

Chronic Abdominal Pain: Psychosocial Strain and Treatment-Associated Changes in Coping

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Keywords

Cognitive-behavioral therapy · Children · Abdominal pain · Psychosocial functioning · Coping

Summary

Background: Chronic abdominal pain (CAP) in childhood is a commonly occurring condition and shows a high stability. Psychosocial dysfunctioning of children, such as increased stress experience, is a burden for children and parents and complicates clinical management. Additional comorbid disorders may develop. To minimize the onset of such disorders, treatment at an early stage and taking psychosocial aspects into consideration is strongly recommended. Through this approach, the cognitive-behavioral, child-centered group program ‘Stop the pain with Happy-Pingu’ was developed, applied, and subsequently evaluated. What is the psychosocial situation of the affected children? Can the cognitive-behavioral group program be applied to improve psychosocial limitations? **Method:** The cognitive-behavioral group program comprises 6 weekly sessions for children and 1 single meeting for parents. In a randomized controlled study, the program was evaluated with 29 children aged between 6 and 12 years. The evaluation was based on a comparison between the intervention group (IG) and the waiting list control group (WLC), measured at 3 measurement points: T1 (pre), T2 (post), and T3 (3-month follow-up). **Results:** Emotional problems in particular can emerge in children with CAP. The program was well received, with a high level of participation through to completion. The results demonstrate that children participating in the IG experienced significant stress reduction and improved psychosocial functioning compared to children participating in the WLC. The effect sizes range from medium to high. **Conclusions:** Drawing upon the above findings, multimodal cognitive-behavioral techniques appear to be suitable to successfully treat children with CAP. However, further controlled studies are required to identify the specific elements of the training that are most effective in reducing pain.

Schlüsselwörter

Verhaltenstherapie · Kinder · Bauchschmerzen · Psychosoziales Wohlbefinden · Coping

Zusammenfassung

Hintergrund: Chronische Bauchschmerzen (CAP) sind im Kindesalter nicht nur weit verbreitet, sondern auch sehr stabil. Insbesondere psychosoziale Funktionseinschränkungen wie ein erhöhtes Stresserleben belasten die Kinder und deren Eltern und erschweren das Krankheitsmanagement; weitere komorbide Störungen können sich entwickeln. Dies legt nahe, dass eine Behandlung frühzeitig einsetzen und zudem auch die psychosozialen Aspekte mit berücksichtigen muss. Vor diesem Hintergrund wurde das kognitiv-behaviorale, kindzentrierte Gruppenprogramm «Stopp den Schmerz mit Happy-Pingu» entwickelt und evaluiert. Wie ist die psychosoziale Situation der betroffenen Kinder? Ist das kognitiv-behaviorale Programm in der Lage, psychosoziale Einschränkungen zu verbessern? **Methodik:** Das Programm besteht aus 6 Sitzungen für die Kinder sowie 1 Elternabend; die Trainingssitzungen fanden 1-mal wöchentlich statt. Im Rahmen einer randomisierten kontrollierten Studie wurde das Programm an 29 Kindern im Alter zwischen 6 und 12 Jahren auf seine Wirksamkeit hin überprüft. Die Evaluation erfolgte anhand eines Vergleiches zwischen Interventionsgruppe (IG) und Wartekontrollgruppe (WKG) zu den 3 Messzeitpunkten T1 (Prä), T2 (Post) und T3 (3-Monats-Follow-up). **Ergebnisse:** Bei den Kindern traten vor allem emotionale Probleme gehäuft auf. Die Akzeptanz des Programms war sehr hoch. Teilnehmer der IG erlebten im Vergleich zur WKG eine signifikante Verbesserung des Stresserlebens und der Coping-Strategien. Die Effektstärken sind überwiegend mittel bis hoch. **Schlussfolgerungen:** Multimodale kognitiv-behaviorale Ansätze scheinen geeignet, um Kinder mit CAP erfolgreich zu behandeln. Weitere kontrollierte Studien sollten unter anderem klären, welche Trainingselemente konkret für die Schmerzreduktion verantwortlich sind.

Introduction

Chronic abdominal pain (CAP) is among the most common types of pain in children [Berger et al., 2007; Schwille et al., 2009], with prevalence rates from 0.3 to 30.8% [Chitkara et al., 2005]. In particular girls are frequently affected [Schwille et al., 2009; van Gessel et al., 2011]. The diagnosis is made according to international guidelines (Rome III) for functional gastrointestinal disorders and considers, besides the duration of pain, its location, frequency, and intensity, also the limitations it puts on daily activities [Magista et al., 2006]. The diagnosis requires that abdominal pain occurs at least once a week and is strong enough to limit the activities of daily life [Magista et al., 2006], such as regular school attendance and meeting friends. Clinically the symptoms cannot be explained organically [Apley and Naish, 1958; Magista et al., 2006]. Nausea and vomiting are described as possible side effects. There often exist comorbid emotional problems [e.g., Campo et al., 2004].

