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Biodanza for kindergarten children (TANZPRO-Biodanza): reporting on changes of cortisol levels and emotion recognition

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ABSTRACT
The evidence-based programme "TANZPRO-Biodanza for children" was developed in 2009 by Marcus Stueck and Alejandra Villegas based on the Biodanza concept of Rolando Toro and Cecilia Luzzi (Children-Biodanza). The 10-session programme includes elements of dance, movement, encounter and non-verbal communication. There are two versions of the programme, for younger children aged 4–6, and older children, aged 7–12. TANZPRO-Biodanza is the nonverbal part of the School of Empathy concept, based on an integrative empathy model by Stueck (2013b, verbal part: "Respectful, nonviolent communication"). In the current study (10 children, age 4–6), a significant reduction in cortisol and improvements in emotion recognition and concentration (in children with high or medium pre-cortisol values) were found. This indicates the potential of TANZPRO-Biodanza to promote stress reduction and the enhancement of social skills. Despite the methodical limitations, the current study is a valid pilot and gives a first insight into the effects of dance on the responses and modulation of neurohormones in 4–6-year-old children.

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Introduction

Biodanza was developed in the 1960s by the Chilean Rolando Toro; it is an intervention method combining music, movement and human contact (Toro,

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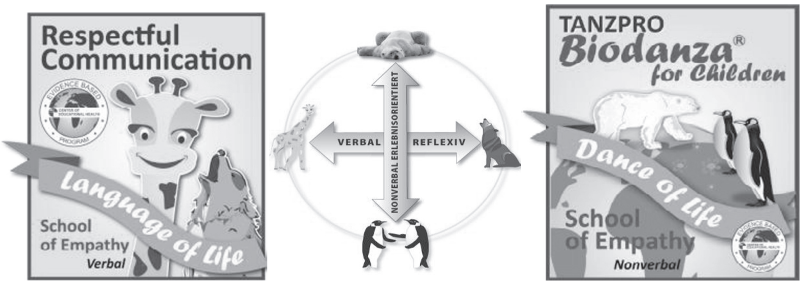
2010). Life ('bios') is danced with integrative moves ('danza') under the guidance of a Biodanza teacher. It promotes emotion to generate intense experiences (so called *vivencias*, Spanish for 'experiences'). These intense moments in one's life are used to influence a child's vitality, affectivity and creativity. Moreover, these *vivencias* promote authentic expression of human feelings and physical (bodily) empathic interaction within the human group; this is characterized by the self-regulation and personality of each of the participants. Since 1998, Marcus Stueck (University of Leipzig, Germany) and Alejandra Villegas (Argentina) together with Rolando Toro and others, have been investigating the psychoneuroimmunological effect mechanisms of Biodanza with scientific methods based on empirical data. Based on these studies, they developed evidence-based Biodanza programmes (called TANZPRO-Biodanza programs) (see Stueck, 2010; Stueck & Villegas, 2008, 2012). For an overview of the research findings (see Stueck & Villegas, 2008, 2012; Stueck, 2008). In addition to the work with children, there is an evidence-based Biodanza-programme for schoolteachers and parents (Stueck, 2003, 2004; Stueck, Villegas, Perche, & Balzer, 2007; Stueck et al., 2008; Stueck et al., 2009; Villegas, 2008).

TANZPRO-Biodanza for children is an evidence-based programme with 10 sessions for 4–6-year-old (version 1) and 7–12-year-old (version 2) children. It is the non-verbal part ("Dance of Life") of the School of Empathy (Stueck, 2013a, 2013b), which was developed in 2009 by Marcus Stueck for the huge project 'Healthy Lifestyles in Kindergartens' of the Ministry of Health in Germany between 2009 and 2011. The verbal part of the School of Empathy ("Language of Life") is the evidence-based programme Respectful Communication (Mueller & Poerschmann, 2009; Schoppe & Stueck, 2012), based on the Non-violent Communication concept of Marshall Rosenberg (Rosenberg, 2007) (Figure 1).

