The effect of applying emotional intelligence components on coping strategies in adolescents with beta-thalassemia major: a randomized clinical trial

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Abstract

Background Thalassemia is one of the most common genetic disorders. Patients with beta-thalassemia major confront serious clinical and psychosocial challenges in their all lives, which require coping strategies. It appears that psychological interventions are necessary to improve their coping skills. The aim of this study was to determine the effect of applying emotional intelligence components on coping strategies in adolescents with beta- thalassemia major.

Methods This randomized clinical trial study involved 60 teenagers with beta- thalassemia major who were divided equally into intervention and control groups. The experimental group participated in 9 sessions of an emotional intelligence program consisting of 90 min, held both virtually and in person, two sessions per week. We investigated problem-focused and emotion-focused (including positive emotion-focused and negative emotion-focused) coping strategies of both groups of adolescents using the Billings and Moos questionnaire before the intervention, immediately after the intervention, and one month after the intervention. Data were analyzed using SPSS 21. Then, according to the research objectives, independent t-tests, Chi-square, Mann–Whitney, repeated measures Analysis of Variance (ANOVA) and Bonferroni test were used.

Results In experimental group, the mean score of problem-focused (problem-solving, cognitive evaluation) and positive emotion-focused (social support) coping increased from (*14.2 ± 2.6) and (5.0 ± 0.5*) before the intervention to (*29.6 ± 3.1) and (10.9 ± 1.3*) one month after the intervention, respectively ($P < 0.001$). However, the mean score of emotional inhibition and somatic inhibition (negative emotion-focused) decreased from (*13.8 ± 1.7*) and (*6.7 ± 1.5*) before the intervention to (*8.6 ± 2.0*) and (*3.8 ± 1.8*) one month after the intervention, respectively ($P < 0.001$). While the mean score of problem-focused and emotion-focused coping strategies before and one month after the intervention remained stable in the control group.

Conclusions Adolescents with beta-thalassemia suffer from psychosocial disorders and they also cope maladaptive with their illness. Applying emotional intelligence has improved their coping strategies. Caregivers should be encouraged to assess coping skills in teenagers with beta-thalassemia major and use methods such as emotional intelligence to improve them. Therefore, it can help these adolescents to deal effectively with stress and complications of the disease.

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Background

Thalassemia is a heritable disorder characterized by a defect in the production or non-production of the globin chain of hemoglobin [1, 2]. This synthetic defect leads to severe anemia, requiring regular blood transfusions and iron chelation therapy [3]. Thalassemia is the most prevalent inherited hemoglobin disease reported in more than 60 countries [1]. This chronic disease has great incidence in the Middle East, Mediterranean, Indian subcontinent, and Southeast Asia [4]. Iran is a country with about 26,000 patients with thalassemia, and its frequency is between 2.5% and 15% in different regions of the country [5].

Patients with Beta-thalassemia and their families bear a significant psychosocial burden throughout their lives [6], which is especially important during childhood [4]. These children suffer from physical, social, emotional and school problems [7]. Physical problems such as chronic anemia, bone deformities, growth retardation, delayed physical maturation, and short height cause poor body image and lack of self-confidence [3, 8]. Also, they face social problems such as separation from family, physical and facial deformities, fear of death, and limitations in social activities, schoolwork, and play which can lead to depression and anxiety in these children [9]. Children with thalassemia think they are different from their friends and have negative beliefs about their lives. Therefore, they feel guilty, highly nervous, and low self-respect [7]. On the other hand, adolescents with thalassemia not only have to cope with the transition from childhood to adulthood and all the challenges that come with it, but also have to adapt to thalassemia and its treatment [10]. Therefore, coping with their emotional problems requires adaptive coping skills [11].

Coping is considered a response to reduce the emotional, physical and psychological distress related to challenging life situations and daily bothers [12]. Lazarus and Folkman (1980) defined coping as the cognitive and behavioral efforts to overcome, tolerate, or decrease external and internal demands and conflicts between them [13]. Coping strategies can be divided into two types: problem-solving strategies involve actively reducing challenging conditions, whereas emotion-focused coping strategies aim to manage the emotional impact of stressful or potentially stressful situations [14]. Effective coping styles alleviate emotional distress, while inappropriate coping strategies exacerbate the negative effects of stress [15]. Results of different studies indicate that children suffering from long-lasting illnesses are less able to cope adaptive with the disease and its side effects [1, 5, 12]. In the treatment of chronic diseases, the patient`s ability to effectively manage the burden of long-lasting illness in daily life can play an impressive role in treatment outcomes [1, 16]. According to the importance of coping skills and the use of maladaptive coping strategies in dealing with stress in beta-thalassemia patients, more attention should be paid to improving coping strategies.

Bar-On & Parker (2000) describe coping strategies and adaptability as important components of emotional intelligence [17]. Salovey and Mayer (1990) introduced emotional intelligence as the ability to observe feelings and emotions of individuals and others, to differentiate between them, and to use this data to guide one`s beliefs and activities [18]. According to the Bar-On model, emotional intelligence includes emotionally and socially-related skills and abilities that specify how to understand and represent oneself, realize other people and communicate with them, and cope with everyday demands [19]. Bar-On identified 5 components of emotional intelligence that comprise 15 subscale, including: Intrapersonal (comprising self-regard, emotional self-awareness, assertiveness, independence, and self-actualization); Interpersonal (comprising empathy, social responsibility, and interpersonal relationship); Stress management (comprising stress tolerance and impulse control); Adaptability (comprising reality-testing, flexibility, and problem-solving); and General mood (comprising optimism and happiness) [19]. The results of some studies found that there was a significant correlation between emotional intelligence and coping strategies [14, 20, 21]. However, other studies indicate that there was not a meaningful relation between emotional intelligence and coping skills [17, 22]. According to the importance of coping with complications of beta-thalassemia major, specific conditions of these patients and also the limitations of studies in this field in Iran, the purpose of the study was to examine the effect of applying emotional intelligence components on coping strategies in adolescents with beta-thalassemia major.