The literature usually associates CAP in childhood with increased stress [Walker et al., 1993]. Children with CAP differ from healthy children by experiencing school stressors [Hjern et al., 2008; Walker et al., 2001] as well as everyday stressors (e.g., stress at home) more frequently and more intensely [Walker et al., 2001]. The stress can also intensify the pain [Walker et al., 2007] and reduce pain tolerance [Dufton et al., 2008]. The emotional strain is enormous [e.g., Campo et al., 2004]; both the persistent stomach pain itself and the unpredictability of when the next episode will occur can cause anxiety and worry. In addition to the acute pain that can impair the lives of the children and their parents [Konijnenberg et al., 2005], the possible impact on various aspects of life (such as leisure activity and school) is often regarded as burdensome. It is important for the further progression of the illness, therefore, how successfully those affected cope with the stress and pain. However, studies have shown that children with CAP often use dysfunctional strategies such as withdrawal, avoidance or catastrophizing thoughts to cope with it. In addition to increased abdominal pain [Compas, 2001; Seiffge-Krenke and Stemmler, 2003], the tendency to resort to such strategies is also associated with depressive symptoms [Sullivan et al., 2001]. In children with chronic headache, it has already been shown that increased seeking of social support is associated with greater pain intensity [Eccleston et al., 2004; Hechler et al., 2008]. Stress and pain associated with unsuccessful coping can therefore negatively affect one another in a vicious cycle: The pain gets worse and is more intensely perceived [Egle and Derra, 2002; Venepalli et al., 2006]. This may in turn strongly affect general well-being. Since coping patterns often persist into adulthood, the vicious cycle must be identified and broken at an early stage [McGrath and Larsson, 1997]. Therefore successful management of pain and stress is essential in dealing with CAP, to strengthen the physical and psychosocial well-being of the children and to reduce their pain experience.

Multimodal cognitive-behavioral programs have been proven effective in the treatment of chronically ill children and adolescents (e.g., those with headaches, asthma, diabetes, and fibromyalgia) [e.g., Kashikar-Zuck et al., 2005; Kröner-Herwig and Denecke, 2002; Warschburger and Wiedebusch, 2009]. Along with psychoeducation (e.g., education about the illness and about stress triggers), teaching adaptive coping strategies are important in these training programs [Eccleston et al., 2002]. Relaxation techniques are also frequently used. Relaxation has definite physiological effects and simultaneously functions as a coping strategy [Hiller and Rief, 2011]. Gaining positive experiences in coping with difficult challenges is essential for the child. The strategies learned shall actually be used in everyday life. In addition to pain reduction, patients learn how to successfully deal with both everyday and illness-related stressors and the resulting psycho-social problems. Cognitive restructuring, in particular, aims to make a positive change in the way pain is dealt with and to reduce the sense of helplessness; it should therefore be used in pain management programs [Eccleston et al., 2002].

Preliminary studies show that cognitive-behavioral programs are effective in reducing pain [e.g., Hechler et al., 2010; Sanders et al., 1989]. There are already evidence-based training programs that can be applied directly to children and adolescents for some chronic pain conditions, such as headaches [Denecke and Kröner-Herwig, 2000], whereas approaches to the treatment of CAP have focused more on the parents or the family [Duarte et al., 2006; Hicks et al., 2006; Levy et al., 2010; Palermo et al., 2009; Robins et al., 2005; Sanders et al., 1994]. The available data on the experience of stress and strain show, however, that children should be enabled to deal independently with their own pain experience. Therefore, a cognitive-behavioral group program was developed [cf. Groß and Warschburger, 2011], which aims to provide functional strategies for dealing with pain and stress and to help children to apply these in everyday life as well. A pilot study with 11 children demonstrated promising results in terms of stress reduction [Warschburger and Groß, 2008]. Since data from an untreated control group were not available; the present work aims to close that gap. A randomized controlled study examined the extent to which participation in pain management training affects psychosocial parameters and functionality (stress, coping, self-esteem). It was further tested whether psychosocial factors such as emotional disorders, stress experience, and coping strategies for pain are associated with pain experience. We also aimed to clarify whether the children in the intervention group (IG) who succeed in changing their stress experience and pain coping strategies, differ in their pain experience from the children who accomplish this to a lesser extent.

For results showing successful pain reduction and improvement in the quality of life of the treated children please consult a recently published paper [Groß and Warschburger, 2012].

Table 1. Inclusion and exclusion criteria for CAP according to Rome III [Magista et al., 2006]

Symptoms	recurrent abdominal pain
Duration of illness	pain for at least 3 months
Duration	0.5–3 h
Frequency	at least once a week
Location	navel area
Associated features	paroxysmal pain intensity accompanying somatic symptoms (nausea, vomiting, dizziness)
Exclusion criteria	mental disorder according to ICD-10 (e.g., depression, anxiety disorder) metabolic, infectious or inflammatory processes that explain the symptoms
ICD-10 = International Classification of Diseases 10.	