It is hypothesized that the claimed self-regulating effect of TANZPRO-Biodanza will have not only psychological but also physiological effects (see Kostrzewa, 2010; Schoenichen & Hoeselbarth, 2013; Stueck et al., 2013). Therefore, we have measured cortisol from saliva as an immune-regulatory parameter related to stress sensitivity. Cortisol is released when the hypothalamic–pituitary–adrenal axis has been activated and influences, among others, these immune regulatory processes (Ockenfels, 1995). Stress-causing situations can lead to activation of this axis. Situational assessment followed by a coping strategy plays a crucial role. Thus, helplessness and depressive reactions are associated with higher cortisol concentrations, whereas viewing a situation as challenging in conjunction with problem-oriented coping causes low cortisol concentrations (Csikszentmihalyi, 1992). Accordingly Ockenfels (1995) presented, with respect to the cortisol concentration in the saliva, a relationship to psychological variables whereby negative effects correlate with higher cortisol levels and positive emotions with lower levels. Lohaus, Domsch, and Fridrici (2007) indicate, in their discussion of the effects of mental stress, a negative impact of stress on the cognitive performance in children. Watamura, Coe, Laudenslager, and Robertson (2010) also found in a study of children aged three to six years that

Schoolof Empathy Concept of Marcus Stueck (2013 a,b)

School of Empathy 1: **Language of Life** **Marshall Rosenberg (2007)** Verbal aspects of Respectful Communication Body to Head	**School of Empathy 2:** **Dance of Life** **Rolando Toro (2010)** Nonverbal aspects of Respectful Communication Head to Body



Evidence-based Programme (Language) verbal	**Evidence-based Programme** (Biodanza) nonverbal
"RESPECTFUL COMMUNICATION" Evidence-based programmes with elements of Nonviolent Communication for children	**"TANZPRO-Biodanza"** Evidence-based "Dance"-programmes with elements of Biodanza for children
2 versions:age 4–6 and 7–12 (Marion Mueller and Norman Pörschmann based on Marshall Rosenberg's Nonviolent Communication Model)	2 versions: age 4–6 and 7–12 (Marcus Stueck, Alejandra Villegas based on Cecilia Luzzi's Biodanza for children and Rolando Toro`s Biodanza Model)
Scientific evaluation: Sebastian Schoppe, Marcus Stueck and others, (2012)	**Scientific evaluation:** Marcus Stueck, Alejandra Villegasand others, (2009, 2013)

Figure 1. Overview of School of Empathy Concept, developed by Stueck (2013b). With 2 Programme logos and the integrated Model of Empathy with the verbal-reflexive axis (language of the Giraffe and wolf) and the non-verbal, experiential axis (lifestyle of the polar bear and the penguins, see Stueck, 2013b and Toro, 2010; Stueck, Villegas, and Toro, 2010).

higher cortisol levels were associated with an increased risk of disease symptoms developing, especially in relation to the upper respiratory tract. Gunnar and colleagues (Gunnar, Connors, & Isensee,1989; Gunnar, Hertsgaard, Larson, & Rigatuso, 1992) measured secreted cortisol levels in a mean range of about .5–1.5 µg/dL; the cortisol levels were highest in the morning and then sank slowly until reaching the lowest level around midnight (Copinschi & Van Cauter, 1990).

For elementary school students (age 7–8) the self-regulating effect of TANZPRO-Biodanza has already been demonstrated by Jaeger and Vogelsang

(2011) and Greaves (2015) who found a reduction in cortisol levels in saliva after the sessions. A similar effect can also be expected in relation to younger children. It is also likely that regulation of the cortisol stress-sensitive parameter is associated with improved cognitive performance. TANZPRO-Biodanza has an emotion-based, pro-social approach, thus improvements might be expected in social skills, such as the correct interpretation of emotions in others, and also in mental concentration, due to a relaxation-inducing auto regulation processes. In adolescents with mild depression, improved emotional responses and modulation of neurohormones (increase of serotonin, decrease of cortisol level) have been found after dance movement therapy (Jeong et al., 2005).