Method

Study design and setting

This was a randomized clinical trial study conducted to investigate the effects of applying emotional intelligence components on problem-focused and emotion-focused (including positive emotion-focused and negative

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emotion-focused) coping strategies in adolescents suffering from beta-thalassemia major referred to Thalassemia and Hemophilia Clinic Center (Sarvar) from July 6th to October 30th 2021 (with the trial registration number IRCT20210521051356N1 in 17/06/2021). This study examined the effects of applying emotional intelligence components on two types of coping skills comprising problem-focused strategies (problem-solving and cognitive evaluation) and emotion-focused strategies, including positive emotion-focused (social support) and negative emotion-focused (emotional inhibition and somatic inhibition). This article is written based on the TREND statement checklist.

Participants

The inclusion criteria were 1) Having the informed consent to participate in the study, 2) Willingness to participate in the study, 3) having a medical record diagnosed with beta-thalassemia major, 4) Aged between 12 and 18 years, 5) Having the ability to read and write, 6) do not suffer from mental illness based on the medical records, 7) do not pass similar courses of emotional intelligence, 8) Lack of complementary therapies (such as acupuncture, yoga).

The exclusion criteria were 1) absence in 2 sessions or more of educational intervention 2) unwillingness to continue cooperation with the researcher during the study, 3) Failure to participate in the post-test 4) occurring stressful events for the patient or his/her family.

Data collect

The data were gathered through demographic information form and Billings and Moos coping strategies questionnaire.

Demographic data included 13 questions of gender, age, educational status, parental economic status, insurance, underlying disease, marital status, and duration of illness, hemoglobin level, ferritin level, history of splenectomy, iron chelation drug and occupation. Billings and Moos (1981), designed a questionnaire consisting of 19 Yes/No questions to assess coping strategies in difficult situations. Its modified version was published by them in 1984 and contained 32 items and evaluated two domains of problem-focused coping (comprising two subscales of problem-solving and cognitive evaluation) and emotion-focused coping (comprising three subscales of social support, emotional inhibition and somatic inhibition) [21, 23]. All these items were scored through a 4-point Likert scale from 0(never used) to 3(always used). The minimum and maximum scores are 0 to 96, respectively; the higher scores show a greater use of all the above-mentioned coping strategies. The retest reliability coefficient was reported 0.79 and for problem-solving, cognitive

evaluation, social support, emotional inhibition and somatic inhibition were 0.90, 0.68, 0.90, 0.65 and 0.90, respectively. The internal consistency reliability of the Persian version for the whole questionnaire was considered to be 0.41 to 0.66 [24]. In this study, Cronbach's alpha coefficients for problem-solving, cognitive evaluation, social support, emotional inhibition and somatic inhibition subscales were 0.76, 0.74, 0.78, 0.72 and 0.84, respectively. Moreover, the validity of this tool was determined by the content validity method. This questionnaire was approved by 10 experts and specialists in the field of the research topic. Back-translation method was used to translate the questionnaire by two independent translators.

Intervention and process

The study samples were recruited through convenience sampling based on the inclusion criteria in Thalassemia and Hemophilia Clinic Center (Sarvar). After explaining the main aim and methodology of the research to the teenagers and their parents, the written consents were obtained from adolescents and their fathers by researcher in Sarvar Clinic, as well as a form to collect demographic information. If the father was absent for any reason and the mother was with adolescent, the written consent was obtained from the mother. Then, potential participants were divided into two groups of intervention and control based on the days of referral (Even and odd days). Lottery was used to determine which day (odd or even) belonged to which group (intervention or control). Then, the intervention group divided into groups of 3–5 people based on lottery. This lottery was conducted by the researcher in the clinic. A number was assigned to each sample of the intervention group. She wrote the numbers in small papers and folded the paper. Then she poured it into a container and blended it. Then, in the presence of other authors, 3 to 5 papers were selected and placed in a group.

The intervention group members took part in training sessions about emotional intelligence components based on Bar-on model. The educational concepts of the classes were designed based on 5 components in Bar-on model as shown in Table 1 [19, 25]. Emotional intelligence training was provided in 9 sessions consisting of 90 min, two sessions per week; the intervention was to be delivered over one month period. Classes were held virtually and in person in groups of 3–5 individuals using lectures, discussion, questions and answers by researcher and clinical psychologist. Virtual meetings were held in WhatsApp by voice and video call. The face-to-face sessions were delivered in the room of Sarvar Clinic. The training content of the classes was the same for all experimental groups (Table 1). The participants of the intervention group were