Table 2. Study participants in the IG and the WLC

	IG	WLC	Test statistic	p
N	15	14		
Age, years	MV = 9.15 (SD = 1.54) range 6.6–11.2	MV = 10.1 (SD = 1.4) range 8.0–11.9	U = 68.00	p = 0.11 (n.s.)
Gender, n,			$\chi^2 = 0.29$	p = 0.58 (n.s.)
Female	13	12		
Male	2	2		
Number of children per grade level				
2. Grade	4 (26.65%)	1 (7.1%)		
3. Grade	4 (26.65%)	4 (28.6%)		
4. Grade	3 (20%)	2 (14.3%)		
5. Grade	3 (20%)	1 (7.1%)		
6. Grade	1 (6.7%)	6 (42.9%)		
Average duration of abdominal pain, min	median = 15.97 range 15–120	median = 13.96 range 10–300	U = 90.50	p = 0.52 (n.s.)
Frequency of abdominal pain episodes (in last month)	median = 15.50 range 2–20	median = 14.46 range 3–30	U = 97.50	p = 0.74 (n.s.)
n.s. = not significant.				

Patients and Methods

Study Procedure

The details of the study procedure have already been presented in detail [Groß and Warschburger, 2012]. 36 children and their parents were intensively studied between April 2008 and February 2009 (table 1); 29 of these children met the inclusion and exclusion criteria. They were enrolled consecutively in the study and randomly assigned to either the IG or the waiting list control group (WLC). The data of the 29 children were analyzed at measurement points T1 (before the training of the IG), T2 (immediately after the training of the IG), and T3 (3 months after the training of the IG). The data were complete, except for one child who had to stop treatment because of a broken leg. Pursuant to an intent-to-treat analysis, these data were included. The Ethics Committee of the University of Potsdam voted in favor of the study.

Sample

The 29 children ranged in age from 6.6 to 11.9 years (mean value (MV) = 9.59 years, standard deviation (SD) = 1.54). 79.3% (n = 23) of the parent questionnaires were filled in by the mother and 3.5% (n = 1) by the father. Table 2 presents sociodemographic and pain-related variables separately for the IG and WLC. The pain-related information (duration and frequency of abdominal pain) was ascertained from the parent interview. There were no systematic differences between the IG and the WLC.

Intervention

The cognitive-behavioral pain management training was conducted in 6 sessions, as a group program with 3–6 children per group, once a week for 90 min. The method is materials-based and the contents are age appropriate (e.g., comics, interview play, group work). Besides psychoeducation, the focus was also on appropriate coping strategies, especially relaxation techniques. The individual sessions, including training of parents, have been described [Groß and Warschburger, 2012; Groß and Warschburger, 2011].

Instruments

The children and their parents each received a questionnaire at the 3 measurement points. Aside from recording satisfaction with the training to assess the quality of the program (administered only at the end of the program), the questionnaires captured mainly psychosocial factors.

Regarding *training satisfaction*, questions were formulated based on the «Questionnaire for the Assessment of Treatment» (Fragebogen zur Beurteilung der Behandlung (FBB)) [Mattejat and Renschmidt, 1999]. The instrument captures aspects of the quality of a therapeutic intervention. Since our intervention involves patient education, 15 of the original 21 questions were modified accordingly. The children indicated how positively or negatively they evaluated the course of treatment, on a 5-point scale from 'not at all' to 'absolutely' (e.g., 'I trusted my trainer'; 'I can recommend the training to others'). Cronbach's alpha reached a satisfactory level in the present study of $\alpha = 0.77$.

Emotional disorders: The Strengths and Difficulties Questionnaire (SDQ) [Goodman, 1999] captures emotional problems and has been psychometrically validated [Goodman et al., 2000]. Before the training, the parents indicated how much the particular behavior applied to their child (in the past 6 months), on a 3-point scale from 'not true' to 'certainly true'. 25 items on 5 scales record emotional problems, hyperactivity, behavioral problems, problems with peers, and prosocial behavior. A so-called total problem score is derived from the sum of the 4 problem scales (excluding prosocial behavior). This can be assessed using the present cut-off values as 'normal', 'borderline' or 'abnormal' [Goodman et al., 2000]. Results are available for standardization in Germany (representative field survey). The scale structure has also been replicated [Woerner et al., 2002]. Cronbach's alpha reached a value in the present study of $\alpha = 0.68$ for the total scale.