The research questions of this study are: (1) What effect does an intervention by the TANZPRO-Biodanza method have on the cortisol levels in the saliva of children of kindergarten age? and (2) How do their cortisol levels interact with their emotion recognition and concentration abilities?

Methods

Subjects

To recruit a suitable experimental group of children, kindergarten teachers undertook training for TANZPRO-Biodanza with one course instructor in the context of the educational project 'Strong Roots', carried out in the district of North Saxony, Germany. They were invited to conduct a TANZPRO-Biodanza course in their day care centre, which was intended to be evaluated according to the research questions and hypotheses of this study. A commitment came from the day care centre 'Sonnenschein' in Mockrehna. Ten girls (aged 4.5–6.5 years) were recruited and taught by one teacher.

TANZPRO-Biodanza program

This is an evidence-based contact and body-oriented intervention method for children which was developed and adapted by Marcus Stueck and Alejandra Villegas (Stueck, 2013b; Stueck & Villegas, 2008, 2012) from the theoretical and methodological Biodanza concept for children of Cecilia Luzzi based on Rolando Toro`s general Biodanza model (Toro, 2010). It was brought into practice by Stueck and Villegas in 2010 with the help of Biodanza teachers (e.g. Andrea Schult in Germany, Vineta Greaves in Latvia, TANZPRO-Biodanza version age 7–12) and kindergarden teachers (e.g. Katja Herrmann, Heike Typiak and Doris Stuebner in Germany, TANZPRO-Biodanza version age 4–6). The program is a simplified evidence-based version of the full Biodanza method for children and thus can be conducted by pre-school teachers or child psychotherapists or other professionals who work with children after a minimum of training. This train the trainer approach (for more information: www.bildungsgesundheit.de) was undertaken and investigated in Sri Lanka after the tsunami (Senarath, 2010); in Indonesia, in a post-disaster training programme (Puspita & Annatagia, 2014), in Latvia for school teachers and psychologists (Greaves, 2015; Stueck, Villegas, & Svence, 2011) and in Germany for schools, kindergartens, child psychotherapy and physiotherapy (Stueck, 2013b, 2015). The here investigated TANZPRO-Biodanza program for children (version 1: age 4–6) consists of 10 weekly sessions each with a different topic (e.g. Snow White). Each session starts with a brief discussion on the topic or a tale for children and also provides an opportunity to speak about experiences at the beginning and end of the session. The following exercises have elements of dance, movement, encounter and non-verbal communication; these are accompanied by music and supported using activating exercises with faster music to promote not only the vitality but also the creativity of children. For example, different moves in a circle at the beginning (alone or in the group) are followed by play (rhythmic variations, plays of vitality). Then quieter exercises together with slower music are used to promote relaxation (children relaxing in circle). More especially, the quiet part of a session contains appropriate (partner) exercises; these can improve the perception and acceptance of emotions as well as emotional regulation and empathy with others. Before finishing a session, the children move in a circle for activation and end up (mentally) processing the experiences in drawings or imaginary journeys. The individual sessions are 45–60 min in duration.

Cortisol measurement from saliva

Saliva samples were taken from the subjects using cotton buds (rolls) both before and after the dance sessions. The saliva samples were frozen in a paper tissue, then later analysed at the Immunological Institute in Leipzig using radial immune diffusion (RID).The saliva was extracted from the cotton wool, using a centrifuge, distributed onto immune diffusion plates, and the cortisol concentration was then determined.

Cognitive measurements: concentration and emotion recognition

The ability to concentrate was measured using the concentration-action method for preschool children (KHV-UK; Ettrich & Ettrich, 2006). This is a standardized Q-sort procedure for measuring the concentration abilities of preschool children; during the sorting of cards to appropriate categories, processing time and accuracy (error) are recorded. The task of the child is to organize 44 cards, each with 12 representational pictures according to specific characteristics.