Table 1 Content of emotional intelligence program training

Session no	Subject	Training content
1	Emotional intelligence	Identifying participants and introduction the basic concepts of emotional intelligence and types of emotions
2	Emotional intelligence components	Applying emotional intelligence in daily life and talking about 5 components and 15 subscales of emotional intelligence
3	Intrapersonal component	Defining the concept of emotional self-awareness, increasing the ability to recognize one's own, awareness of strength and weakness and discussing about assertiveness, self-regard and self confidence
4	Intrapersonal component	Talking about independence, how to set goals and plan to achieve them and self-actualization
5	Interpersonal component	Discussing about empathy, promoting the ability of creating emotional solidarity and friendship with others, talking about social responsibility and interpersonal relationship (such as verbal and non-verbal communication and body language)
6	Stress management	Discussing stress tolerance and impulse control; Teaching stress process and its consequences, stressors, ability to tolerate stress and its strategies
7	Adaptability	The ability to recognize and accept the problem as a modifiable natural phenomenon, attempting to solve a problem, decision making skills, Factors influencing decision making and explaining about reality-testing and flexibility
8	General mood	Talking about optimism and its relation with hope and happiness
9	Overall summary	Summarizing all sessions and encouraging people to express their opinions

provided with an educational booklet about the emotional intelligence and asked to practice at home daily and discuss their opinions at the beginning of the next session. For ethical reasons the control group members were provided with an educational booklet at the completion of the study. Moreover, the standard of care (including the Periodic medical visit, blood transfusion, iron chelation therapy, giving educational pamphlets, self-care training) was carried out. The intervention groups were asked not to talk with control group members about implementation due to avoid exchanging data between them, all participants including experimental and control groups were asked to complete the Billings and Moos questionnaire before the intervention, immediately after the intervention, and one month after the intervention. The participants were asked to think about the stressful events that happened to them in the last month and answer the questionnaire based on how they responded to the stressful events. A face-to-face self-report interview was used to collect information.

Statistical analysis

To calculate the sample size, we using G-POWER software and t test with the power of 80% and the error probability ratio of 5%, 33 individuals were assigned into each group [26]. Then by considering attrition rate, 2 more individuals were added into each group and finally each group comprised 35 people. We performed a statistical power analysis using independent t test. The power was 0.20 with considering 35 individuals in each group.

The collected data analysis was performed using The SPSS software (version 21). For examining and summarizing demographic data of subjects, descriptive statistics, such as frequency, percentage, mean and standard deviation (SD) were used. We tested the normality of quantitative variables by using Kolmogorov–Smirnov and Shapiro Wilk tests. To examine the homogeneity of the two groups in terms of intervening and background variables, chi-square (qualitative variables), independent t (quantitative variables with normal distribution) and Mann–Whitney (quantitative variables without normal distribution or rank) was used. To achieve the objectives of the research, repeated measures Analysis of Variance (ANOVA) and Bonferroni were used. Statistical significance was considered at $p < 0.05$ and reliability 95%. The statistical analyst was blinded to minimize the bias.

Results
Recruitment

The per protocol analysis used for this clinical trial. During the study, *31* of the *35* teenagers in the intervention group completed the training courses. *1* of the *31* who were in the experimental group and *5* of the *35* adolescents in the control group were not able to complete the second and third evaluation. Finally, the study was performed on *60* individuals (*30* in the intervention group and *30* in the control group) and the results were calculated without missing samples (Fig. 1; Diagram of the participants in the study).

The mean age of the participants was *15.6 ± 1.8* and *15.5 ± 2.3* years in the intervention and control groups, respectively. *33.3% (n = 10)* were female and *66.7% (n = 20)* were male in the intervention group and *33.3% (n = 10)* were female and *66.7% (n = 20)* were male in the
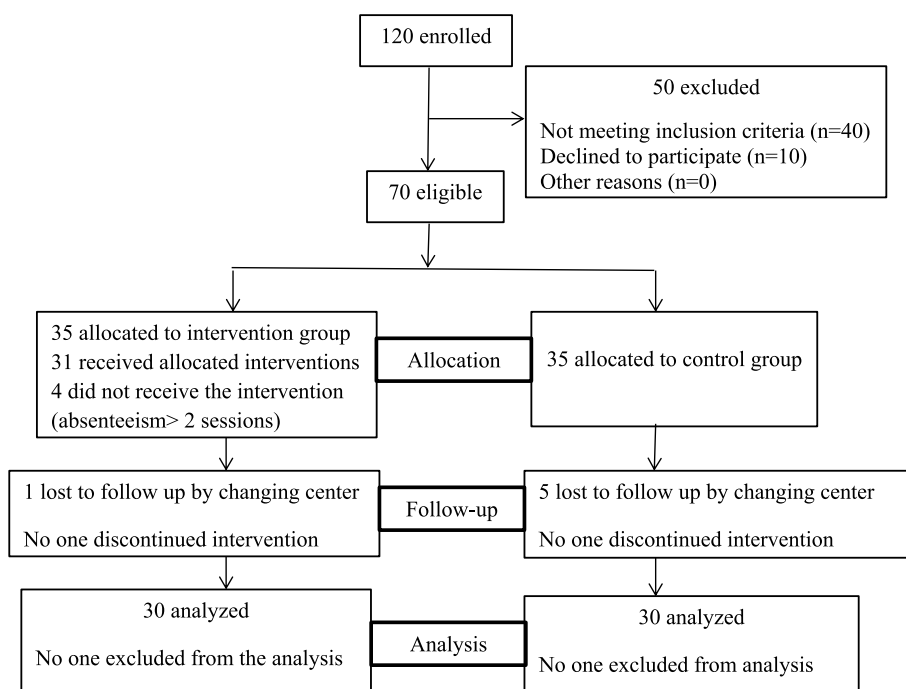
Fig. 1 Diagram of the participants in the study

control group. Considering the duration of disease in the experimental group was *15.0 ± 2.0* years and in the control group was *15.1 ± 2.2* years (Table 3).

