

## Mental state and quality of life after 10 session whole-body cryotherapy

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*(Received 4 September 2012; final version received 21 February 2013)*

The aim of this study was to evaluate the impact of a whole-body cryotherapy (WBCT) on various parameters of the mental state of patients depending on their age, gender, and diagnosed illness. The study included 55 subjects – 43 women and 12 men aged from 20 to 70 years. Based on the diagnosed illness, the patients were divided into two diagnostic groups. The first group consisted of patients with spinal pain syndromes ( $n=34$ ). The second group comprised patients with peripheral joint disease ( $n=21$ ). All patients underwent 10 WBCT sessions. The subjects completed a survey at two time points: before the first WBCT treatment (T1) and after completing the tenth treatment (T2). The World Health Organization Quality of Life-Bref (WHOQOL-Bref) questionnaire and the Psychological General Well-Being Index (PGWBI) questionnaire were used in the study. After a series of WBCT treatments, the WHOQOL-Bref and PGWBI scores significantly improved ( $p=.005161$ ,  $p=.000862$ , respectively). WBCT proved to be more effective in enhancing the mood and well-being of the patients than in improving their quality of life. WBCT has a significant influence on improving the well-being and mood of patients (in terms of both psychological and somatic aspects) and consequently leads to an improvement in their quality of life. The worse the mental state of the patients is prior to the cryotherapy, the stronger its effect. The observed effectiveness of cryotherapy was the strongest in women, patients with spinal pains and in patients with severe depressive symptoms.

**Keywords:** cryotherapy; mood disorders; quality of life; gender; spinal pain syndromes; peripheral joint disease

### Introduction

Whole-body cryotherapy (WBCT) consists of a systemic exposure to extremely low air temperatures ( $-100^{\circ}\text{C}$ ) while wearing minimal clothing for 2–3 min (Metzger, Zwillingmann, Protz, & Jackel, 2000). WBCT has analgesic and decongestant properties, causes skeletal muscle relaxation, increases muscle strength, and improves the range of joint motion. These effects last for at least three hours after cryotherapy, which creates very good conditions for carrying out intensive rehabilitation (Zagrobelny, Halawa, Jezierski, & Wawrowska, 1993).

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Since the introduction of cryotherapy, there have been numerous reports of the impact of this method on the ability to exercise (Piechura, Kaczmarek, & Załęski, 1998; Zimmer, 2003). It's effectiveness in treating fibromyalgia (Offenbacher & Stucki, 2000) and numerous diseases of the musculoskeletal system (Metzger et al., 2000; Stratz, Mennet, Knarr, & Mülle, 1991; Wichmann & Fricke, 1990) has also been confirmed. Currently, cryotherapy plays an important role in the process of rehabilitation and rejuvenation.

Based on the available literature, it is clear that the problem of the impact of WBCT on mental state and quality of life of patients has not been the subject of many scientific studies. The Polish team presented preliminary reports. It was noted that the majority of patients leaving the cryogenic chamber experienced improved mood, memory, vigor, relaxation, and a significant decrease in tension and fatigue and a greater amount of energy (Rymaszewska, Biały, Zagrobelny, & Kiejna, 2000). The aim of the present study was to assess the effect of 10 sessions of WBCT on the mental state of patients depending on the diagnosis, age, gender, and severity of depressive symptoms.

### Material and methods

Fifty five people, 43 women (78%) and 12 men, aged from 20 to 70 years, were enrolled in the study, (mean  $48.4 \pm 12.1$ ). All participants in the study were patients of the Malopolska Cryotherapy Center and used WBCT as part of a standard procedure used in this rehabilitation center. There was no incentive on the part of researchers to participate in the study. All subjects provided an informed, written consent. All patients, who agreed to participate in the initial study, have also completed the final survey. Based on the patients' illnesses, they were divided into two diagnostic groups. The first group consisted of patients with spinal pain syndromes ( $n=34$ ). The second one consisted of patients with peripheral joint disease ( $n=21$ ). Women prevailed in both diagnostic groups (76% and 86%, respectively), whereas the age in both groups was comparable at  $47.2 \pm 12.4$  and  $50.2 \pm 11.5$  ( $p=.4$ ), respectively. The patients underwent 10 WBCT sessions (from 1 to 2 min in the first two sessions to 3 min during the following eight sessions). The procedure, dress code, and methodology used in performing WBCT were carried out according to standards. None of the patients enrolled in the study received any other physiotherapy treatment at the time. The pharmacotherapy administered to patients was not altered throughout the duration of the study.

