1 Introduction

"Physical training can be recommended to increase a feeling of well-being and reduce feelings of depression according to clinical experience." (Nationale Versorgungsleitlinie (National Prevention Guidelines), 2009). This statement is based on numerous published studies on the effects of physical training on mental well-being and symptoms of depression. In 2010, the Cochrane Collaboration analyzed the data based on 144 publications on this topic, whereby only 23 studies sufficiently met scientific criteria. While a significant effect from physical activity could be shown on symptoms of depressive patients, the effect was only moderate for the three studies that met the highest criteria. A study by Nabaskorn et al. (2006), for example, investigated the effect of physical activity (jogging) on a depressive condition, the release of stress hormones and on the variable of physical fitness among adult women (18-20 years old) with depressive symptoms in a cross-over study. After the training, the depressive symptoms were significantly lower. The release of stress hormones for the training group was similarly reduced and the standing heart rate was also significantly lower. The control group showed no change. Other studies on the effects of endurance training programs have shown similar results (Dimeo et al., 2003; Knubben et al., 2007). Some researchers have investigated whether sport therapy could actually replace the use of anti-depressants (Blumenthal et al., 2007; Knubben et al., 2007) and came to the conclusion that physical activity is suitable and important as a replacement therapy but cannot replace drug therapy. Other training forms, such as, for example, the effect of strength training, have already been researched and led to similar conclusions as the endurance training. This makes physical activity appear to have a subordinate role regarding the reduction of symptoms of depression.

The German association of sports physicians had already published a 'Guidelines for Movement and Sport Therapy for Depression' in 1999, however, the research is still far from being able to explain the anti-depressive and anxiety reducing effect of sport. For this reason there is still no general concept regarding sport as therapy for depression and anxiety (Ströhle, 2009), whereby depressions are among the most frequent mental illnesses of today. According to WHO, 121 million people suffer from depression. Symptoms such as drive disorders, unhappiness, sleep disorders, hallucinations and low physical fitness make it clear how serious

the illness really is. Above all, based on a multi-factorial etiology, neurobiological factors play a significant role in addition to genetic, environmental and psychological explanatory models in the emergence of depression. According this, a functional deficit of noradrenalin, serotonin and dopamine as well as an imbalance in cholinergic and noradrenergic transmitters (imbalance hypothesis) are the main causes of depression (Kaspar and Voz, 2009). It has been determined in studies with humans that when exertion intensity exceeds 60-70% of the VO2 max, the endorphins increase by three times the baseline value. Endorphins, in turn, cause an increased release of dopamine, the so-called 'happy hormone'. Further studies on rats showed increased concentrations of the neurotransmitters dopamine, serotonin and noradrenalin during physical exertion, whereby the latter two had similarly positive effects on mood as dopamine (Jung, 2001).
Similar effects have also been attributed to drumming and music in general. Music, which has been a known form of communication for more than 3,000 years, can influence the emotional and spiritual state of a person. Furthermore, effects from music, such as the release of neurotransmitters, can be verified using neuro-physiological parameters (Hagendorf, 2011). On this basis, dance (or, movement to music) - among others - is frequently studied and applied as a form of therapy for depression patients. In addition to the social aspect of making music together or drumming, studies have verified that rhythmic drumming stimulates the nervous system and releases certain neurotransmitters (Drumbl, 2010) as well as has positive effects on mood and the immune system (Bitmann et al. 2001, 2003).

Based on these findings, the present pilot study has the objective of investigating the effects of conventional sport therapy on physiological and psychological parameters compared to a very promising new type of intervention which applies combines movement, dance, music and drumming. Drums Alive® appears to be especially suitable as a movement therapy in the sense of a replacement therapy for patients with depression based on its unique combination. The following questions should be investigated in detail:

1. What is the influence of a Drums Alive® intervention on the physical fitness of patients with depression compared to conventional sport therapy?

2. What is the influence of a Drums Alive® intervention on the balance skills of patients with depression compared to conventional sport therapy?
3. What is the influence of a Drums Alive® intervention on the reaction ability of patients with depression compared to conventional sport therapy?
4. What are the effects of a Drums Alive® intervention on the psycho-social health compared to conventional sport therapy?
5. How do the symptoms of serious depression change through a Drums Alive® intervention compared to conventional sport therapy?
6. To what extent does Drums Alive® have an influence on the self-evaluation of activities and participation of patients with depression compared to conventional sport therapy?