In addition, the *children's self-esteem* was captured in the child's own report and that of the parent. For the self-report, we used the 'self-esteem' scale from the KINDL-R [Ravens-Sieberer and Bullinger, 2000], with 4 items. The children checked off a 5-point rating scale from 'never' to 'almost always', regarding how much each statement applies to them. High values signify high self-esteem. The internal consistency (Cronbach's alpha) for the scale was $\alpha = 0.69$. The 'self-esteem' subscale from the Child Health Questionnaire (CHQ) PF50 by Landgraf et al. [1996] (German authorized translation by the Center for Clinical Psychology and Rehabilitation (Zentrum für Klinische Psychologie und Rehabilitation (ZRF), 1997) was used to assess the parental perspective. This is a standardized measuring instrument, often employed internationally to record the child's quality of life from the parents' perspective. High scores on the scale are associated with high self-esteem. Cronbach's alpha for the scale is $\alpha = 0.85$.

Pain experience: To assess the frequency, intensity, and duration of pain, the children kept a pain diary for 2 weeks for all 3 measurement points; this technique had been successfully used in the pilot study [Warschburger and Groß, 2008]. Diaries are considered reliable and valid instruments for pain assessment in children [e.g., Denecke and Hünseler, 2000]. A global pain indicator was calculated based on the diary, with the intensity of pain per day multiplied by the duration of pain in h per day. Such a composite score (similar to the Abdominal Pain Index of Walker et al. [1997]) provides more valid data, because it gives a comprehensive picture of the pain experience. A high score is associated with greater pain experience.

The detection of *stress experience* was performed with the subscale 'stress vulnerability' from the questionnaire 'Assessment of Stress and Coping with Stress in Childhood and Adolescence' (Erhebung von Stress und Stressbewältigung im Kindes- und Jugendalter (SSKJ3-8)) of Lohaus et al. [2006]. On a 4-point rating scale (from 'no stress at all' to 'a lot of stress'), the children estimated how much stress they experience in different situations (e.g., 'Imagine that you are having a heated argument with a friend'). In addition, we used the following 2 items on stress experience from the SSK questionnaire of Lohaus et al. [1994]: 'Imagine that you have to make a presentation to the class, but you didn't do the work'. 'Imagine that you would very much like to see a particular show on TV, but your parents forbid it'. The 8 items are added up to a total value and standardized. High values are associated with a more frequent feeling of stress in various different situations [Lohaus et al., 2006]. Cronbach's alpha for the scale is $\alpha = 0.79$.

The *Pediatric Pain Coping Inventory* (PPCI) was developed by Varni et al. [1996] to detect strategies for coping with pain, especially in chronically ill children. During the study, the following situation was specified: 'Please imagine now that you are having abdominal pain'. The original version of the PPCI consists of 41 items. On a 3-point scale from 'never' to 'often', the children indicate how frequently each strategy was used in various situations. High values are associated with frequent use of the strategy. The scale structure of the German version of the questionnaire was validated by Hechler et al. [2008]. From this, 3 scales can be distinguished: 1) 'passive coping with pain' (e.g., 'I lie down'); 2) 'seeking social

support' (e.g., 'I tell my mother or my father about it'); 3) 'positive self-instruction' (e.g., 'I think about beautiful things'). Due to insufficient psychometric properties, some scales or items of the original version were eliminated. Cronbach's alpha in the study by Hechler et al. [2008] reached the following values: $\alpha = 0.74$ (scale 1), $\alpha = 0.804$ (scale 2), and $\alpha = 0.71$ (scale 3). The present publication uses this approach.

Sample Determination

A previous calculation of sample size showed that for a mean interaction effect between IG and WLC according to Bortz and Döring [2005], 14 participants are required for each group.

Statistical Analyses

The statistical analyses were performed using SPSS 17. It was expected that participation in the program would be associated with an improvement in psychosocial aspects (stress, self-esteem) as well as in coping with the illness, in comparison to the WLC (interaction group \times time). The hypotheses were calculated using 2-factorial repeated measure analyses of variance. Analysis of covariance was used for existing pre-test differences between the IG and the WLC. If sphericity was violated (Mauchly's test), a correction was made of the degrees of freedom according to Greenhouse and Geisser [1959, cited in Field, 2009]. To check at which measurement points changes occurred, within-subject contrasts were calculated. Group differences in effect sizes according to Cohen [1988] were also calculated [Jacobs, 2010], for being able to reach judgments about the magnitudes of change and their clinical relevance. According to Cohen [1988], an effect size of 0.8 and above is considered high, an effect size of 0.5–0.79 is moderate, and an effect size of 0.2–0.49 is small.

For the investigation of the interrelationships between psychosocial aspects as well as coping strategies on the one side, and pain experience on the other, Spearman correlations were calculated. Because of the exploratory nature of the questions, no correction was made for multiple testing.

The chi-square test was used for exploratory analysis within the IG of differences in pain experience, depending on the degree of change in stress experience and coping strategies.