Parallel test reliability is for the time value in the range of .83–.89 and for the error value between .73 and .83. The consistency of the error values, depending on the investigated age group, is between .72 and .83. The test–retest reliability in the interval of four weeks is .88 for the values and .67 for the error values . The validity of the KHV-VK test was also shown with different levels of development (normally developed to significantly developmentally delay) by the comparison of children in terms of time and error values. Additionally, the stand-alone indication performance of the test was determined by correlations with other cognitive functions.

Emotion recognition used the subtest "Photo album" from the standardized Wiener Development test (Kastner-Koller & Deimann, 2002). It measures the ability of children to interpret and name different emotions. The test–retest reliability is between .81 and .84. The validity of the test was determined by correlations with the intelligence and ability test K-ABC (Kaufman, Kaufman, Melchers, & Preuss, 2009).

Study design

Cortisol was measured as a *process variable* (i.e. during the period of the TANZPRO-Biodanza program) whereas the cognitive parameters (concentration and emotion recognition) were measured as *effect variables* to evaluate the outcomes of the whole training course.

The measurements were made at the following times:

Process evaluation: cortisol before and after sessions 1, 3, 5, 7 and 9 *[28 September–7 December 2012]*

Effect evaluation: cognitive performance one week before and after the course *[21 September and 14 December 2012]*

Data analysis

Data were analysed using SPSS 17 with descriptive, statistical inference and multivariate methods. Because of the small sample size, non-parametric

Table 1. Group-averaged pre-and post-session cortisol concentrations for sessions 1, 3, 5, 7 and 9 (**p<.05; **p<.01) – see also Figure 2. In 3/5 sessions a significant reduction was seen.*

Measurement time		Mean (µg/dL)	SD	N	Significance (two-tailed)	Effect size d′	Power 1-β
Session 1	*Pre*	.25	.16	8	.07	.76	.43
	Post	.14	.04				
Session 3	*Pre*	.32	.22	10	.01**	1,09	.85
	Post	.14	.07				
Session 5	*Pre*	.33	.25	9	.11	.75	.48
	Post	.14	.03				
Session 7	*Pre*	.25	.18	9	.01**	.80	.54
	Post	.11	.04				
Session 9	*Pre*	.31	.17	10	.03*	.85	.64
	Post	.16	.07				

Wilcoxon tests were used to calculate whether the central tendencies of the two related samples are significantly different. Any changes were considered relevant if any one of the following three criteria were satisfied (i) significance of $p \le .05$ (ii) effect size above an intermediate level of $d' = .50$ (Cohen, 1988) or (iii) power above an average level of $1{-}ß = .60$ (Faul & Erdfelder, 1992).

Additional comparisons of subgroups (in terms of cortisol levels and cognition) were carried out. We had to divide the group, even though it is a very small one, to show some specific effects, which could otherwise not be shown. Moreover, a significant result was assessed as relevant only in conjunction with at least moderate effect size of $d' = .25–.50$ (Bortz & Doering, 2002; Sachs, 1999). Effect sizes and power were calculated using a different program, the G*Power 3® from Faul and Erdfelder (1992; small = .2, medium = .5, high = .8). The determination of cluster boundaries, to study how changes in parameters depend on their starting level, was based on the mean and standard deviation of the pre-readings, and also on the frequencies of values, assuming a normal distribution within each cluster. To investigate how cognitive parameters depending on cortisol levels, clustering was performed by dichotomizing the average cortisol levels of children during the investigation period.

Results

Process (i.e. short-term) variable – cortisol

Group cortisol levels

Short-term changes in group cortisol levels caused by individual TANZPRO-Biodanza sessions are shown in Table 1. Averaged pre-and post-session cortisol concentrations (with means and standard deviations) are given, along with values of significance, effect size and power, for all five measurement time points.