2.2.1 Current State of Research Regarding Sport Therapy and Depression

Ströhle (2009) compared all of the literature on the topic of the link between physical activity and the prevalence and indication of depression as well as the therapeutic potential of physical activity with patients suffering from depression and anxiety, and came to the following conclusions:

- Research is far from explaining the anti-depressive and anti-anxiety effect of sport
- The following psychological factors have occurred: increased self-efficacy; distraction, better self-image, better central noradrenaline neurotransmission, changes in the hypothalamus-adrenal cortex system, improved serotonin synthesis
- There is no general concept for employing sport therapy in the treatment of depression and anxiety. Usually 3-4 units/week are conducted for a duration of 20-30 minutes. Most studies indicate an 8-14 week intervention. Keeping an activity journal is recommended.
- Moderate intensities appears to be more effective than energetic activities
- Interventions targeted for specific groups, or tailored to an individual are generally more effective interventions
- Additional descriptions of exercises and motivating activities in print form or on the computer seem to be more effective than face-to-face individual counseling
- Training plans tailored to the illness with relevant information and exact information for patients are an advantage
- Strategies such as situational analyses, setting goals, self-monitoring, house activities and supportive after-care can support compliance and behavioral changes.

- Some patients with major depression were able to show improvement through other treatments before the intervention with physical activity.
- Other patients, such as, for example, non-responders or people who refuse drug therapy or psychotherapy, can benefit in particular from physical training.
- Implementation and other optimizations of physical training programs for patients with depression and anxiety need a multi-disciplinary approach which includes researchers and physicians in psychiatry, psychology and sports medicine as well as health prevention providers and public financing

In the following, variously selected studies on the effect of athletic activity on the symptoms of depression will be presented. The various forms of training will be distinguished. Studies which exclusively investigated the effect of endurance training or strength training or a combination of both will be presented. Furthermore, studies which targeted the influence of the degree of fitness and the

intensity will be presented. First, the efficacy of an endurance training program will be discussed.

Nabaskorn et al. (2006) investigated the effect of physical activity on a depressive condition, the release of stress hormones and the variable of physical fitness among adult women (18-20 years old) with depressive symptoms in a cross-over study. The 49 test subjects completed an 8-week group jogging program (5 days/week, 50 minutes/unit) at a low (constant) intensity (< 50% HRmax, calculated according to the Karvonen Form). They were divided into two groups whereby the second group continued their daily routine (control group n=8). After eight weeks the groups switched.
The appearance of depressive symptoms was measured with the CES-D scale (Center for Epidemiological Studies Depression Scale), which the subjects filled out every 4 weeks. After the training, the CES-D scale showed a significant increase. The control group showed no change. The release of the stress hormones was reduced among the training group. In addition, the training group had a significantly lower standing heart rate and improved oxygen intake as well as lung capacity.

Dimeo et al. (2003) investigated the effects of a short-term endurance training program on the cognitive functioning of patients with endogenous depression and had shown in earlier studies that an endurance program for depression patients leads to a substantial reduction of complaints within a short period of time. However, there is no information about the effects of physical training on the cognitive performance in this patient group. In a controlled, randomized study, the researchers evaluated the effect of a short-term endurance training program on the mood and cognitive performance of patients with endogenous depression. 36

patients with endogenous depression were randomly put in either an endurance training group 'AT' (walking on a treadmill at an intensity of 80% of the max. heart rate, n=19) or in a control group 'KG' (light stretching exercises, n=17). Both groups trained 30 min. a day for 10 days. At the beginning and end of the study, the intensity of the depression was evaluated using the Bech-Faffaelsen Melancholy Scale and cognitive performance using the Rey Auditory Verbal Learning test (RAVL), the Verbal Fluency test (VF) and the Trail Making test (Reitan-TM). The results showed that

the intensity of the depression and the cognitive performance of both groups was the same at the beginning of the study. After 10 days, the reduction in the depression

scores for the intervention group was significantly more than those of the control group (36% vs. 18%, $p<0.05$): The RAVL and VF scores of both groups were unchanged at the end of the study. A similar improvement in the Reitan-TM scores (22% vs. 21%, p=n.s.) were observed for both AT and KG. In summary, it can be said that a short endurance training program leads to a reduction in symptoms for depression patients however does not cause an improvement in cognitive performance among this patient group.