All subjects filled out a survey at two time points – before the treatment (T1) and at the end of treatment (T2). The World Health Organization (WHO) Quality of Life-Bref (WHOQOL-Bref) questionnaire and the Psychological General Well-Being Index (PGWBI) were used in the study. The WHOQOL-Bref is a standardized research tool developed by the WHO designed to assess the quality of life of healthy and sick persons, both for cognitive and clinical purposes. There are 26 questions that provide a quality of life profile in four domains (somatic, psychological, social relationships, and environment). In addition, the first two survey questions are analyzed separately. The first question concerns the individuals overall perception of their quality of life, while the second one looks at their perception of their own health (Orley, 1996). The PGWBI questionnaire consists of 22 questions. It is designed to assess the subjective mental well-being and stress level of patients. The patient is evaluated in six aspects – anxiety (ANX), depression (DEP), well-being (PWB), self-control (SC),

general health (GH), and vitality (VT). The final result is also used for diagnostic purposes with a range of 0–110 points (Dupuy, 1984). The studies (Grossi et al., 2006; Hawthorne, Herrman, & Murphy, 2006; Revicki, Leidy, & Howland, 1996; Saxena, Carlson, Billington, & Orley, 2001) have confirmed the reliability and validity of the WHOQOL-Bref and PGWB.

### Statistical analysis

The analysis of the results was carried out using the Statistica 7.0 program. To assess the first two questions of the WHOQOL-Bref questionnaire the Wilcoxon test was used. In order to assess the impact of cryotherapy on various parameters of the mental state, the Student's *t*-test was used for dependent samples. In order to assess whether the results before and after cryotherapy were different in groups of men and women as well as in different diagnostic groups, the Student's *t*-test for independent samples was used as well as the Anova analysis of variance with repeated systems.

### Results

The analysis of the responses to the first two WHOQOL-Bref questions showed that both the quality of life and satisfaction with one's own health increased significantly after completing the WBCT treatment cycle compared with the initial measurement ( $p = .005161$ ,  $p = .000862$ ).

For each variable, and on both WHOQOL-Bref and PGWBI scales, the recorded results were higher after completing the treatment cycle than before its commencement with a greater difference between T1 and T2 values in the area related to the well-being of the patients (PGWBI scale scores) and a smaller one in their quality of life (Table 1). A significant relationship was observed between the level of SC and mood ( $p < .0001$ ).

Table 1. The results WHOQOL-Bref and PGWBI in the study group ( $n = 55$ ). Values of test *t*-Student for dependent samples before (T1) and after (T2) cryotherapy.

	Mean (T1)	SD	Mean (T2)	SD	<i>t</i>	<i>p</i>
Somatic domain	14.14	2.22	15.32	2.28	-3.5834	.000728
Psychological domain	15.12	2.28	16.21	2.10	-3.9616	.000220
Social domain	14.93	2.43	15.68	2.50	-2.4474	.017673
Environmental domain	13.68	2.48	14.52	2.14	-3.0721	.003326
WHOQOL-Bref total score	93.01	13.19	99.72	12.30	-4.1637	.000113
Anxiety (ANX)	60.21	19.12	73.81	15.84	-7.0683	.000001
Depression (DEP)	72.60	18.35	83.39	13.38	-6.7051	.000001
Well-being (PWB)	57.18	17.09	67.00	16.82	-6.0592	.000001
Self-control (SC)	73.93	19.29	84.48	12.70	-4.8237	.000012
General health (GH)	55.39	17.49	70.42	15.90	-7.8588	.000001
Vitality (WT)	59.72	16.98	72.09	14.39	-6.3265	.000001
PGWBI global score	62.47	15.30	74.56	12.99	-8.1818	.000001

The analysis of differences between the groups of men and women showed that at commencement of the study (T1) the groups did not differ in age ( $p=.2$ ) but differed significantly in terms of the severity of ANX ( $p=.021349$ ), level of SC ( $p=.012077$ ), and the PGWBI global score ( $p=.026585$ ). After WBCT treatment the dynamics of improvement in the group of women was much greater than in the group of men (Table 2).

