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ALTERED CONSCIOUSNESS IN FLOTATION-REST AND CHAMBER-REST: EXPERIENCE OF EXPERIMENTAL PAIN AND SUBJECTIVE STRESS

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Twenty-three sportsmen were given one 45-minute exposure to flotation-REST and one exposure to chamber-REST on two occasions, incorporating random assignment to either flotation-REST followed by chamber-REST or vice versa. On each occasion, the Restricted Environmental Stimulation Technique (REST) procedure was followed immediately by testing experimentally induced pain to one arm using a blood pressure cuff. It was found that flotation-REST induced a significantly higher degree of altered states of consciousness (ASC), as measured with an instrument assessing experienced deviation from normal state (EDN), than did chamber-REST. Participants experiencing High EDN in the flotation-REST condition reported higher levels of both "experienced pain" and "experienced stress" than did those experiencing Low EDN. These results suggest that the particular distinguishing features of flotation-REST and chamber-REST may cause selective deviations from normal levels of consciousness, under experimental conditions, that may underlie the subjective experience of pain and stress thresholds.

Experimental methods for studying pain processes may elucidate questions arising in clinical pain research. For example, experimental pain studies may be used to develop "coping" strategies as well as to evaluate the efficacy of these strategies (Edens & Gil, 1995). Nevertheless, studies involving experimentally

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induced pain are severely limited in their capacity to model the pain experienced, for example, in chronic pain conditions, since among restrictions the affective component is missing generally in the experimental setting (Rang, Dale, & Ritter, 1999). Furthermore, whereas experimental pain is usually predictable, this is not the case in chronic pain, as participants in a pain experiment may terminate the study at any time in full knowledge that at no time are they at risk for tissue damage (Edens & Gil).

Although several methods exist for induction of experimental pain, induced ischemia (due to lack of oxygen) and cold-presser pain are considered methods-of-choice as models of chronic pain condition (Rainville, Feine, Bushnell & Duncan, 1992). In the latter case, the participant is required to submerge his/her hand into a bucket of ice water whereas in the former ischemic pain is induced by elevating pressure at the blood pressure cuff on the participant's arm. In ischemic pain, lack of tissue oxygen at the cuff inhibits the sodium-potassium pump thereby increasing extracellular K^+ concentrations which in turn depolarize pain receptors with consequent impulse generation and perception of pain (Nisell & Lundeberg, 1993). Lack of tissue oxygen leads also to bradykinin accumulation, further reinforcing the pain (Nisell & Lundeberg, 1993; Rang, Dale, & Ritter, 1999).

Measurement of pain intensity can be performed using a Visual Analog Scale (VAS) from 0-100, which is expressed often as being the “gold standard” for assessment of pain (Yarnitsky, Sprecher, Zaslansky, & Hemli, 1996), although verbal descriptions are utilized too. Comparisons of VAS with verbal descriptor techniques indicate that both methods are equally sensitive for quantification of pain intensity and its affective component (Duncan, Bushnell, & Lavigne, 1989).

At present, there are only a few studies on human participants involving *experimental pain* in combination with relaxation/stress-reduction, whereas there are a substantial number of studies showing the analgetic effect of relaxation when using flotation-REST on *clinical pain* (e.g., Kjellgren, Sundequist, Norlander, & Archer, 2001). Flotation-REST (Restricted Environmental Stimulation Technique) is a mild form of sensory deprivation where the participant is comfortably floating on his/her back in a saline solution contained in a dark, anechoic tank. In order to further reduce incoming sensory perceptions, the participant wears earplugs and the saline water solution is heated to skin temperature, thus reducing auditory and tactile stimulation. The method induces a state of relaxation and stress-reduction (e.g. Norlander, Kjellgren, & Archer, 2001).

The studies that have been made with REST and pain relief have in common the fact that they study an already existing, chronic pain which is present when the REST-treatment is begun (Kjellgren et al., 2001). These studies in no way claimed that the pain relief was to be explained by the elevation of the

participant's pain threshold, but rather noted that the participants experienced attenuation of the existing pain over time as REST-treatments were continued.

The aim of this study was consequently to investigate whether or not the degree or level of altered state of consciousness could be of importance for the subjective experience of experimental pain induced when the participant was already in a mild altered state of consciousness. In order to practically achieve this altered state of consciousness; sensory deprivation was used in a flotation-REST tank and on a couch in a dark, silent room (chamber-REST), respectively.