The question of the effect of a short-term endurance program was posed by Knubben et al. (2007). The influence on the depression values for patients with major depression who were already taking antidepressants was more closely investigated. In a randomized procedure, the patients were either put into an intervention group (n=20) which performed a ten-day walking program or into a placebo group (n=18) with a ten-day stretching and relaxation program. After the intervention, the depression values for the intervention group were significantly lower than for the placebo group. The portion of patients with clinical response for the intervention group was also significantly higher than for the placebo group.

The efficacy of aerobic endurance training compared to a standard medication treatment with Sertraline was investigated by Blumenthal et al. (2007). During a period from October 2000 until November 2005, 153 women and 49 men (n total =153) were randomly assigned to one of the following four groups:

- Monitored aerobic endurance training in a group
- Training at home
- Antidepressants (Sertraline, 50-200mg/day)
- Placebo pills

During an observation period of 16 weeks, the endurance training was conducted in the form of 3x/30 minutes of running or walking with 70-85% of the HRmax. The diagnosis was made using clinical tests, the HAMD or the BDI for ambulant patients. A HAMD value of <8 meant a remission and a response was defined as a lessening of depressive symptoms in the BDI by >50%. The intervention groups showed higher remission rates compared to the placebo group. The results, however, were not statistically significant. The reduction of the HAMD

score was also not significant compared to the placebo group. In summary, it can be said that the efficacy of aerobic endurance training is not significant compared to standard therapy, however, the interventions appeared to be superior compared to the placebo group.

Pereira et al. (2011) investigated the efficacy of a moderate training program as a supplemental therapy to pharmacotherapy for treatment resistant patients with major depression in a study. From 150 patients meeting the intake and exclusion criteria, 33 were assigned to one of 2 study groups in a randomized procedure:

- Pharmacotherapy (n=11)
- Pharmacotherapy and supplemental aerobic endurance training (n=22)

The training program consisted of 30-45 minutes of walking, performed five times a week over the intervention period, which was 12 weeks. The degree of intensity for the depression was measure using the HAMD and the BDI scales. The measuring time points were before the intervention and four, eight and twelve weeks during the intervention time.
The training group could significantly lower their HAMD values and the reduction of the values was also significant compared to the control group. In summary, it can be said that a 12-week endurance training leads to a reduction in the level of intensity of major depression for therapy-assisted patients and accordingly a moderate endurance training represents an efficacious supplemental therapy.

The following study researched the efficacy of a strength training.
Pilu et al. investigated the efficacy of using strength training as a supplemental therapy for patients with major depression in 2007. 30 female patients between the ages of 40 and 60 with resistant major depression participated in the study. They were assigned in a random procedure either to the intervention group (n=10) with continuation of pharmacotherapy plus a strength training program or to a control group (n=20) receiving only pharmacotherapy. The degree of intensity for the depression was determined at the beginning of the intervention and then 8 months afterwards. The results showed a significant reduction of the reported values in the intervention group and no significant reduction in the control group. Thus, it could be determined that strength training appears to be just as meaningful of a supplemental therapy in the treatment of depression.
A further study on the efficacy of aerobic and anaerobic training in treating clinical depression was led by Doyne et al. (1987). 40 women (ages 18-35 years old) with major and minor depression were assigned to one of the following three groups randomly:

- running group
- strength training group
- placebo control group

The intervention time period was 8 weeks and the intensity of the depression was determined using the HAMD and the BDI scales during the intervention as well as one, seven and twelve months afterwards. Using sub-maximal treadmill tests, the fitness of the patients was determined. The results showed that both the endurance group and the strength training group showed a significantly higher reduction of symptoms. There was no significant difference between the two intervention groups in terms of effectiveness. However, physical fitness could not be improved among any of the three groups.