Findings

First, the normality of quantitative variables was tested by using Kolmogorov–Smirnov and Shapiro Wilk tests (Table 2). Independent t-test (for normal quantitative variables), Mann–Whitney test (for non-normal quantitative and rank variables) were used to compare two groups. Nominal variables were also compared in two groups using the chi-square test. This statistical analysis showed there were no meaningful differences between the demographic variables of intervention and control groups (Table 3). Statistical significance was considered at *p < 0.05.*

A repeated-measures ANOVA was performed to evaluate the effect of applying emotional intelligence components on coping strategies. The means and standard deviations for coping strategies are presented in Table 6. Mauchly's test indicated that the assumption of sphericity had been violated, [Mauchly's W = 0.676] and [$P < 0.001$], and therefore degrees of freedom were corrected using Huynh–Feldt as presented in Table 4.

The effect of time on total score of coping strategies was significant at the [0.05] level, F-ratio = [777.906], p = [< 0.001], partial Eta Squared = [0.86] and degree of freedom = [1.557]. The effect of group on total score of coping strategies was significant at the [0.05] level, F-ratio = [9022.576], p = [< 0.001], partial Eta

Squared = [0.98] and degree of freedom = [1]. The results of weighted repeated measures analysis of variance (ANOVA) of coping strategies based on the effect of time and group are presented in Table 5.

Post-hoc pairwise comparisons with a [Bonferroni] adjustment indicated that there was no significant difference between the total scores of coping strategies in the control [34.73 ± 5.420] and experiment [34.90 ± 6.359] groups before the intervention (p = [0.169]). However, there was a significant difference between the total scores of coping strategies before the intervention [the initial assessment] and immediately after the intervention [the follow-up assessment] in the control [34.80 ± 5.359] and intervention [39.07 ± 6.297] groups, ($P < 0.001$). Similarly, there was a significant difference between the total scores of coping strategies immediately after the intervention [the first] and one month after the intervention [second follow up assessments] in the control [34.83 ± 5.331] and intervention groups [41.20 ± 6.440], ($P < 0.001$). Moreover, the total scores of coping strategies were significantly higher at the second follow-up assessment [one month after the intervention] than the first assessment [immediately after the intervention], ($P < 0.001$). The results of Bonferroni test are shown in the Table 6.

Problem-focused coping strategy

The effect of time on problem-focused strategies was significant at the [0.05] level, F-ratio = [7951.162], p = [< 0.001], partial Eta Squared = [0.98] and degree of freedom = [1.455].

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Table 2 The normality of quantitative variables in control and intervention groups

Variables	Intervention group			Control group		
	Kolmogorov–Smirnov	Shapiro Wilk	Result	Kolmogorov–Smirnov	Shapiro Wilk	Result
Age	0.012	0.035	Non-normal distribution	0.034	0.001	Non-normal distribution
Duration of illness	0.164	0.110	Normal distribution	0.040	0.005	Non-normal distribution
Hemoglobin level	0.020	0.080	Normal distribution	0.200	0.564	Normal distribution
Ferritin level	0.089	0.003	Normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of coping strategies before the intervention	< 0.001	0.005	Non-normal distribution	< 0.001	0.001	Non-normal distribution
The total score of coping strategies immediately after the intervention	0.020	0.012	Non-normal distribution	< 0.001	0.001	Non-normal distribution
The total score of coping strategies one month after the intervention	0.053	0.019	Normal distribution	< 0.001	0.001	Non-normal distribution
The total score of coping strategies immediately after the intervention compared to before the intervention	0.007	0.001	Non-normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of coping strategies one month after the intervention compared to before the intervention	0.013	0.029	Non-normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of coping strategies one month after the intervention compared to immediately after the intervention	< 0.001	< 0.001	Non-normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of Problem-focused strategies before the intervention	0.036	0.067	Normal distribution	0.146	0.175	Normal distribution
The total score of Problem-focused strategies immediately after the intervention	0.001	0.004	Non-normal distribution	0.070	0.224	Normal distribution
The total score of Problem-focused strategies one month after the intervention	0.015	0.007	Non-normal distribution	0.161	0.114	Normal distribution
The total score of Problem-focused strategies immediately after the intervention compared to before the intervention	0.032	0.029	Non-normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of Problem-focused strategies one month after the intervention compared to before the intervention	0.044	0.012	Non-normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of Problem-focused strategies one month after the intervention compared to immediately after the intervention	< 0.001	< 0.001	Non-normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of Emotion-focused strategies before the intervention	0.081	0.072	Normal distribution	0.200	0.289	Normal distribution
The total score of Emotion-focused strategies immediately after the intervention	0.200	0.060	Normal distribution	0.035	0.060	Normal distribution
The total score of Emotion-focused strategies one month after the intervention	0.067	0.062	Normal distribution	0.200	0.090	Normal distribution
The total score of Emotion-focused strategies immediately after the intervention compared to before the intervention	< 0.001	0.001	Non-normal distribution	< 0.001	0.001	Non-normal distribution

Table 2 (continued)