METHOD

PARTICIPANTS

The study was carried out during two weeks, with a six-week interval separating each week, at the Human Performance laboratory at Karlstad University (Karlstad, Sweden). Twenty-three sportsmen were recruited through association with sports-active groups in the province of Värmland (Sweden). Their mean age was 29.48 years (*SD* = 4.97, range = 21 to 41), and 13 individuals were students whereas 10 had professions. The participants reported that they performed some form of sports activity at least 353.48 minutes per week (*SD* = 265.63). Sixteen participants had never smoked, 4 participants smoked only on special occasions, like parties, and only 3 participants were regular smokers.

In order to obtain further background data two Hospital Anxiety and Depression scales (HAD, Herrmann, 1997) were applied. The mean values for HAD were: for the depression scale: 2.17 points (*SD* = 1.59), and for the anxiety scale: 4.91 points (*SD* = 2.19), which may be compared with the clinical boundary of 6 points for evidence of both depression and anxiety.

The participants received the pain induction procedure on two occasions (see "Design") and on both occasions had experienced pain prior to arrival at the laboratory, which was estimated on a 100-degree scale (where 0 = *no pain*, 100 = *intensive pain*). Mean values on the first occasion were estimated to be 10.08 (*SD* = 16.36) and on the second occasion 8.00 (*SD* = 14.72), a difference that was not found to be significant (paired-samples *t*-test, $p = 0.413$).

DESIGN

Each participant received a chamber-REST treatment and a flotation-REST treatment. There was a 6-week interim period between the two REST treatments and the order of treatment was randomized. Directly after the REST treatment, degree of altered consciousness was measured as well as experienced time of the REST treatment. On both occasions, the participants received the pain induction procedure directly after the REST treatment. During the pain induction procedure, measurements of experienced pain, experienced stress, pulse, and

blood pressure were made. Directly after the pain induction procedure, the experienced time of pain induction was estimated by the participant. For analysis, a paired samples design (chamber-REST versus flotation-REST) was applied in some analysis and in other analysis an independent samples design was used whereby the dependent variables were analyzed within each respective REST condition with Altered state of consciousness (Low, High) as the independent variable.

INSTRUMENTS

(a) Flotation tank. A flotation tank (Aqua-Anima, Sweden) measuring 2700 mm x 1500 mm x 1300 mm was used. The depth of water varied between 250 and 300 mm. The tank was insulated, partially in order to prevent incoming noise, but also to maintain a constant temperature for both water and air within the tank. Despite slight variation, water temperature was maintained at 34.2°C. The water in the flotation tank was saturated with magnesium sulphate to a concentration of 1.3 g/ml (cc). In contrast to a sodium chloride solution, magnesium salts (also called Epsom salts) are benign upon the skin surface. The salt does not irritate or dry out the skin. The roof of the tank was horizontally hinged and could easily be opened and closed by participants. Between participants, the water was filtered and sterilized with UV-light, and hydrogen peroxide was regularly added to ensure hygiene.

(b) Couch. A simple couch overlaid with a soft mattress, dimensions: 2000 x 800 mm was placed in the dark, quiet, noise-insulated room that was assigned to provide the chamber-REST condition.

(c) Pulsoxymeter. Ohmeda Biox 3700e. The apparatus consists of an ear probe attached to one ear lobe. Oxygen gas saturation, SpO_2, and pulse frequency may be assessed. The ear probe was attached to a participant's ear lobe immediately before the start of the pain induction procedure. Registration of pulse and oxygen saturation occurred 2, 5, 8, 10, 12, 13, 14 and 15 minutes after pain induction.

(d) Sphygmo manometer. Blood pressure cuff (Umedico, Sweden) as well as a 10-cm broad rubber band (Dauer, Sweden).

(e) Questionnaire 1. Background variables and Exclusion criteria. The participants' expectations concerning flotation and eventual bodily responses to pain were estimated on a VAS (0 - 100). Furthermore, questions regarding age and tobacco as well as education, occupation and sports and exercise were responded to. Additionally, participants responded “yes” or “no” to questions pertaining to a) skin problems, cuts, bruises or any other complaints, b) any acute or chronic illness, c) whether or not one was taking medication, and, d) whether or not one suffered from any psychological problem. If a participant responded with “yes”, the physician with medical responsibility made an examination to decide whether or not the participant needed to be excluded.