In this regards, Veale et al. (date?) investigated the efficacy of an endurance program as a supplement for standard therapy, and then, in a second step, whether the efficacy could be attributed to the increase in the level of fitness. In the first phase, 83 patients (19-58 years old) were either randomly assigned to an endurance group (supplemental to standard therapy) or to a control group (no supplemental intervention). In the second investigation phase, the subjects were either assigned to an aerobic endurance group or a training group with low intensity. Here, 41 additional subjects were slipped in. The endurance program (jogging) was performed with a frequency of 3 times per week and a duration of 12 weeks for both phases. The control group performed relaxation, stretching and yoga exercises. The physical fitness was measured and determined using the VO2max which was derived from the heart frequency after 6 minutes on a bicycle ergometer.
After the first investigation phase, no significant difference could be determined between the two groups in regards to the depression symptoms. There was also no difference in regards to the level of fitness. In the second phase, there was a reduction in BDI in both intervention groups, however, the difference was not significant. Similarly, no relationship could be shown between the improvement in the level of fitness and the reduction of symptoms for any of the groups. In regards to the results, it can be assumed that a reduction of depressive symptoms is not due to an increase in physical fitness.

Another much discussed point is the efficacy in terms of the level of energy turnover during physical activity on the depression symptoms. Trivedi et al. (2011) looked into this question. In their study, they investigated the efficacy of two different endurance training programs (as supplemental intervention to treatment with antidepressants). They studied 126 patients (82% female) with

major depression who did not go into remission in the first treatment phase with antidepressants (SSRI). The subjects were randomly assigned either to a group with supplemental training with an energy turnover of 16 kcal/kgKG/week (16-NNP) or a group with 4 kcal/kgKG/week 4-NNP). The intervention period was 12 weeks. In both groups the remission rate could be significantly increased. In the NNP-16 group, the increase was

28.3% and in the NNP-4 group 15.5%. The differences between the groups were not significant. In regards to the VO2max such as the NNP-16 group compared to the NNP-4 group (no change) there was a significant increase. The results show that a training in the area of the known recommendations appears to be more effective than a training below this threshold.

Dunn et al. (2005) have also studied the much discussed degree of intensity for physical activity and its effect on the level of intensity of depression. The study investigated the effectiveness of an endurance training on mild and moderate major depression and, in addition, the efficacy in relation to the degree of intensity. The subjects were between 20 and 45 years old and were randomly assigned to one of four of the following groups or to the placebo control group:

- total energy turnover of 7kcal (kgKG/week) - 3 times/week
- total energy turnover of 7kcal (kgKG/week) - 5 times/week
- total energy turnover of 17.5kcal (kgKG/week) - 3 times/week
  (Public Health Dose- PHD-3)
- total energy turnover of 17.5kcal (kgKG/week) - 5 times/week
  (Public Health Dose- PHD-5)

The training consisted of an endurance training on a treadmill or ergometer and the placebo control group performed a flexibility training 3 times a week.

The degree of intensity for the depression was evaluated using the HAMD at the beginning and end of the intervention. The patients in the study did not receive any further therapy.

The HAMD values were reduced by 47% in the training group with an energy turnover of 17.5kcal/kgKG/week. They were reduced by 30% in the group with an energy turnover of 7kcal/kgKG/week. The HAMD values were 29% lower in the control group. No link existed between the training frequency and the reduction of symptoms. Only the total consumption was decisive.

Perraton et al. (2010) used a systematic review to analyze the parameters of endurance programs in studies that investigated the efficacy for depression symptoms. In this review work, only randomized, controlled studies were included which reported a positive effect from athletic interventions. The components intensity, endurance,

frequency and type of exertion were studied. In 14 of the studies included, 20 intervention measures were analyzed. 11 of 14 studies investigated a monitored aerobic endurance training. Only two studies investigated anaerobic training and one study analyzed the combination of aerobic and aerobic training. The most frequent exertion parameters were:

- exertion intensity of 60-80% of HRmax
- exertion duration of 30 min.
- exertion frequency of three times per week

- intervention period of at least 8 weeks

In regards to the form of organization, the group training was clearly superior to individual training. A significant superiority of one type of sport over another could not be established. According to the results, aerobic endurance sport types in group training are recommended as a supplemental therapy for depressive patients. The standard of exertion should be maintained as described above in so doing.

2.3 Current State of Research Regarding Dance Therapy and Depression

In addition to conventional sport therapy, dance therapy is being used increasingly for psychological illnesses. The following selected studies provide an overview of the state of the research for dance therapy related to topics of depression.