Results

Frequency of Emotional and Behavioral Problems in Children with Abdominal Pain

In its evaluation of cut-off values for the total problem score (sum of the 4 problem scales) of the SDQ, the present study shows that 26 children (89.7%) could be rated as 'normal' and 3 children (10.3%) as 'borderline abnormal'. Table 3 shows the frequencies in percent for the scale-based assignment to the categories 'normal', 'borderline', and 'abnormal'. Frequencies for the category 'abnormal' are also contrasted with the results of the 'Child and Youth Health Survey' (Kinder- und Jugendgesundheitsurvey (KiGGS)) [Erhart et al., 2011]. In all areas except for emotional problems, the children in our study presented lower problem scores.

Satisfaction with the Program

It was possible to evaluate the data from 22 of the 29 children (75.86%) in terms of satisfaction with the program. The data of the children from the IG were used at T2 and the values of the children from the WLC at T4 – i.e., in each case immediately after the training. The children on average were very much satisfied with the training (MV = 4.3; SD = 0.29).

Table 3. Frequencies for the SDQ total problem value and for assignment to the category ‘abnormal’ for each problem area

	KiGGS study [Erhart et al., 2011] ^a		
	chronic abdominal pain (N = 29), % (n)	chronic somatic illness (N = 1,091), %	no chronic-somatic illness (N = 8,986), %
SDQ total problem value			
Normal	89.7 (26)	68.4	87.0
Borderline	10.3 (3)	10.9	6.6
Abnormal	(0)	20.6	6.4
Emotional problems			
Normal	72.4 (21)		
Borderline	6.9 (2)		
Abnormal	20.7 (6)	22.1	8.1
Behavioral problems			
Normal	93.1 (27)		
Borderline	3.45 (1)		13.5
Abnormal	3.45 (1)	23.1	
Hyperactivity problems			
Normal	86.2 (25)		
Borderline	6.9 (2)		
Abnormal	6.9 (2)	17.0	6.6
Problems with peers			
Normal	93.1 (27)		
Borderline	6.9 (2)		
Abnormal	(0)	21.8	10.2

^aResults are taken from the KiGGS study.

Table 4. Standardized means, standard deviations, significance level, effect sizes, and post-hoc tests for level of psychosocial functioning of the IG and the WLC at the measurement points baseline, post, and 3-month follow-up

	IG		WLC		p ^a	d	Post-hoc test ^b	
	MV	SD	MV	SD			F	p
Stress experience					p < 0.001*			
Baseline	43.89	16.51	44.35	13.34		2.34 (1–2)	26.56	<0.001 (1–2)
Post	12.22	13.13	44.94	12.14		0.28 (2–3)	1.21	0.28 (2–3)
3-month follow-up	10.00	12.97	46.13	11.49		2.72 (1–3)		
Self-esteem (child data)					p = 0.011*			
Baseline	46.00	15.95	43.93	17.12		1.57 (1–2)	8.42	0.007 (1–2)
Post	64.33	7.04	44.29	15.42		0.12 (2–3)	0.09	0.76 (2–3)
3-month follow-up	68.67	8.96	47.14	17.40		1.45 (1–3)		

MV = mean value, SD = standard deviation, p = significance level, d = effect size.

^aFor interaction effect; correction of degrees of freedom and significance level (Greenhouse-Geisser).

^bTests of within-subject contrasts for interaction effects.

Change in Psychosocial Aspects and in Coping with Illness Due to Participation in Cognitive-Behavioral Training

Table 4 summarizes the results for stress and self-esteem of the IG compared to the WLC. There was a significant interaction (group × measurement point (MP)) for the stress experience ($F(1,35; 36,71) = 25,45; p < 0.001^*$) and self-esteem (KINDL-R: $F(1,51; 40,87) = 5,74; p = 0.011^*$). Thus in the course of treatment, stress experience and self-esteem of the IG improved more than in the untrained control group. The analysis of covariance for the ‘child’s self-esteem (parental perspective)’ with the covariate of the scale values at T1 showed no difference between the 2 groups (IG and WLC) either at T2 ($F(1,26) = 0.12; p = 0.73$) or at T3 ($F(1,26) = 2.43; p$

$= 0.13$). The following values were determined for the child’s self-esteem (parental perspective): T1 (IG: MV = 55.11; SD = 16.42; WLC: MV = 69.05; SD = 9.65); T2 (IG: MV = 61.78; SD = 11.26; WLC: MV = 61.19; SD = 10.75); T3 (IG: MV = 67.78; SD = 6.98; WLC: MV = 65.00; SD = 8.75). Significant main effects by group were shown for stress experience ($F(1,27) = 36.39; p < 0.001$) and self-esteem from the child’s perspective (KINDL-R: $F(1,27) = 15.09; p = 0.001$). Differences could be shown between the groups in stress experience and self-esteem (child’s perspective). Based on the descriptive data in table 4, the children in the IG at T1 and T2 feel less stressed and report higher self-esteem than the children in the WLC. The effect sizes for the group differences, with values between