(f) Hospital Anxiety Depression Scale (HAD). The validity and reliability of the HAD-scale for assessing degree of anxiety and depression symptoms has been examined by Herrmann (1997). The HAD-scale measures the degree of anxiety and depression wherein values under 6 are considered normal, those between 6 and 10 are assessed as being borderline and all values over 10 points are indicative of a probable depression-anxiety diagnosis.

(g) Experienced deviation from normal state (EDN). Utilizing the internationally applied psychometric instruments APZ-questionnaire and OAVAV (Dittrich, 1998) for obtaining judgments of altered states of consciousness, a shortened but similar instrument was modified for use with flotation-REST (Kjellgren et al., 2001). The APZ- and OAVAV-forms are the internationally applied standard for this purpose and these tests have been validated in several studies over different countries (Dittrich, 1998). In total, the EDN consists of 29 questions the answers to which are given on a VAS (0-100). The major portion of these data is not applicable to the present study, so only a part of the test form results are presented here. A complete "index of experience" was constructed from the points obtained from all 29 questions which were averaged to provide a "sum of experience". These values ought to reflect the total experience of deviation from normal states (EDN).

(h) Visual Analog Scale (VAS). This scale was used for measuring pain and stress. The scale consists of a 10-cm horizontal line with the anchors *no pain* on the left extreme and *excruciating pain* on the right extreme. As Yarnitsky et al. (1996) point out: "VAS is considered the "gold standard" for assessment of clinical and suprathreshold experimental pain, and changes in VAS score are regarded as significant evidence of individual response to treatment, placebo, or experimental manipulation". The accuracy and precision have been examined for both clinical and experimental pain, and found adequate (Price, 1988).

(i) Final Questionnaire. On arrival for the third visit at the laboratory, each participant was asked about bodily pains, as well as his experience of remaining complaints after the prior occasion's induction of pain.

PROCEDURE

Twenty-four sportsmen were recruited through contacts with the sports community of Värmland County (Sweden) as participants in this study. On the occasion of the first meeting, each participant was provided with information about how the study was set up and told that it was possible to terminate participation at any time. Questionnaires with background data and exclusion criteria were assembled and collected and the participants responded to the HAD-test. Afterwards, each participant was shown the procedure by which experimental pain would be induced on the next occasion. An ordinary blood pressure cuff was applied to each participant's nondominant arm. Systolic blood

pressure was measured. The participant was then asked to hold his arm in an upright position for 2 minutes, and at the same time to keep all his fingers outstretched. After this, the arm (still upright) was bound hard with a rubber band (the so-called Dauer binding) in order to constrict blood circulation from the fingers to the point where the as-yet-deflated blood pressure cuff was applied. Then the participant's arm was allowed to descend to a normal resting position on the table. Following this, the blood pressure was pumped up to double the systolic blood pressure that had been measured earlier (normally about 250 mm Hg). It was at this point that the actual pain induction (as performed in all the following tests) was initiated, but during this introductory occasion the demonstration was terminated by instead releasing the air from the cuff and removing the rubber band. After this, the laboratory and flotation tank were shown to the participant who was asked to use the lavatory and shower before floating and shown how to insert the earplugs before going into the tank. Following this, a test flotation over 20 minutes was given. Later, after showering and dressing the participant was randomly assigned, for his next visit, to either the flotation-REST or chamber-REST condition. Then the dark, quiet room with the couch for chamber-REST was shown and the next visit of the participant was booked.

On arrival for his second visit, the participant experienced either flotation-REST or chamber-REST for 45 minutes, according to the condition to which he had been randomly assigned. Flotation-REST procedures were maintained as described above. The chamber-REST procedure was preceded by a toilet visit and a change to comfortable clothes (T-shirt and underpants). On completion of flotation-REST, the participant was allowed 15 minutes for showering and changing. In order to ensure a similar temporal arrangement for chamber-REST, the participant was required to remain in the room a further 15 minutes. After completion of the respective REST-treatment the participant was required to complete the EDN-test. After this, the induction of pain procedure was initiated. The same procedure was completed, as described earlier, during the first visit as well as the careful attachment of the pulsoxymeter and ear-probe to the participant's ear. Paper and coloring pens were available on a table in front of the participant and he was urged to "draw something" with his free arm during the time that the induction of pain procedure was maintained.