Comparing cortisol concentrations before and after each session, the measured post group means are less than the corresponding pre values in all five sessions. In three of the five sessions, these differences are significant ($p \le .05$) and also show high effect sizes and medium to high power. In the first session, a significant trend was observed with a medium effect size. Thus, the hypothesis of a short-term effect due to the TANZPRO-Biodanza session is shown by cortisol levels measured in individual sessions.

The session effect (pre vs. post) was also considered averaged over all five measured sessions (Figure 2). Average cortisol levels in the pre–post comparison showed a significant decrease ($p > .05$), with a large effect ($d' = 1.23$) and a high power of $1{-}ß = .87$.

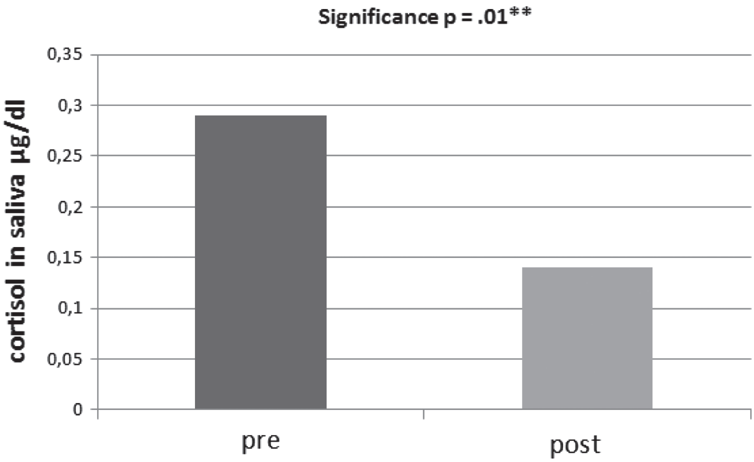


Figure 2. Cortisol levels in kindergarten children before and after a TANZPRO-Biodanza® session. Values are averaged over all 10 children and over the 5 sessions when saliva samples were taken; see also Table 1. Cortisol is an indicator of stress; its reduction by a half supports the idea that TANZPRO-Biodanza® reduces stress.

Individual cortisol levels

Subjects were divided into three groups based on their initial (pre-session) cortisol levels: low (<.12 µg/dL), medium (.12–.50) and high (>.50). The reduction in cortisol (averaged over the five measured sessions) depended on the pre-session cortisol level (Table 2).

In the clusters of medium and high pre-session cortisol level, the pre–post difference is highly significant and also has high power (towards reduction of cortisol). The post-session values of these two clusters approach the pre- and post-values of the cluster with low cortisol level. In this low cortisol cluster, no significant pre–post changes in cortisol levels were observed.

Table 2. Post-session changes in average cortisol concentration in groups with low (<.12 µg/dL), medium (.12–.50) and high (>.50) pre-session cortisol levels. The medium and high-level groups show significant reduction post-session, towards the value of the low cortisol group. (*$^*p < .05$; $^{**}p < .01$) – see also Figure 2.*

Cluster time		Mean (µg/dL)	SD	N	Significance (two-tailed)	Effect size d′	Power 1-β
Low Cortisol	*Pre*	.10	.01	8	.92	.04	.05
	Post	.10	.03				
Medium Cortisol	*Pre*	.26	.11	31	.00**	1,03	1.00
	Post	.14	.05				
High Cortisol	*Pre*	.67	.04	7	.00**	1.87	1.00
	Post	.18	.06				

Effect (i.e. long-term) variables – cognition: concentration and emotion recognition

In view of the importance of pre-session cortisol levels found in the short-term process analysis (see above), the changes in long-term effect variables were analysed taking into account the pre-session cortisol levels. Subjects were divided into two equal groups (both $N = 5$) having low (<.50 µg/dL) and high (>.50 µg/dL) levels of pre-session cortisol.

Concentration

The number of mistakes in the concentration tests showed only a tendency toward decreasing from pre to post, for both groups ($p = .10$, $\eta^2 = .30$). There is no interaction effect with cortisol.