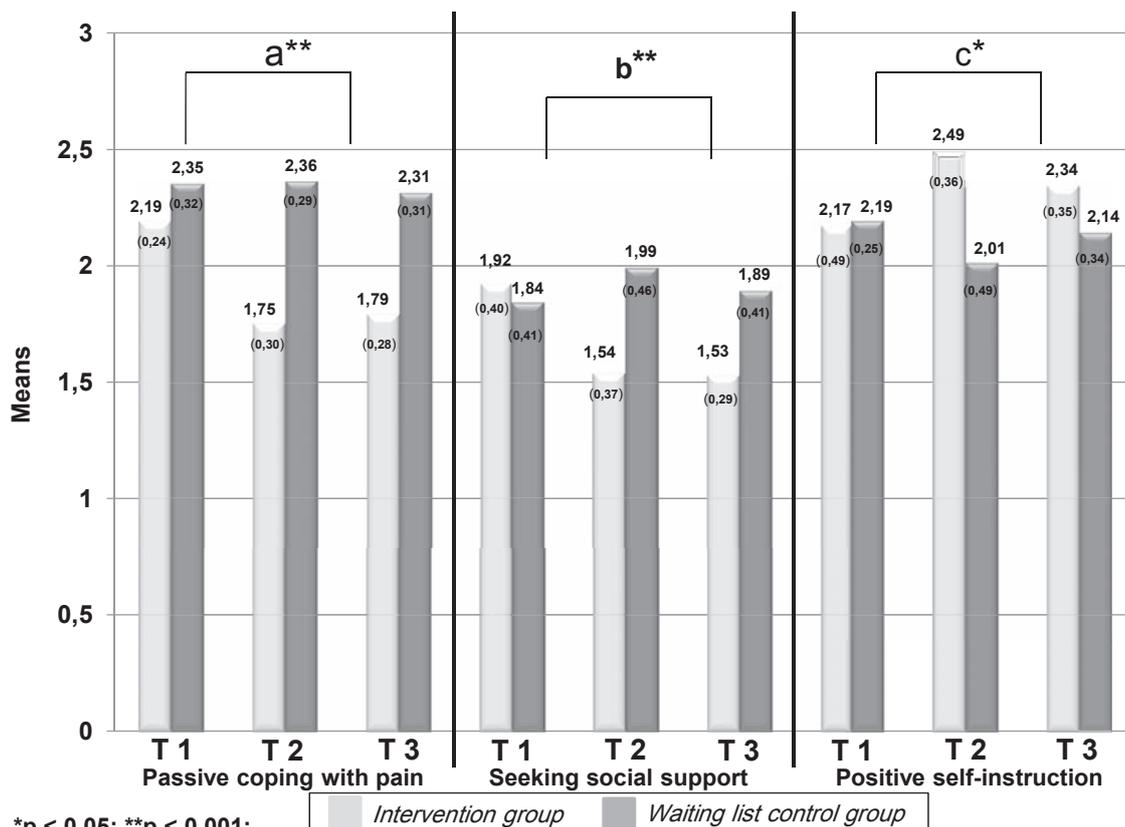


Fig. 1. Coping strategies (IG and WLC) at 3 times, baseline (T1), post (T2), and 3-month follow-up (T3): standardized mean values and standard deviations, significance level (p), effect sizes (d), and post-hoc analyzes. (IK (IA) = within-subject contrasts for interaction).

*p < 0,05; **p < 0,001;
^ad₍₁₋₂₎=1,49; ^ad₍₂₋₃₎ = 0,33; ^ad₍₁₋₃₎=1,19; IK(IA): ^a(F=25,96;p<0,001); ^a(F=1,21;p=0,28)
^bd₍₁₋₂₎=1,28; ^bd₍₂₋₃₎=0,07; ^bd₍₁₋₃₎=1,21; IK(IA): ^b(F=14,06;p=0,001); ^b(F=0,47;p=0,49)
^cd₍₁₋₂₎=1,86; ^cd₍₂₋₃₎=0,55; ^cd₍₁₋₃₎=1,31; IK(IA): ^c(F=11,76;p=0,002); ^c(F=3,93;p=0,06)
^dd₍₁₋₂₎=0,48; ^dd₍₂₋₃₎=0,71; ^dd₍₁₋₃₎=0,22; IK(IA): ^d(F=1,35;p=0,26); ^d(F=2,39;p=0,13)

d = 1.17 and d = 2.34, are considered high. For the WLC, there were no significant changes on any of the scales over time.