Variables	Intervention group			Control group		
	Kolmogorov–Smirnov	Shapiro Wilk	Result	Kolmogorov–Smirnov	Shapiro Wilk	Result
The total score of Emotion-focused strategies one month after the intervention compared to before the intervention	0.010	0.117	Normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of Emotion-focused strategies one month after the intervention compared to immediately after the intervention	< 0.001	< 0.001	Non-normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of Problem-solving strategies before the intervention	< 0.001	< 0.001	Non-normal distribution	0.004	0.004	Non-normal distribution
The total score of Problem-solving strategies immediately after the intervention	< 0.001	< 0.001	Non-normal distribution	0.004	0.004	Non-normal distribution
The total score of Problem-solving strategies one month after the intervention	< 0.001	< 0.001	Non-normal distribution	0.002	0.005	Non-normal distribution
The total score of Problem-solving strategies immediately after the intervention compared to before the intervention	< 0.001	< 0.001	Non-normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of Problem-solving strategies one month after the intervention compared to before the intervention	< 0.001	< 0.001	Non-normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of Problem-solving strategies one month after the intervention compared to immediately after the intervention	< 0.001	< 0.001	Non-normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of Cognitive evaluation strategies before the intervention	0.005	0.009	Non-normal distribution	0.042	0.013	Non-normal distribution
The total score of Cognitive evaluation strategies immediately after the intervention	< 0.001	0.005	Non-normal distribution	0.039	0.042	Non-normal distribution
The total score of Cognitive evaluation strategies one month after the intervention	0.004	0.019	Non-normal distribution	0.014	0.007	Non-normal distribution
The total score of Cognitive evaluation strategies immediately after the intervention compared to before the intervention	< 0.001	< 0.001	Non-normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of Cognitive evaluation strategies one month after the intervention compared to before the intervention	< 0.001	< 0.001	Non-normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of Cognitive evaluation strategies one month after the intervention compared to immediately after the intervention	< 0.001	< 0.001	Non-normal distribution	< 0.001	< 0.001	Non-normal distribution
The total score of Emotional inhibition strategies before the intervention	0.012	0.023	Non-normal distribution	0.007	0.002	Non-normal distribution
The total score of Emotional inhibition strategies immediately after the intervention	0.003	0.040	Non-normal distribution	0.028	0.014	Non-normal distribution
The total score of Emotional inhibition strategies one month after the intervention	0.087	0.091	Normal distribution	0.072	0.015	Normal distribution

Table 2 (continued)

Variables	Intervention group			Control group		
	Kolmogorov–Smirnov	Shapiro Wilk	Result	Kolmogorov–Smirnov	Shapiro Wilk	Result
The total score of Emotional inhibition strategies immediately after the intervention compared to before the intervention	*< 0.001*	*< 0.001*	*Non-normal distribution*	*< 0.001*	*< 0.001*	*Non-normal distribution*
The total score of Emotional inhibition strategies one month after the intervention compared to before the intervention	*< 0.001*	*< 0.001*	*Non-normal distribution*	*< 0.001*	*< 0.001*	*Non-normal distribution*
The total score of Emotional inhibition strategies one month after the intervention compared to immediately after the intervention	*< 0.001*	*< 0.001*	*Non-normal distribution*	*< 0.001*	*< 0.001*	*Non-normal distribution*
The total score of social support strategies before the intervention	*< 0.001*	*0.005*	*Non-normal distribution*	*0.028*	*0.009*	*Non-normal distribution*
The total score of social support strategies immediately after the intervention	*0.034*	*0.259*	*Normal distribution*	*0.002*	*0.019*	*Non-normal distribution*
The total score of social support strategies one month after the intervention	*0.008*	*0.073*	*Normal distribution*	*0.031*	*0.151*	*Normal distribution*
The total score of social support strategies immediately after the intervention compared to before the intervention	*< 0.001*	*0.001*	*Non-normal distribution*	*< 0.001*	*< 0.001*	*Non-normal distribution*
The total score of social support strategies one month after the intervention compared to before the intervention	*< 0.001*	*0.006*	*Non-normal distribution*	*< 0.001*	*< 0.001*	*Non-normal distribution*
The total score of social support strategies one month after the intervention compared to immediately after the intervention	*< 0.001*	*< 0.001*	*Non-normal distribution*	*< 0.001*	*< 0.001*	*Non-normal distribution*
The total score of Somatic inhibition strategies before the intervention	0.020	0.009	Non-normal distribution	0.003	0.005	Non-normal distribution
The total score of Somatic inhibition strategies immediately after the intervention	0.077	0.015	Normal distribution	0.039	0.023	Non-normal distribution
The total score of Somatic inhibition strategies one month after the intervention	0.033	0.006	Non-normal distribution	0.010	0.012	Non-normal distribution
The total score of Somatic inhibition strategies immediately after the intervention compared to before the intervention	*< 0.001*	0.001	Non-normal distribution	*< 0.001*	*< 0.001*	Non-normal distribution
The total score of Somatic inhibition strategies one month after the intervention compared to before the intervention	0.005	0.016	Non-normal distribution	*< 0.001*	*< 0.001*	Non-normal distribution
The total score of Somatic inhibition strategies one month after the intervention compared to immediately after the intervention	*< 0.001*	*< 0.001*	Non-normal distribution	*< 0.001*	*< 0.001*	Non-normal distribution

The effect of group on problem-focused strategies was significant at the [0.05] level, F-ratio=[1407.417], p=[<0.001], partial Eta Squared=[0.90] and degree of freedom=[1] (Table 5).

Post-hoc pairwise comparisons with a [Bonferroni] adjustment indicated that there was no significant difference between the scores of problem-focused strategies (problem-solving and cognitive evaluation) in the

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Table 3 Comparing demographic characteristics of both control and intervention groups