In contrast, the average test processing time showed a dramatic effect. Children with low cortisol levels, both before and after the TANZPRO-Biodanza course, processed the concentration test significantly faster than the children with high cortisol levels. Accordingly, the test of between subjects (cluster) analysis of variance with repeated measures showed a significant decrease and with a relevant effect size (*$p = .02$, $\eta^2 = .45$) (Figure 3).

Emotion Recognition

The low cortisol cluster showed no significant pre–post change in their ability to interpret emotions of others properly. For the high cortisol cluster, the post-session average score was almost twice the pre-session average score, and approached the average for the low cluster, although the improvement was a significant tendency ($p \leq .10$). Accordingly, the analysis of variance with repeated measures does indeed give the comparison of the measured time points a significant trend for within-subject factor ($p = .08$, $d` = .34$), and interaction of the cluster ($p = .08$, $d` = .34$) with a medium effect size for both. However, the result for the between-subjects factor is highly significant ($p = .00$**; $d` = .69$) and confirmed a marked difference in the ability to recognize emotions between the two subgroups. Thus, the high cortisol cluster benefitted more from the training in terms of their ability to recognize emotion (Figure 4).

Discussion

As might be expected, the level of cortisol secretion within the TANZPRO-Biodanza sessions decreased by an amount that depended on the pre-session value, with a correspondingly large decrease in cortisol levels for those with high or medium levels of secretion prior to the session (.67 ± .26 mean µg/dL). Those with high and medium initial cortisol seem to be 'normalizing' (Table 2), whilst those with low cortisol seem to be already 'normalized'; there may be a similar effect after the course is over; low-cortisol children already have good emotion recognition (Figure 4), whilst high-cortisol children start to approach such good performance. These findings suggest a tentative conclusion that there is an auto regulatory effect of TANZPRO-Biodanza sessions in children of kindergarten age. However, this could only be confirmed by including a control group, which we were not able to do in this study.

The influence of stress on cognitive performance in this group can be inferred from the measured correlations between cortisol levels and concentration (low

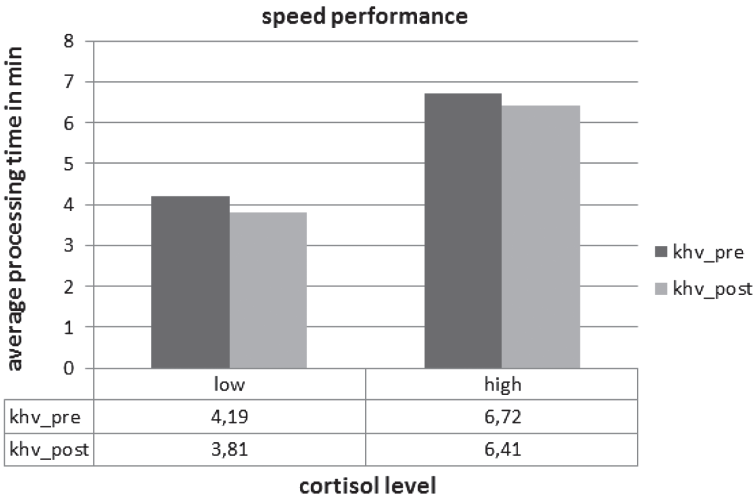


Figure 3. In the KHV concentration test, children with low cortisol values (<.50 µg/dL) performed the test much faster than children with high-cortisol levels. Post-session times were slightly lower.