Measures of experienced pain were taken, by questioning, then every minute (which the participant marked on the horizontal line on the VAS-scale, whereby 0 indicated *no pain* and 100 indicated *excruciating pain*). Degree of "experienced stress" was estimated, by questioning, at 2, 5, 8, 10, 12, 13, 14 and 15 minutes, here too the VAS-scale was used whereby 0 indicated *not stressed at all* and 100 indicated *maximum possible stress*. Concurrently with the participant's estimations of experienced stress, pulse frequency and oxygen levels were

measured using the pulsoxymeter. The participants had not received any information about how long the experiment could continue but rather, were instructed to carry on as long as they were able to. After 15 minutes the cuff was removed and the experiment terminated. As part of the experiment it was decided that the experimenter would terminate the experiment if any participant estimated "experienced pain" on the VAS-scale between 75-80 or more, or if some aspect of the verbal communication between the experimenter and the participant indicated that the individual was unnecessarily troubled by pain. However, this situation did not occur for any of the participants. Immediately after the cuff had been removed, the participant was required to estimate the length of time that it had remained inflated upon his arm.

On arrival at the laboratory for the third and final visit, the participant was required to complete a questionnaire containing questions about bodily pain and eventual discomfort following previous induction of pain. After this, the experiment was carried out in an identical manner to the procedure used during the participant's second visit to the laboratory except that the other REST-condition, compared to that applied in the previous visit, was presented. On completion of the experiment the participants were each thanked for their participation.

RESULTS

Data Reduction

In order to facilitate the statistical analysis, the possibility of performing reduction of the data regarding experienced pain, experienced stress, pulse rate and oxygen saturation was investigated by regression analysis (enter-method) through calculating Multiple R (R).

The analyses indicated significant correlations for experienced pain following couch ($R = 0.99$, p = 0.002) and following flotation tank ($R = 0.99$, $p < 0.001$), for experienced stress following couch ($R = 0.94$, $p < 0.001$) and following flotation tank ($R = 0.96$, $p < 0.001$), for pulse rate following couch ($R = 0.91$, $p < 0.001$) and following flotation tank ($R = 0.95$, $p < 0.001$), as well as for oxygen saturation following couch ($R = 0.91$, $p < 0.001$) and following flotation tank ($R = 0.93$, $p < 0.001$). Since these analyses indicated high correlation values ($R > 0.90$), the mean values for the results pertaining to experienced pain, experienced stress, pulse rate and oxygen saturation in exhaled air were applied to further statistical analysis.

Comparison Between Chamber-REST and Flotation-REST

In order to analyze the dependent variables, statistics with Paired Samples *t*-test (5% level) were used. The analyses did not indicate any significant differences

between chamber-REST and flotation-REST with regard to experienced pain (p = 0.989), experienced stress (p = 0.985), pulse rate (p = 0.293), blood pressure (p = 0.476), oxygen saturation in blood (p = 0.316), estimated time for REST-treatment duration (p = 0.086), and estimated time for blood pressure cuff duration (p = 0.966). However, there was a significant difference with regard to altered state of consciousness (EDN) [t (22) = 4.88, $p < 0.001$], whereby it was indicated that flotation-REST induced a higher degree of altered state of consciousness (M = 32.48, SD = 15.94) compared with the chamber-REST condition (M = 15.10, SD = 13.11). Table 1 presents the means and standard deviations for each variable in the flotation-REST and chamber-REST conditions.

TABLE 1
MEANS (AND STANDARD DEVIATIONS) FOR THE VARIABLES PERTAINING TO THE REST-CONDITIONS

	Chamber-REST		Flotation-REST		%Quotient
Experienced pain	26.92	(15.63)	26.88	(18.37)	100
Experienced stress	11.61	(12.42)	11.65	(13.30)	100
Pulse	69.26	(11.01)	70.77	(10.90)	102
Blood pressure	108.26	(12.76)	111.09	(10.76)	102
Experienced REST-time	36.17	(8.05)	41.89	(10.06)	116
Experienced cuff time	10.08	(2.89)	9.46	(2.96)	94
EDN *	14.57	(13.06)	32.48	(15.94)	223

Notes: * indicates significant difference (5% level) between REST-conditions.
% Quotient was derived by dividing Flotation-REST mean values by chamber-REST mean value and multiplying by 100.