With respect to the coping strategies (fig. 1), there were significant interactions (group × MP) for the scales ‘passive coping with pain’ (F(2,54) = 12.31; p < 0.001), ‘seeking social support’ (F(2,54) = 10.05; p < 0.001) and ‘positive self-instruction’ (F(2,54) = 5.97; p = 0.005). Whereas the values in the IG on the scales ‘passive coping with pain’ and ‘seeking social support’ declined, in the WLC there were no changes; the values on the scale ‘positive self-instruction’ increased only in the IG, not in the WLC. There was also a significant difference between the groups (‘main effect’) for the scale ‘passive coping with pain’ (F(1,27) = 20.68; p < 0.001), but not for the scales ‘seeking social support’ (F(1,27) = 3.64; p = 0.07) and ‘positive self-instruction’ (F(1,27) = 3.49; p = 0.07). Figure 1 presents the mean values, effect sizes, and results of the post-hoc analyzes. The group differences for changes from T1 to T2 and T1 to T3, with effect sizes between d = 1.19 and d = 1.86, are considered high. There were no significant changes over time on any of the scales for the WLC.

Calculation of the within-subject contrasts showed that only the improvements for all variables from T1 to T2 were significant, but not from T2 to T3.

Relationship between Psychosocial Factors and Coping with Illness and Pain Experience

The following are the results of the Spearman correlations. The data for all 29 children were evaluated at measurement point T1. To determine possible relationships after completion of training, only the data of the 15 children of the IG were analyzed from measurement points T2 and T3. For each measurement point 1 pain indicator was calculated (multiplying the intensity of pain per day by the duration of pain in h per day), based on the Abdominal Pain Index of Walker et al. [1997]. The following values were determined for the pain indicator (at T2 and T3, the values are given separately for the IG and WLC): T1 (MV = 1.01; SD = 1.06); T2 (IG: MV = 0.02; SD = 0.08; WLC: MV = 1.95; SD = 1.99); T3 (IG: MV = 0.02; SD = 0.08; WLC: MV = 1.12; SD = 1.43).

Before training: Emotional and behavioral problems were only recorded at T1. The scale ‘emotional problems’ was significantly positively correlated with pain experience at the beginning of training (r = 0.32; p = 0.04) – i.e., children who have frequent emotional problems reported greater pain experience. All other subscales of the SDQ showed no significant correlations: ‘behavioral problems’ (r = 0.16; p = 2.01), ‘hyperactivity’ (r = -0.12; p = 0.27), ‘problems with peers’

Table 5. Results of chi-square test for children in the IG (n = 15)

		Pain experience		× 2	df	p ^a
		slight change, n	large change, n			
Stress experience	slight change	5	4	0.71	1	0.61
	large change	2	4			
Coping with pain (PPCI)						
Passive coping with pain	slight change	4	4	0.07	1	1.0
	large change	3	4			
Positive self-instruction	slight change	4	4	0.07	1	1.0
	large change	3	4			
Seeking social support	slight change	3	3	0.05	1	1.0
	large change	4	5			

^ap value according to Fisher's exact test, as per cell occupation <5 (expected frequencies).

($r = 0.05$; $p = 0.40$). Contrary to expectations, there was no significant relationship between the frequency of stress experience and the experience of pain at T1 ($r = -0.27$; $p = 0.08$). None of the scales of the PPCI showed significant correlations with pain experience before training: 'passive coping with pain' ($r = -0.17$; $p = 0.18$), 'seeking social support' ($r = -0.87$; $p = 0.33$), 'positive self-instruction' ($r = 0.002$; $p = 0.49$).

After training: There was a significant positive correlation for the IG between pain experience and the stress experienced ($r = 0.69$; $p < 0.001$). None of the scales of the PPCI showed significant correlations with pain experience: 'passive coping with pain' ($r = 0.16$; $p = 0.28$), 'seeking social support' ($r = -0.03$; $p = 0.46$), 'positive self-instruction' ($r = -0.07$; $p = 0.39$).

3 months after training: There was a significant positive correlation between pain experience and the frequency of stress experience ($r = 0.74$; $p < 0.001$). However, there were no significant correlations between the severity of pain and the coping strategies: 'passive coping with pain' ($r = 0.44$; $p = 0.05$), 'seeking social support' ($r = -0.03$; $p = 0.46$), 'positive self-instruction' ($r = 0.41$; $p = 0.07$).

Pain and Coping with Illness: Differences among Children in the IG, Depending on Extent of Change

An exploratory analysis within the IG should clarify whether the children who successfully changed their stress experience and their pain coping strategies also differ in their pain experience from children who do this to a lesser extent. Therefore change values were first configured between measurement points T1 and T2. 2 'success groups' were formed by a median split (very much improved vs. little improvement). The chi-square test was used for analysis. The results are shown in table 5. There were no significant differences for any of the outcome variables.