Variables		Control group	Experience group	Result
Quantitative variables		Mean ± SD	Mean ± SD	
Age (year)		*15.47 ± 2.285*	*15.57 ± 1.832*	*Mann–Whitney test*
				Z = 0.0
				*P value = 0.976**
Duration of illness (year)		*15.13 ± 2.161*	*15.02 ± 1.976*	*Mann–Whitney test*
				Z = -0.3
				*P value = 0.789**
Hemoglobin level (mg/dL)		*9.52 ± 0.806*	*9.780 ± 0.645*	*Independent t-test*
				*P value = 0.168**
				T = -1.397 Df = 58
Ferritin level (ng/ml)		*3583.20 ± 2445.715*	*3272.23 ± 1797.070*	*Mann–Whitney test*
				Z = -0.3
				*P value = 0.734**
Qualitative variables		*Number(percent)*	*Number(percent)*	
Gender	Female	*10 (33.3%)*	*10 (33.3%)*	*Chi square Tests*
	Male	*20 (66.7%)*	*20 (66.7%)*	*P value -[a]*
Ethnicity	Iranian (Khorasan province)	*30 (100%)*	*30 (100%)*	*Chi square Tests*
				P value -[b]
Education status	High school	*30 (100%)*	*30 (100%)*	*Chi square Tests*
				P value -[b]
Marital status	Married	*1 (3.3%)*	*1 (3.3%)*	*Chi square Tests*
	Single	*29 (96.7%)*	*29 (96.7%)*	*P value -[a]*
Occupation	Employed	*8 (26.7%)*	*8 (26.7%)*	*Chi square Tests*
	Unemployed	*22 (73.3%)*	*22 (73.3%)*	*P value -[a]*
Parental economic status	Sufficient	*20 (66.7%)*	*20 (66.7%)*	*Chi square Tests*
	Low than sufficient	*10 (33.3%)*	*10 (33.3%)*	*P value -[a]*
Parental education	Elementary school	*10 (33.3%)*	*10 (33.3%)*	*Chi square Tests*
	High school	*20 (66.7%)*	*20 (66.7%)*	*P value -[a]*
Insurance	Yes	*27 (90.0%)*	*27 (90.0%)*	*Chi square Tests*
	No	*3 (10.0%)*	*3 (10.0%)*	*P value -[a]*
Splenectomy	Yes	*2 (6.7%)*	*3 (10.0%)*	*Chi square Tests*
	No	*28 (93.3%)*	*27 (90.0%)*	*Chi square = 0.218*
				Df = 1
				*P value = 0.640**
Underlying disease	Yes	*3 (10.0%)*	*4 (13.3%)*	*Chi square Tests*
	No	*27 (90.0%)*	*26 (86.7%)*	*Chi square = 0.162*
				Df = 1
				*P value = 0.688**

* *(P > 0.05)* is not considered statistically significant

[a] cannot be calculated because the frequency of the variable in both control and intervention groups is completely equal

[b] cannot be calculated because the variable has only one category

control [14.200 ± 2.551] and experiment [14.233 ± 2.661] groups before the intervention ($p = $[0.913]). However, there was a significant difference between the scores of problem-focused strategies before the intervention [the initial assessment] and immediately after the intervention [the follow-up assessment] in the control [14.266 ± 2.476] and intervention [24.333 ± 2.941] groups, ($P < 0.001$). Similarly, there was a significant difference between the scores of problem-focused strategies immediately after the intervention [the first] and one month after the intervention [second follow up assessments] in the control [14.400 ± 2.443] and intervention groups [29.633 ± 3.189], ($P < 0.001$). Moreover, the scores of problem-focused strategies were significantly higher at the second follow-up assessment [one month after the intervention] than the first assessment [immediately after the intervention], ($P < 0.001$) in the intervention group (Table 6).

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Table 4 Mauchly's test sphericity of coping strategies

Variables	Mauchly's Test of Sphericity	
	Mauchly's W	Sig.
Strategies (Total score)	*0.676*	*P < 0.001*
Problem-focused strategies	*0.727*	*P < 0.001*
Emotion-focused strategies	*0.503*	*P < 0.001*
Cognitive evaluation	*0.671*	*P < 0.001*
Problem-solving	*0.766*	*P < 0.001*
Emotional inhibition	*0.501*	*P < 0.001*
Social support	*0.786*	*P < 0.001*
Somatic inhibition	*0.655*	*P < 0.001*

Emotion-focused coping strategy

The effect of time on total emotion-focused strategies was significant at the [0.05] level, F-ratio = [846.535], p = [< 0.001], partial Eta Squared = [0.94] and degree of freedom = [1.380]. The effect of group on total emotion-focused strategies was significant at the [0.05] level, F-ratio = [901.775], p = [< 0.001], partial Eta Squared = [0.94] and degree of freedom = [1] (Table 5).

Post-hoc pairwise comparisons with a [Bonferroni] adjustment indicated that there was no significant difference between the scores of emotion-focused strategies in the control [20.533 ± 4.023] and experiment [20.666 ± 5.261] groups before the intervention (p = [0.913]). However, there was a significant difference between the scores of emotion-focused strategies before the intervention [the initial assessment] and immediately after the intervention [the follow-up assessment] in the control [20.533 ± 4.049] and intervention [14.733 ± 5.258] groups, (P < 0.001). Similarly, there was a significant difference between the scores of emotion-focused strategies immediately after the intervention [the first] and one month after the intervention [second follow up assessments] in the control [20.433 ± 4.091] and intervention groups [11.5667 ± 5.230], (P < 0.001). Moreover, the scores of emotion-focused strategies (emotional inhibition and somatic inhibition) were significantly lower at the second follow-up assessment [one month after the intervention] than the first assessment [immediately after the intervention] in the intervention group, (P < 0.001). However, the score of social support was significantly higher at the second follow-up assessment [one month after the intervention] than the first assessment [immediately after the intervention] in the intervention group, (P < 0.001) (Table 6).