COMPARISON BETWEEN LOW AND HIGH EDN WITHIN RESPECTIVE REST CONDITION

The participants' points regarding altered state of consciousness (EDN) following the chamber-REST treatment were divided to form two groups (cut-off-point = 47.8 %), that is, one group presenting a low altered state of consciousness (Low EDN, 11 individuals, M = 4.98, SD = 2.12) and one group presenting a high altered state of consciousness (High EDN, 12 individuals, M = 23.36, SD = 12.69). An identical procedure was applied to participants' points regarding altered level of consciousness (EDN) following the flotation-REST treatment in that they were divided to form two groups (cut-off-point = 47.8 %), with one group presenting a Low EDN (11 individuals, M = 19.29, SD = 7.23) and the other group presenting a High EDN (12 individuals, M = 44.58, SD = 12.26).

Chamber-REST. Independent Samples t-tests (5% level) with EDN (Low, High) as independent variable did not indicate any significant differences between low

and high degree of altered state of consciousness regarding experienced pain (p = 0.073), experienced stress (p = 0.110), pulse rate (p = 0.762), blood pressure (p = 0.410), oxygen saturation in blood (p = 0.462), estimated time for REST-treatment duration (p = 0.443), or estimated time for blood pressure cuff duration (p = 0.355). Table 2 presents the means and standard deviations between Low and High EDN in the chamber-REST condition.

TABLE 2
COMPARISONS BETWEEN THE LOW-EDN AND HIGH-EDN REPORTING PARTICIPANTS WITHIN THE CHAMBER-REST CONDITION

	Low-EDN		High-EDN		%Quotient
Experienced pain	20.84	(7.50)	32.49	(19.15)	155
Experienced stress	7.27	(6.04)	15.58	(15.46)	214
Pulse	70.01	(7.69)	68.57	(13.70)	98
Blood pressure	105.91	(13.75)	110.42	(11.96)	104
Experienced REST-time	34.57	(7.16)	38.40	(9.50)	111
Experienced cuff time	9.38	(2.83)	10.72	(2.97)	115
EDN *	4.98	(2.12)	23.36	(12.69)	469

Notes: * indicates significant difference (5% level) between High and Low EDN.
% Quotient was derived by dividing High-EDN mean values by Low-EDN mean value and multiplying by 100.

Flotation-REST. Independent Samples *t*-tests (5% level) with EDN (Low, High) as independent variable did not indicate any significant differences between low and high degree of altered state of consciousness levels regarding pulse rate (p = 0.820), blood pressure (p = 0.156), oxygen saturation in blood (p = 0.192), and estimated time for REST-treatment duration (p = 0.191). However, there was a significant difference with regard to experienced pain [$t(21) = 3.59$, $p = 0.002$], whereby further analysis indicated that the participants presenting High EDN experienced a higher level of pain (M = 37.49, SD = 18.84) compared with those presenting a Low EDN (M = 15.30, SD = 8.30). Furthermore, there was a significant difference with regard to experienced stress [t (21) = 2.23, p = 0.037], whereby further analysis indicated that the participants presenting High EDN experienced a higher level of stress (M = 17.10, SD = 16.06) compared with those presenting a Low EDN (M = 5.70, SD = 5.54). Finally, there was a significant difference with regard to estimated time for blood pressure cuff duration [$t(21)$ = 3.057, p = 0.010], whereby further analysis indicated that the participants presenting Low EDN experienced a longer duration of blood pressure cuff (M = 12.00, SD = 2.74) compared with those presenting a High EDN (M = 8.00, SD = 2.07). Table 3 presents the means and standard deviations between Low and High EDN in the flotation-REST condition.

TABLE 3
COMPARISONS BETWEEN THE LOW-EDN AND HIGH-EDN REPORTING PARTICIPANTS WITHIN THE FLOTATION-REST CONDITION

	Low-EDN		High-EDN		%Quotient
Experienced pain*	15.30	(8.30)	37.49	(18.84)	245
Experienced stress*	5.70	(5.54)	17.10	(16.06)	300
Pulse	71.33	(10.09)	70.26	(12.06)	98
Blood pressure	107.73	(8.47)	114.17	(12.03)	106
Experienced REST-time	39.27	(9.21)	45.50	(10.66)	116
Experienced cuff time*	12.00	(2.74)	8.06	(2.07)	67
EDN *	19.29	(7.23)	44.58	(12.26)	231

Notes: * indicates significant difference (5% level) between Low and High-EDN.
% Quotient was derived by dividing High-EDN mean values by Low-EDN mean value and multiplying by 100.