Table 2. The results WHOQOL-Bref and PGWBI in groups of women and men. Values of test  $t$ -Student for dependent samples before (T1) and after (T2) cryotherapy.

	Woman ( $n=43$ )				Man ( $n=12$ )			
	Time	Mean	SD	$p$ -value	Time	Mean	SD	$p$ -value
Somatic domain	T1	14.0	2.2	.001437	T1	14.7	2.4	.178286
	T2	15.1	2.3		T2	16.1	2.2	
Psychological domain	T1	14.9	2.3	.001930	T1	15.8	2.2	.056239
	T2	16.0	2.1		T2	17.1	2.1	
Social domain	T1	14.7	2.5	.053320	T1	15.8	2.2	.166087
	T2	15.4	2.6		T2	16.7	2.1	
Environmental domain	T1	13.6	2.4	.013200	T1	14.0	2.9	.137617
	T2	14.4	2.2		T2	15.1	1.7	
WHOQOL-Bref total score	T1	92.1	12.8	.000414	T1	96.6	14.7	.101288
	T2	98.3	12.3		T2	104.9	11.4	
Anxiety (ANX)	T1	57.1	18.1	.000001	T1	71.3	19.5	.007021
	T2	71.1	16.1		T2	83.7	10.7	
Depression (DEP)	T1	70.4	18.9	.000001	T1	80.6	14.3	.001877
	T2	82.3	13.9		T2	87.2	10.8	
Well-being (PWB)	T1	55.9	17.0	.000014	T1	61.7	17.5	.002937
	T2	65.3	17.3		T2	72.9	14.2	
Self-discipline (SC)	T1	70.5	18.9	.000016	T1	86.1	15.9	.338801
	T2	83.3	12.6		T2	88.9	12.5	
General health (GH)	T1	53.2	16.5	.000001	T1	63.3	19.4	.021024
	T2	69.3	16.1		T2	74.4	15.3	
Vitality (VT)	T1	57.6	16.6	.000001	T1	67.5	16.9	.023052
	T2	71.0	14.5		T2	75.8	13.8	
PGWBI global score	T1	60.1	14.8	.000001	T1	71.1	14.6	.001628
	T2	73.0	13.19		T2	80.2	10.9	

Note: time – measuring point.

Similarly, patients with spinal pain syndromes experienced greater severity of ANX and DEP, lower SC and less VT and hence a lower PGWBI global score. After the series of WBCT, a significant improvement was reported in both diagnosis groups, but the dynamics of change were significantly greater in patients with spinal pain (Table 3).

Finally, it was found that patients with severe depressive symptoms at T1 achieved the greatest improvement in mood ( $p=.000011$ ), general well-being ( $p=.000113$ ), and SC ( $p=.000295$ ). In the group of patients who reported no mood problems at T1 improvements in the above-mentioned areas were also noted, but the change was not so apparent ( $p<.05$ ).

Table 3. The results WHOQOL-Bref and PGWBI in groups formed according to the diagnosis (1) back pain, (2) peripheral joint disease. Values of test *t*-Student for dependent samples before (T1) and after (T2) cryotherapy.