Discussion

Studies have indicated that patients with beta-thalassemia major suffer from psychosocial disorders. For instance, the study of Messina et al. (2008) revealed that thalassemic patients are likely suffer from psychiatric problems and impaired psychosocial functioning such as somatization, depression and obsessive–compulsive traits and also the most used coping skills was escape-avoidance [27]. Moreover, Adib-Hajbaghery et al. [3] reported that a majority of beta-thalassemia patients suffer from mild to severe depression, anxiety, and stress [3]. According to the psychosocial problems, it could be helpful to identify the strategies that can improve the coping skills of the patients. Therefore, in the present study, the effect of applying emotional intelligence components on coping strategies in adolescents with beta-thalassemia major was investigated.

Based on the findings of this study, Bonferroni test indicated no statistically differences in the mean scores of problem-focused and emotion-focused coping strategies in both intervention and control groups in the pre-intervention phase. Hence, it can be assumed the used coping strategies in the terms of types and amounts were same in the two groups before the intervention.

Problem-focused coping strategies

The present study showed that there are positive effects of applying components of emotional intelligence on problem-focused coping strategies and the mean scores of problem-solving and cognitive evaluations are significantly increased in adolescents with beta-thalassemia major. Simply put, patients in the experimental group used more problem-focused coping strategies after the intervention, in comparison to the control group.

In line with the present study, Kovaþeviü et al., (2018) conducted a study on patients with Schizophrenia, showed that there is a significant positive relation between emotional intelligence and problem-focused coping strategies [17]. Nogaj(2020), also found that emotional intelligence correlates positively significant with coping strategies among music school students in the context of visual art and general education students [28]. Additionally, the study of Moradi et al., [21] demonstrated that emotional intelligence had positive relationship with problem-solving and cognitive evaluation in university students [21]. Moreover, Noorbakhsh et al., (2010) revealed that emotional intelligence was positively associated with problem-focused coping strategies [14]. Furthermore, the study of Boyer et al., (2017) on depressed patients and their caregivers indicated their caregivers, who get higher score of emotional intelligence than patients, used more problem-focused coping strategies [29]. Besides, Delhom et al., [30] in the study on investigation the associations among emotional intelligence, coping and depressed mood, concluded that elderly people with high emotional intelligence are more

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Table 5 Weighted repeated measures analysis of variance (ANOVA) of coping strategies

Variables	The name of the test	Time Effect				Group Effect				Time * Group Effect			
		Partial Eta Squared	F-ratio	Degrees of freedom	Test result	Partial Eta Squared	F-ratio	Degrees of freedom	Test result	Partial Eta Squared	F-ratio	Degrees of freedom	Test result
Strategies (Total score)	Weighted Repeated Measures	0.86	777.906	1.557	$P<0.001$*	0.98	9022.576	1	$P<0.001$*	0.85	719.019	1.557	$P<0.001$*
Problem-focused strategies	Weighted Repeated Measures	0.98	7951.162	1.455	$P<0.001$*	0.90	1407.417	1	$P<0.001$*	0.98	7649.624	1.455	$P<0.001$*
Emotion-focused strategies	Repeated Measures	0.94	846.535	1.380	$P<0.001$*	0.94	901.775	1	$P<0.001$*	0.94	814.710	1.380	$P<0.001$*
Cognitive evaluation	Weighted Repeated Measures	0.90	1817.845	1.167	$P<0.001$*	0.85	1143.069	1	$P<0.001$*	0.90	1761.945	1.167	$P<0.001$*
Problem-solving	Weighted Repeated Measures	0.90	1436.989	1.740	$P<0.001$*	0.85	880.997	1	$P<0.001$*	0.90	1426.376	1.740	$P<0.001$*
Emotional inhibition	Weighted Repeated Measures	0.85	2212.092	1.481	$P<0.001$*	0.32	191.817	1	$P<0.001$*	0.85	2165.933	1.481	$P<0.001$*
Social support	Weighted Repeated Measures	0.85	1342.414	1.619	$P<0.001$*	0.69	517.334	1	$P<0.001$*	0.83	1150.580	1.619	$P<0.001$*
Somatic inhibition	Weighted Repeated Measures	0.71	434.29	1.22	$P<0.001$*	0.32	92.25	1	$P<0.001$*	0.62	327.89	1.22	$P<0.001$*

* $(P < 0.05)$ is considered statistically significant

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Table 6 Comparison of mean scores of coping strategies in two groups before and after intervention

Variables	Group	Before the intervention		Immediately after the intervention		One month after the intervention	
		Mean ± SD	Test result	Mean ± SD	Test result	Mean ± SD	Test result
Coping Strategies (Total score)	Control	34.73 ± 5.420	*P = 0.169 Bonferroni test*	34.80 ± 5.359	*P < 0.001* Bonferroni test*	34.83 ± 5.331	*P < 0.001* Bonferroni test*
	Experiment	34.90 ± 6.359		39.07 ± 6.297		41.20 ± 6.440	
Problem-focused strategies	Control	14.200 ± 2.551	*P = 0.903 Bonferroni test*	14.266 ± 2.476	*P < 0.001* Bonferroni test*	14.400 ± 2.443	*P < 0.001* Bonferroni test*
	Experiment	14.233 ± 2.661		24.333 ± 2.941		29.633 ± 3.189	
Emotion-focused strategies	Control	20.533 ± 4.023	*P = 0.913 Bonferroni test*	20.533 ± 4.049	*P < 0.001* Bonferroni test*	20.433 ± 4.091	*P < 0.001* Bonferroni test*
	Experiment	20.666 ± 5.261		14.733 ± 5.258		11.5667 ± 5.230	
Cognitive evaluation	Control	5.27 ± 1.202	*P = 0.008* Bonferroni test*	5.37 ± 1.245	*P < 0.001* Bonferroni test*	5.33 ± 1.184	*P < 0.001* Bonferroni test*
	Experiment	5.57 ± 1.040		9.10 ± 1.269		11.00 ± 1.287	
Problem-solving	Control	3.67 ± 0.735	*P = 0.003* Bonferroni test*	3.71 ± 0.817	*P < 0.001* Bonferroni test*	3.67 ± 0.781	*P < 0.001* Bonferroni test*
	Experiment	3.97 ± 0.453		7.01 ± 0.521		8.40 ± 0.574	
Emotional inhibition	Control	13.00 ± 0.754	*P < 0.001* Bonferroni test*	12.80 ± 0.889	*P < 0.001* Bonferroni test*	13.02 ± 1.032	*P < 0.001* Bonferroni test*
	Experiment	13.83 ± 1.759		10.26 ± 2.093		8.61 ± 2.082	
Social support	Control	5.25 ± 0.936	*P = 0.011* Bonferroni test*	5.29 ± 0.980	*P < 0.001* Bonferroni test*	5.49 ± 1.077	*P < 0.001* Bonferroni test*
	Experiment	5.00 ± 0.517		8.71 ± 0.958		10.93 ± 1.314	
Somatic inhibition	Control	7.39 ± 1.307	*P = 0.002* Bonferroni test*	7.32 ± 1.363	*P < 0.001* Bonferroni test*	7.18 ± 1.458	*P < 0.001* Bonferroni test*
	Experiment	6.73 ± 1.578		5.00 ± 1.774		3.82 ± 1.899	