DISCUSSION

In the present study, twenty-three male athletes participated in two REST conditions (chamber, flotation), wherein the order of presentation of the conditions was randomized, but the time interval between each REST condition was held constant, that is, six weeks. One main finding was that flotation-REST induced a significantly higher degree of altered states of consciousness (ASC), as measured with EDN, than chamber-REST. This finding confirms the results of earlier studies (e.g., Norlander, Kjellgren, & Archer, in press). In this study the experience of an ASC is described in terms of a continuum of the two REST conditions by which participants achieving a "higher altered state" in the Chamber-REST condition essentially displayed the same EDN points as did those participants achieving a "lower altered state" in the flotation-REST condition. Participants achieving higher ASC in the latter condition experienced significantly more pain and stress, and also perceived pain duration as shorter compared with those participants with a lower ASC in the same condition. Comparison of lower and higher ASC in the chamber-REST conditions did not produce such differences. Thus, it is possible that acute induced pain may be experienced with more intensity under conditions wherein the higher levels of ASC (as assessed by EDN) are associated with elevated levels of awareness and sensitivity consciousness and sensitivity for sensory stimuli. It appears that the hypothesis regarding the role of ASC in receptivity to acute pain was confirmed. As indicated previously, an ASC is marked by increased focus and attention upon internal stimuli and processes (Ludwig, 1990). Nevertheless, it does not appear that the role of ASC in acute induced pain has been addressed previously. With regard to chronic pain, several studies have shown that flotation-REST induced an alleviation of pain (e.g., Kjellgren et al., 2001).

Certain cognitive relationships may underlie the influences of Flotation-REST upon acute and chronic pain, respectively. REST appears to induce a "cognitive shift" (Norlander, Bergman, & Archer, 1998) whereby primary process thinking (i.e., "here and now" thinking) is reinforced at the cost of secondary process thinking (i.e., a more "abstract and temporal-based" thinking). It is possible that under the influence of heightened primary process thinking, for example, through the Flotation-REST experience, an individual with an existing pain (chronic) experiences greater attention upon physical and psychological relaxant effects accompanied by reduced attention upon the pain signal. Conversely, if an individual not bearing any particular pain experience directly after Flotation-REST is exposed to intense pain he/she may experience intensive distress due to the abrupt termination of primary process thinking. Previous studies (Norlander et al., 1998) have demonstrated an "after-effect" whereby elevation of primary process remains for at least an hour after flotation. Possibly, the stronger the influence of primary process the greater the distress due to enforced "cognitive shift".

The application of intense experimental pain in the present study distinguishes it from other REST studies. Furthermore, all the participants were aware that the experimental pain would not cause lasting damage, and that the pain would end when the experiment was terminated or when they themselves, as free volunteers, chose to terminate. These considerations indicate that the affective components otherwise associated with chronic pain were missing (as discussed earlier, this is one of the weaknesses of experimental pain studies). Further, it ought to be noted that the present study incorporated a single instance of REST-Flotation rather than a series of treatments as applied in the previous pain-reduction studies wherein different types of neurohumoral and/or physiological changes may have occurred and to some extent been measured (Kjellgren, et al., 2001).

The present study suggests the existence of some "threshold-level" in the degree of ASC that must be overcome before measurable effects on the variables investigated are observed. The finding that degree of experienced ASC in the chamber-REST condition induced means for the highest EDN values (i.e., most altered) that were comparable to those of the lowest EDN values for Flotation-REST seems to support this notion. Note that the means of the highest EDN values (ASC) for flotation-REST are much higher (High-EDN as a percentage of Low-EDN: Experienced pain = 245%, and Experienced stress = 300%) than those of the highest EDN values for chamber-REST (High-EDN as a percentage of Low-EDN: Experienced pain = 155%, and Experienced stress = 214%). It ought to be indicated that there were no significant differences for experienced pain and stress on the comparison between the methods, flotation-REST and chamber-REST, but rather the significantly higher pain and stress experiences were reported from individuals showing the highest ASC values.