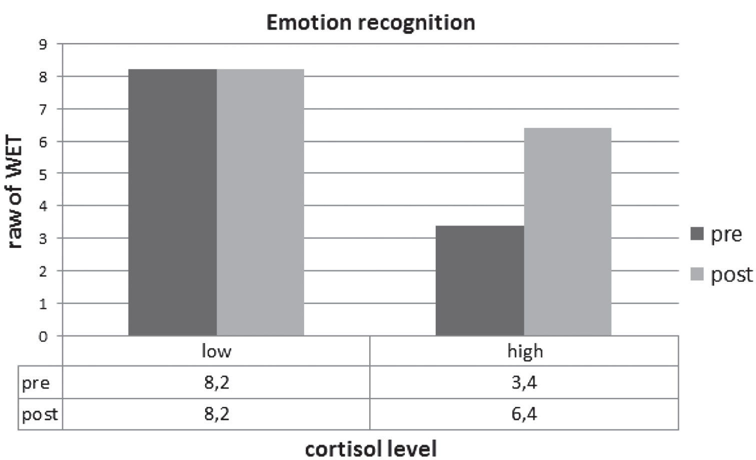


Figure 4. In the emotion recognition test, children with low-cortisol values (<.50 µg/dL) performed well before and after the session (high WET score). High-cortisol children initially performed less well, then after the session almost doubled their score, approaching the average for the low cluster, although the improvement was only a significant tendency ($p \leq .10$).

cortisol level, higher speed performance in concentration test) and emotion recognition abilities (Figure 3 and 4). Thus, for children with higher levels of cortisol an influence of TANZPRO-Biodanza on the enhancement of emotion recognition can be shown.

The 'emotion recognition' photo album test is an approximation to what happens in real human interaction. Therefore, it is possible that the Biodanza intervention helped the high-cortisol children improve their empathy more than is indicated by our results.

Limitations of the research methodology

The study design was not ideal for several reasons. One limitation of the study is the small sample size ($N = 10$), so that we cannot generalize our findings.

There was no control group, with a randomized allocation to groups to test the session effects. Randomization would then be possible only on class and not at the individual level. Other interventions (e.g. respectful communication training, the verbal part of school of empathy) (see Figure 1) could perhaps also have produced similar cortisol reductions to those seen in Tables 1 and 2, and also the cognitive changes (Figures 3 and 4).

The study does not provide evidence for any long lasting effects of Biodanza on concentration or emotional recognition, so ideally data should also be collected more than a month after the intervention.

Studies of children selected for high cortisol would have more statistical power and potentially more impact since these children are the ones most likely to benefit from an intervention. The possible improvement in emotional recognition that was found in the high-cortisol children (Figure 4) could, if present, be confirmed by using a (possibly larger) sample of children selected specifically for high cortisol.

A direct measurement of cognitive performance immediately after the TANZPRO-Biodanza session might detect some short-term effects associated with the measured short-term cortisol reduction. The results of the cognitive performance tests and the emotional recognition photo album in relation to cortisol should be repeated in a laboratory experimental test design. Despite these shortcomings, the current study is a valid pilot and gives a first insight in the effects of dance on cognition responses and modulation of neurohormones in 4–6 year-old-children.

Conclusions

Although findings are far from being conclusive, it is possible that TANZPRO-Biodanza has a short-term positive effect on the auto regulation capacity of 4–6 year-old children (as measured by improved cortisol modulation). The study reported on here also suggested that this intervention could enable the development of social skills such as emotion recognition ability; a skill that may have a sustainable effect. This is an open topic and should be followed up with further investigations with tighter research designs, a control group, randomisation and larger sample sizes.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Marcus Stueck holds the professorship for Psychology at Educational University (RPIVA) in Riga in 2011; since 2012 professorship for Psychology and head scientist at University of Applied Science (DPFA) in Leipzig in the field of psychology in child education, interventional and psychotherapeutic research with children and adults; basic research about chronobiopsychology and human behaviour in extreme environments (e.g. in high mountain); his pioneer works are in the field of Yoga research for children (since 1993, PhD 1997) and since 1998 the Foundation of the Biodanza research worldwide (evidence based BIODANZA, professorial dissertation / habilitation, 2007) at the Institute of Psychology at Leipzig university with a wide range of publications and scientific projects; in 2012 together with Alejandra Villegas foundation of the IBF-Research Network "BIONET – Art meets science"; approbated psychotherapist in Markranstaedt/ Leipzig; Yoga and, Biodanza teacher.

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