Discussion

CAP is very common in children [Schwille et al., 2009]. Those affected suffer from numerous psychosocial limitations

[Walker et al., 2001]; often coping ability is limited and physical as well as psychological well-being are diminished [Campo et al., 2004; Compas et al., 2001]. These psychosocial strains should be particularly considered in intervention programs, so that the children become capable of dealing with recurring pain autonomously, in different situations (e.g., at school or with friends). We therefore developed a cognitive-behavioral group program [Groß and Warschburger, 2011] which focuses on the children and their functional strategies (such as relaxation techniques) for dealing with the pain, as well as helping the children to use these strategies in everyday life. Particularly by conveying appropriate coping strategies in the training program and how to use them in everyday life, stress experience should be reduced. As of today little is known about how participation in a cognitive-behavioral program affects psychosocial aspects and what role emotional problems and changes in coping with illness play with regard to pain experience.

29 children ages 6–12 were consecutively and randomly assigned to the IG or the WLC. The medical and psychosocial outcomes were compiled using validated instruments, primarily self-reporting.

We observed that children with CAP mostly have emotional problems, which coincides with observations from other studies [e.g., Walker et al., 1993]. This is noteworthy, because children with a mental disorder were excluded in the run-up phase on the basis of a clinical interview. In comparison with the data from the KiGGS study [Erhart et al., 2011], the percentage of 'emotional disorders' is similarly high. Furthermore, frequent emotional problems appear to coincide with increased pain experience. This is consistent with numerous findings about CAP in children [e.g., Campo et al., 2004].

A first step in the evaluation of a training program is the treatment satisfaction. Overall, the children rated the training very positively. The high acceptance of the training was underlined in the fact that except for 1 child who had a broken leg, no participants discontinued the treatment.

Related to psychosocial well-being, we noticed that the children in the IG were able to improve their stress experi-

ence as well as their self-esteem during the training course, in comparison to the WLC. The effect sizes of the changes from T1 to T2 and from T1 to T3 are consistently high. It should be stressed that in the WLC, no significant changes were observed during the entire 5-month waiting period. The changes in self-esteem are also significant in both the self-report and the proxy-report by the parents.

In addition, we intended to test whether changes in coping behavior are accompanied by a reduction in pain, as described by other authors [e.g., Eccleston et al., 2004; Hechler et al., 2010]. We were able to verify that within the IG, all coping strategies changed significantly in the expected direction. The effect sizes for significant changes from T1 to T2 and T1 to T3 were consistently high; post-hoc analyzes of the changes from T1 to T2, and even for the strategy 'positive self-instruction' from T2 to T3, were significant, and suggest that the children in the IG further improved after the intervention, at least in terms of positive self-instruction. Possibly in the context of the cognitive restructuring, positive self-instruction is intensively trained and could also be applied to everyday life, through practice at home (homework). The results for reduction of passive coping strategies and seeking social support are consistent with the results of inpatient treatment of chronic headaches in children [Hechler et al., 2010]. In contrast to the present study, Hechler et al. [2010] detected no changes in the IG for the strategy of 'positive self-instruction'. As we hypothesized, our results show that the usage of 'seeking social support' can be reduced. The contents of the program – the teaching of coping strategies – took into account, among other things, that seeking social support is associated with higher pain intensity [Eccleston et al., 2004; Hechler et al., 2008] and the children should be therefore reinforced in their own coping strategies. Parental support should only be requested if they cannot handle the situation themselves.

It is also essential to consider the extent to which psychosocial factors and coping with illness are associated with pain experience. As a limitation, it must be noted that due to the small sample size, we only calculated correlations and therefore can only identify trends. Before training, children with more frequent emotional problems also presented greater pain experience. There was no significant relationship be-

tween the frequency of stress experience and the strategies of coping with pain experience. After training and during the follow-up, there were no significant correlations for the children of the IG between their coping strategies and pain experience, but rather between the frequency of the experience of stress and of pain. Further studies with a larger sample size should perform regression analyses in order to explore that relationship more thoroughly.

We checked whether children in the IG differ according to the degree of change (in pain experience and coping) but no significant differences could be found.

Overall, both the changes in stress experience and coping strategies, and their relationship to pain experience, illustrate the key role of psychosocial factors in the treatment of CAP. The present results, however, do not allow us to draw conclusions about whether these are mediators, since more in-depth analyses had to be omitted due to the small sample size. In summary, this randomized controlled trial showed that a relatively brief psychological intervention (6 sessions) for children with CAP, which aims to build and expand cognitive-behavioral pain coping strategies, leads to an improved stress experience and self-esteem, as well as an increased use of adaptive coping strategies. Above all the role of psychosocial factors in pain events expands our previously presented work on improvements of pain experience and health-related quality of life [Groß and Warschburger, 2012]. Thus emotional problems, passive coping with pain as well as seeking social support (e.g., from parents) are especially associated with increased pain experience. Future studies should validate these findings in larger samples and also investigate which components of the training and which strategies are particularly effective.

Disclosure Statement

The authors declare that there is no conflict of interest.

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