: Statistical Indicators for BRIEF-SR scores during the test phase

Variables	Numbers	Min	Max	.S.D	Mean
Inhibit	120	39	85	8.49	50.58
Shift	120	31	86	9.5	56.78
Monitor	120	37	73	8.43	53.65
Emotional control	120	39	78	7.96	49.51
Working memory	120	38	81	7.99	48.25
Organization	120	39	72	8.48	50.96
Organization of materials	120	31	75	9.56	50.65
Task completion	120	33	74	8.45	51.76
Total score	120	31	71	8.85	51.9

54 ones were girls (45%) and 66 boys (55%). The adolescents were randomly selected by cluster sampling from schools in different regions of Tehran. Of the 120 adolescents admitted, they were at least 11.1 years of age and a maximum of 18.1 years old. The difference between the ages of the oldest person to the smallest person was 7 years. The average age of these teenagers was 15.3 years.

The age of the participants in the research was examined according to gender. The minimum age for admission was 11 years and the maximum age limit was 18.11 18 years and 11 months.

The Scores and Indicators of the Questionnaire

The scores for the BRIEF-SR questionnaire, the mean scatter indicators and the standard deviation of their scales at the test stage are presented in Table 4.

Internal consistency

In order to check the internal consistency of items in the Persian version of the BRIEF-SR questionnaire, Cronbach's alpha coefficient was used. The correlation matrix of questionnaire items at the first level is shown in Table 5.

Correlation between working memory scale and emotional control with inhibit scale (r=0.65 and r=0.68) and working memory scale with planning and organization scale (r=0.68) showed an acceptable internal correlation. Correlation between test items is also scattered from poor (r=0.38) to medium to high (r=0.7).Cronbach's alpha scores showed a significant correlation between working memory and shift and monitor components of executive function.(r=0.67 and r=0.69), and between task completion and monitor index (r=0.64). However, there is a weak correlation between the indicators of organization and monitor (r=0.38).

In order to evaluate the internal consistency of items in the Persian version of BRIEF-SR, Cronbach's alpha coefficient was used which was obtained as 0.906. Its standardized one was 0.906 too. Also, the Cronbach's alpha coefficient was calculated at the test stage in case of item removal, which is shown in Table 6, below.

Table 5. Correlation matrix among the items at the first phase of execution

	Inhibit	Shift	Monitor	Emotional control	Working memory	Organization	Organization of materials	Task completion
Inhibit	1							
Shift	0.43	1						
Monitor	0.39	0.48	1					
Emotional control	0.68	0.54	0.76	1				
Working memory	0.65	0.67	0.69	0.64	1			
Organization	0.49	0.56	0.57	0.73	0.76	1		
Organization of materials	0.7	0.63	0.38	0.62	0.68	0.59	1	
Task completion	0.72	0.71	0.64	0.46	0.7	0.64	0.76	1

Table 6. Correlation between questions in case of the removal of the item

BRIEF-SR	Cronbach's alpha coefficient after the removal of the item
inhibit	0.866
monitor	0.915
Emotional control	0.886
Shift	0.884
Working memory	0.896
Planning and organization	0.889
Organization of materials	0.896
Task completion	0.879

Table 7: Pearson correlation coefficient for the scales of the BRIEF-SR questionnaire

Items	Correlation	Interpretation
inhibit	0.80	Very high
monitor	0.82	Very high
Emotional control	0.81	Very high
Shift	0.83	Very high
Working memory	0.85	Very high
Planning and organization	0.80	Very high
Organization of materials	0.81	Very high
Task completion	0.82	Very high

Test-retest reliability

The Pearson Correlation Coefficient for BRIEF-SR questionnaire was used for test-retest reliability. The result shown in Table 7.

Discussion

In recent years, standard tools have been developed to evaluate executive function, which is most commonly used by adults. However, in recent years, standard tools have been developed to evaluate executive function for children and adolescents which often have a specific approach in evaluating specific executive capacity and are not appropriate for evaluating executive function directly for academic skills. In this study, the prepara-

tion of the Persian version and determining the face and content validity and reliability of the Persian version of the BRIEF-SR questionnaire were examined. The BRIEF-SR test has been developed to evaluate executive function from a behavioral viewpoint that evaluates the function of an individual's natural environment. In choosing a measurement tool, one should always pay attention to the easy translation and a desirable quality of the translated version to the target language. Initial designers of the original version should pay more attention to this which means in the choice and use of words in phrases, try to avoid vague, non-transparent, and different meanings contextsand thus facilitate the translation of test content into other languages.

The BRIEF-SR questionnaire is a test to evaluate executive function in adolescents aged 11 to 18 years and eleven months old; it examines the executive function using the self-report of the adolescent in the natural environment of their life. In this study, we strived to prepare the Persian version of this test, and address its face and content validity as well as its reliability features.

The results of the content validity index (desirable CVI scores) showed that, according to experts, all the item of the BRIEF-SR questionnaire have simple, expressive, and clear meanings. However, items (43, 52, 61, and 75) showed an unacceptable and questionable scores for the measurement of executive function (item 43 (I do not know if my works cause others to be disturbed), item 52 (I commit mistakes due to carelessness), item 61 (I say inappropriate things), item 75 (it simply gives me a feeling of crushing)). It seems to experts that the above items have a psychological burden for adolescents and may lead to their misunderstandings. According to most experts, these items do not seem to be essential for evaluating executive functions. As indicated above, these four items showed unacceptable scores for measuring executive functions; that is, there was little agreement on the importance of the existence of these items in the Persian version of the BRIEF-SR questionnaire, however, because of the dependence of the final scores of the scales and total score of the questionnaire for all items, these four terms were also included in the Persian version of the BRIEF-SR questionnaire.