* *(P < 0.05)* is considered statistically significant

likely to use problem-centered strategies and achieve better psychological adjustment [30]. These findings are consistent with the results of the present study, which indicates applying emotional intelligence can improve problem-focused coping strategies.

Emotion-focused coping strategies

This study indicated applying components of emotional intelligence reduced the mean score of emotional and somatic inhibition and promote the mean score of social support. In other words, patients in the intervention group used more social support coping strategy and less emotional and somatic inhibition coping strategies after the intervention, in comparison the control group.

The result of Noorbakhsh et al., `study (2010) that aimed to determine the relationship between emotional intelligence and coping styles with stress, revealed that emotional intelligence was positively related with positive emotion-focused coping, and negatively associated with negative emotion-focused coping, which is in agreement with the present study [14]. Moradi et al., [21] also confirmed that emotional intelligence has positive correlation with social support and negative relationship with physical control coping strategies [21]. Moreover, in the study of Enns et al., (2018) participants with higher emotional intelligence showed lower perceived stress, used more of adaptive coping skills (included problem-solving and social support) and used less of maladaptive coping strategies [31]. Furthermore,

the study of Hajisabbagh et al., (2017) on patients with epilepsy, confirmed that patients with lower emotional intelligence used more emotion-centered strategies and improving the emotional intelligence of these patients can help them to use more adaptive coping skills [20]. Additionally, Sarabia et al., (2017) found that coping styles were increased significantly by emotional intelligence workshop and emotional intelligence training can promote adaptive coping strategies [32]. These findings are in agreement with our study demonstrated that applying emotional intelligence components improve the coping strategies of patients and help them to cope better with stressful situations.

Contrary to our findings, Kovaþeviü et al., (2018) reported that emotion-oriented strategies had no meaningful relationship with emotional intelligence and its subscales [17]. It can be attributed to the difference in the research community; they conducted research on patients with schizophrenia between the ages of 18 and 55 and these patients have endured many complications of the disease and its treatments over the years, so it is not easy to change coping strategies in these patients and changing coping skills requires long-term intervention [17]. The study of Manicacci et al., (2019) on the relationship between emotional intelligence and coping strategies in Mothers of Autistic Children also indicated no significant correlation between emotional intelligence and coping strategies. It can be attributed to the difference in the research community and data

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collection method; they conducted the study on mothers of autistic children aged 23–61 years and outcomes show what they were thinking and feeling when they answered. Besides that, data collection method was anonymous and online, therefore researcher cannot confirm the children's diagnoses indicated by the mothers, nor the degree of autism severity [22].

Moreover, the results reveal that the effect of time and group on all coping strategies is significant (*P < 0.001*). Considering that the two groups were homogenous in terms of all the demographic characteristics, thus, the main effect of time and group on the average of coping strategies in adolescents with beta-thalassemia major in the two groups can be attributed to the effect of the research intervention including the applying of emotional intelligence components.

In conclusion, emotional intelligence training can improve coping strategies in adolescents with beta-thalassemia major. Emotionally intelligent people think differently about the stressful situation and they see it as an opportunity instead of a threat, they have better ability and more skills to control their emotions to cope with work-related problems and daily life challenges [33].

Limitations
The present study has some limitations, including the small sample size, which limits the generalizability of the results. Moreover, because of the coronavirus pandemic, the most training sessions were held virtually. Moreover, our results show what the teenagers were thinking and feeling when they answered the questionnaires.

Conclusions
Overall, the findings of the present study demonstrated that applying components of emotional intelligence can promote problem-focused (problem-solving and cognitive evaluation) and positive emotion-focused (comprising social support) coping strategies and reduce negative emotion-focused (comprising emotional inhibition and somatic inhibition) coping strategies. In other words, applying emotional intelligence enabled adolescents with beta-thalassemia major to use adaptive coping skills and deal better with complications of the disease.

Health care providers are often the first point of contact with children and adolescents, in meeting with adolescents with chronic illness and their families, they can identify and evaluate coping strategies used and then apply methods to improve them. Promoting positive coping can play an important role in decreasing stress, ameliorating therapeutic outcomes and the quality of life. As a result, we strongly recommend that

health professionals consider educating and applying emotional intelligence as part of psychological and non-pharmacological treatments in health centers.

Declarations

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