	Diagnosis 1 ( <i>n</i> = 34)				Diagnosis 2 ( <i>n</i> = 21)			
	Time	Mean	SD	<i>p</i> -value	Time	Mean	SD	<i>p</i> -value
Somatic domain	T1	14.3	2.1	.002302	T1	13.9	2.4	.054417
	T2	15.3	2.2		T2	15.3	2.5	
Psychological domain	T1	15.2	2.3	.002603	T1	15.0	2.4	.020674
	T2	16.1	2.2		T2	16.5	2.3	
Social domain	T1	15.1	2.8	.017223	T1	14.7	1.6	.313902
	T2	15.9	2.4		T2	15.3	2.7	
Environmental domain	T1	13.7	2.4	.047010	T1	13.6	2.6	.034152
	T2	14.3	2.4		T2	14.9	1.8	
WHOQOL-Bref total score	T1	93.7	13.1	.000174	T1	91.9	13.7	.030047
	T2	99.3	12.6		T2	100.5	12.1	
Anxiety (ANX)	T1	57.1	19.4	.000001	T1	65.3	18.0	.013573
	T2	73.2	15.6		T2	74.9	16.5	
Depression (DEP)	T1	70.6	18.9	.000014	T1	75.9	17.4	.000188
	T2	82.2	12.9		T2	85.4	14.2	
Well-being (PWB)	T1	54.9	16.1	.000001	T1	60.9	18.5	.041607
	T2	66.9	15.2		T2	67.1	19.6	
Self-control (SC)	T1	72.5	18.7	.000321	T1	76.2	20.5	.014848
	T2	83.3	12.2		T2	86.3	13.6	
General health (GH)	T1	52.0	16.9	.000001	T1	60.9	17.4	.004039
	T2	69.4	13.2		T2	72.1	19.7	
Vitality (VT)	T1	58.1	17.3	.000013	T1	62.4	16.5	.001633
	T2	70.9	12.9		T2	74.0	16.6	
PGWBI global score	T1	60.1	15.3	.000001	T1	66.3	14.8	.001970
	T2	73.7	11.9		T2	75.9	14.8	

Note: time – measuring point.

## Discussion

In the present study, the positive impact of WBCT on different aspects of general well-being (both somatic and psychological) and the quality of life was confirmed. Similarly, Gregorowicz noted that among participants with multiple sclerosis, more than 70% stated an improvement in mood after WBCT (Gregorowicz & Dalidowski, 1998). Our results show that the greater the problems of the patients before the commencement of therapy (in terms of their mood and well-being), the stronger the effects of WBCT. This is evident in the group of women who, at the first measurement, reported much more severe symptoms of ANX, lower SC, and worse general well-being than men. At the same time, their improvement in all the analyzed parameters after 10 WBCT sessions was more dynamic than that of men.

The situation was similar in case of patients with the diagnosed spinal pain syndromes and people with severe depressive symptoms. This is important because, in general, this type of patient (due to problems with mood, lack of motivation, lack of faith in the effectiveness of the undertaken therapy, and aversion to physical activity) gains much less from participation in various kinds of rehabilitation program than a patient without depression (Clark & Smith, 1998; Pincus, Burton, Vogel, & Field, 2002; Szczepańska-Gieracha, Kowalska, Malicka, & Rymaszewska, 2010).

In addition, the presented results show a strong correlation between mood improvement and increased SC, which is fundamental in ensuring the success of therapy in all

chronic progressive diseases with pain and limited joint mobility. Patients suffering from depression are not able to force themselves to carry out daily physical exercise. Attempting to limit their pain, they avoid physical activity, which worsens their condition, increases their discomfort and mental tension, and consequently accelerates the progression of the disease. The strong influence of WBCT on the mental state encourages its use in typically psychiatric disorders, particularly depression, where it could be used in addition to the applied therapy, or in cases where the current therapy does not bring desired effects.

This study has several limitations first of all the small sample and the lack of a control group. The intervention was administered in a group, so in addition to the cryotherapy, participants were receiving daily social contact. This fact alone could help to improve the mood regardless of WBCT. Additionally, follow-up is needed to determine how long do the positive effects of treatment last.

## Conclusion

Cryotherapy has a significant impact on the improvement of patient's well-being, mood, and quality of life.

The observed improvement is independent of the age of the patients.

An increased effectiveness of cryotherapy was observed in women, people with spinal pain and patients with severe depressive symptoms.

Along with mood improvement, there is an increase in self-control, which may significantly increase the effectiveness of the undertaken treatment and rehabilitation.

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