One characteristic property of ASC is disturbance of temporal perspective (Ludwig, 1990). It was found that the experience of time during which pain was applied (cuff-duration) was significantly different for participants expressing a high degree of ASC within the flotation condition. Previous flotation-REST studies (Norlander, Kjellgren, & Archer, 2001) have shown too that, for individuals under the influence of the flotation tank experience, time passes more quickly. The shortened time perspective by the High-EDN participants in the Flotation-REST condition (High-EDN as a percentage of Low-EDN: Experienced cuff duration = 67%) compared to Low-EDN participants may offer further effects of the condition that may be pertinent to the more intensive experience of pain. In the chamber-REST condition, the High-EDN participants indicated a slightly, but nonsignificantly, lengthened time perspective (High-EDN as a percentage of Low-EDN: Experienced cuff duration = 67%) compared to Low-EDN participants.

It is possible that a different group of participants may have provided a different set of results. The pain experience in an experimental pain method may also be modulated by the type of instructions provided to participants. Here, the instruction was: “try to withstand the pain as long as you are able to” instead of informing the participants that pain was to be experienced during a fixed time duration (in this case 15 minutes). Thorn and Williams (1989) have shown that estimations of pain in ischemic pain tests are lower if participants are given prior information that the pain was of fixed duration. The “fixed-time” instruction was withheld in order to provide a semblance of clinical pain wherein an uncertainty regarding duration of pain is probably a factor of some influence.

REFERENCES

Dittrich, A. (1998). The standardized psychometric assessment of Altered States of Consciousness (ASCs) in Humans. *Pharmacopsychiatry*, **31**, 80-84.

Duncan, G. H., Bushnell, M. C., & Lavigne, G. J. (1989). Comparison of verbal and visual analogue scales for measuring the intensity and unpleasantness of experimental pain. *Pain*, **37**, 295-303.

Edens, J. L., & Gil, K. M. (1995). Experimental induction of pain: Utility in the study of clinical pain. *Behavior Therapy*, **26,** 197-216.

Herrmann, C. (1997). International experiences with the Hospital Anxiety and Depression Scale - a review of validation data and clinical results. *Journal of Psychosomatic Research*, **42**, 17-41.

Kjellgren, A., Sundequist, U., Norlander, T., & Archer, T. (2001). Effects of flotation-REST of muscle tension pain. *Pain Research and Management*, **6,** 181-189.

Ludwig, A. M. (1990). Altered states of consciousness. In C. T. Tart (Ed.) *Altered states of consciousness* (pp. 18 - 33). San Fransisco: Harper Collins.

Nisell, R., & Lundeberg, T, (1993). *Smärta och inflammation* [Pain and inflammation]. Södertälje: Syntex Nordica.

Norlander, T., Bergman, H., & Archer, T. (1998). Effects of Flotation REST on creative problem solving and originality. *Journal of Environmental Psychology*, **18**, 399-408.

Norlander, T., Kjellgren, A., & Archer, T. (2001). The experience of flotation-REST as a function of setting and previous experience of altered states of consciousness. *Imagination, Cognition and Personality*, **20**, 161-178.

Norlander, T., Kjellgren, A., & Archer, T. (in press). Effects of flotation- versus chamber-restricted environmental stimulation technique (REST) on creativity and realism under stress and non-stress condition. *Imagination, Cognition and Personality*.

Price, D. D. (1988). *Psychological and neural mechanisms of pain.* New York: Raven Press.

Rainville, P., Feine, J. S., Bushnell, M. C., & Duncan, G. H. (1992). A psychophysical comparison of sensory and affective responses to four modalities of experimental pain. *Somatosensory & Motor Research*, **9,** 265-277.

Rang, H. P., Dale, M. M., & Ritter, J. M. (1999). *Pharmacology*. Edinburgh: Churchill Livingstone.

Thorn B. E., & Williams, G. A. (1989). Goal specification alters perceived pain intensity and tolerance latency. *Cognitive Therapy and Research*, **2,** 171-183.

Yarnitsky, D., Sprecher, E., Zaslansky, R., & Hemli, A. (1996). Multiple session experimental pain measurement. *Pain*, **67**, 327-333.