In order to assess the relative repeatability of the frequency of the test, the Persian version of the BRIEF-SR questionnaire with intervals of 2 to 4 weeks (in accordance with the time interval specified in the main implementation of the test) was given to 120 adolescents at first round and in the second round, 40 adolescents completed the questionnaire. The comparison of test-retest reliability was performed using Pearson correlation coefficient and the results showed that the test-retest reliability was high. The study by Duko and his colleagues in 2014 examining the reliability of the pre-school version of the test showed that the Canadian version of this questionnaire had a high degree of reliability. Girls received better inhibition and planning than the boys in working memory scales, and the results also showed that the scales of the questionnaire had a good convergence and good internal consistency (Slick D J et al., 2006). Byerly et al. (2013) demonstrated a BRIEF_SR validity for adolescents with brain impairment. The BRIEF_SR questionnaire has a high and desirable test reliability as well (ToplakM E, 2008).

In the present study, the Cronbach's alpha coefficient for items in the Persian version of the BRIEF_SR questionnaire was very good. It can be concluded that the Persian version of the BRIEF_SR questionnaire has a good and satisfactory internal consistency and shows that the BRIEF_SR questionnaire has well provided the components required for measuring executive function. Cizewski et al. (2014) performed the validity and reliability of the BRIEF-A questionnaire in 251 adolescents, and showed that this questionnaire was a valid and reliable tool for measuring the executive function of adolescents (Ciszewski S et al 2014). The results of the study by Stabouli et al. in 2017 also showed that the Greek version of BRIEF_SR had a very high internal consistency and an excellent test-retest reliability (Stabouli et al, 2017).

Therefore, considering the homogeneity and consistency of the Persian version, the results of this study could be compared toother studies in this regard, and state that this version has been able to maintain the consistency of the items in the original version and can

hope that the tool would be consistent with the original tool.

Conclusion

The results of face and content validity showed that from the point of view of adolescent specialists, all items enjoyed easy translation and had a desirable quality. The results of content validity index showed that, according to experts, almost all the items of the Persian questionnaire express the concepts related to the assessment of executive functions.The comparison of the test-retest was performed in two turns (n=40) using Pearson correlation coefficient, which indicated that the test-retest reliability was good. In general, it can be concluded that the Persian version of the BRIEF_SR questionnaire has a high and desirable test-retest reliability.Therefore, the use of the Farsi version of the "Behavior Rating of Executive Function" is recommended as a useful and appropriate tool, and this tool will be able to meet the existing clinical and research needs of researchers, specialists, therapists, and especial occupational therapists.

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Conflict of Interest

The authors declared no conflict of interest.

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مقالهٔ پژوهشی

تهیه و اعتبارسنجی نسخه فارسی پرسشنامه رتبه بندی رفتاری کارکردهای اجرایی (BRIEF-SR) در نوجوانان هنجار ۱۱-۱۸ ساله

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چکیده

زمینه و هدف: کارکردهای اجرایی شامل مجموعه ای از فرآیندهای شناختی است که برای کنترل رفتار ضروری است. کارکردهای اجرایی به مدیریت و کنترل افکار و اعمال کمک می کند و به فرایندهای پیچیده شناختی اشاره دارد که به هماهنگی با سایر زیر فرایندهای مغزی نیاز دارند. اندازه گیری کارکردهای اجرایی همیشه با چالش هایی همراه است، اما معتبرترین راه برای ارزیابی عملکرد اجرایی در نوجوانان، استفاده از گزارش عملکردهای اجرایی آن ها در محیط طبیعی زندگی است. هدف از این مطالعه تهیه و اعتبارسنجی نسخه فارسی پرسشنامه رتبه بندی رفتاری کارکردهای اجرایی نوجوانان (BRIEF-SR) بهنجار ۱۱ تا ۱۸ ساله بود.

روش کار: در این مطالعه ی روان سنجی ، ابتدا نسخه انگلیسی پرسشنامه BRIEF-SR به فارسی ترجمه شد و سپس پایایی هر مقیاس مورد بررسی قرار گرفت. روایی محتوای این پرسشنامه از طریق نظرسنجی از ۱۰ تا ۱۵ کاردرمانگر با تجربه انجام شد. در گام دوم ، ارزیابی آزمون - بازآزمون نسخه فارسی پرسشنامه BRIEF-SR انجام شد.

یافته‌ها: نتایج روایی محتوا نشان داد که تقریباً کلیه گویه های پرسشنامه BRIEF-SR در شاخص اعتبار محتوا بالاتر از ۰/۷۹ و در نسبت روایی محتوا ، کلیه موارد به استثنای ۵ مورد بالاتر از ۴۹,۹ است. سازگاری داخلی نسخه فارسی پرسشنامه BRIEF-SR نیز توسط آلفای کرونباخ برابر ۰,۹ بدست آمد که نشانگر قابلیت اطمینان خوب است. همچنین ضریب همبستگی پیرسون بالاتر از ۰/۸ بود که نشان دهنده همبستگی بالا است.

نتیجه‌گیری: نتایج مطالعه حاضر نسخه فارسی نشان داد که پرسشنامه BRIEF-SR ابزاری معتبر و مطمئن برای ارزیابی عملکرد اجرایی در نوجوانان ۱۱ تا ۱۸ سال است.

واژه‌های کلیدی: نسخه فارسی ، پرسشنامه رتبه بندی رفتاری کارکردهای اجرایی ، نوجوان ، اعتبار سنجی