Alpert et al. investigated the effect of a modified jazz dance training on balance, cognition and mood (above all depression) among older adults in 2009. 13 older females with a median age of 68 years were studied. The data was gathered using questionnaires (Folstein Mini Mental Status Examination, MMSE), the Geriatric Depression Scale (GDS) and the Sensory Organisation Test (SOT) for measuring equilibrium. The data was collected at three measuring points – at the beginning of the intervention, at the half-point, and at the end. The differences in the MMSE and GDE during the intervention period were not significant. However, the SOT values showed an increasing trend ($p<0.001$), which means that equilibrium improved through the intervention. The results made it clear that a jazz dance intervention among older females doesn't appear to have any influence on cognition and mood, but can improve balance. These results could have important consequences for fall prevention among the post-menopausal population.

However, the extent to which jazz dance can be used for preventing falls among older adults, especially also among men, must be investigated.

Jeong et al. (date?) investigated the influence of a 12-week dance therapy on the psychological health and changes in the neuro-hormones of 40 youths with mild depression and a mean age of 16 years. They were randomly assigned to either a dance therapy group (n=20) or to a control group (n=20). The results for the intervention group showed a significant reduction in the psychological distress values, an increase in the plasma serotonin concentration and a decrease in the dopamine concentration. This may be an indication that a dance therapy stabilizes the sympathetic nerve system, leads to a beneficial modulation of serotonin and dopamine concentrations and can alleviate psychological distress among youths with mild depression.

A comparison of the effects of movement to music, rhythmic activities and competitive games on depression, anxiety, stress and anger was made by Cevasco et al. (2005). Ten adult females were investigated as part of an ambulant drug rehabilitation program which lasted 6 weeks during which they participated twice a week in one of three music intervention programs (4 units per intervention). After every intervention, the expression of anxiety was measured with the State-Trait Anxiety Inventory as well as the anger level. The ANOVA with repeated measurement resulted in no significant difference among the three music intervention types. The data which was measured directly before and after each intervention, showed reduced depression symptoms and levels of stress, anxiety and anger. It thus appears that interventions with musical elements have positive effects on symptoms of depression, anxiety, stress and anger.

2.4 Summary

In summary, it can be said that numerous studies already exist in regards to conventional sport therapy which investigate the efficacy of athletic activity. However, as the review work from Perraton et al. (year?) confirm, the majority of the studies primarily investigated the efficacy of endurance training programs. Few studies concerned the influence of the intensity of a training program or of strength training as an intervention for depression patients. Based on the results of numerous studies, endurance training has been verified to show a positive effect. However, a potential efficacy multiplier through a combination of aerobic and anaerobic training is still too unknown, primarily since the effects of purely strength training are still insufficiently researched. Similarly, the influence of the intensity especially in regards to higher training intensities has not been researched much up until now.

Dance therapy is also appearing in the treatment of depression with increasing frequency. Moving to music appears to have positive effects in this regards on symptoms. Even though dance is increasingly used in practice and positive experiences are being made, the state of research on this topic is still too insufficient. Here too, there is the question, among others, regarding the influence of intensity and the related dance style used.

In regards to drumming or, respectively, making music in general, there are numerous studies which verify the positive effects on mood and other relevant parameters in connection with depression. Bittmann (year?) in the USA above all, was concerned with

the influence of musical interventions on parameters such as mood, anger, anxiety, self-image and depression. Here, not only improvements through the intervention in the defined parameters but also economic advantages related to it were the focus of the work.

The results of the study indicate that a combination of conventional sport therapy, movement to music and, as well, making music can have a clearly positive effects on the treatment of depressions. Drums Alive® combines these three components and for this reason appears to be suitable as a supplemental form of therapy.

5 Discussion

The present study investigated the effects of a Drums Alive® intervention on physiological, psychological and motivational parameters in comparison to conventional sport therapy. 14 subjects participated in the study; 3 dropped out. Thus, 11 complete data sets existed for the analysis. The 11 subjects were then divided into two groups whereby the sport therapy group had 5 and the Drums Alive® group had 6 subjects. Because of the small sample, some results should be viewed with skepticism in regards to their interpretation. An important disturbance factor was the heterogeneity of the groups which again resulted from the small sample number. Furthermore, because of the large distribution of the data occurring from the heterogeneity, some results cannot be generalized to the overall population because of the size of the sample.

The results of all tests are discussed individually in the following.

5.1 Physiological Test Procedures

5.1.1 Modified Harvard Step Test

This test was used to determine the physical fitness and its before and after comparison. Test duration, heart rate upon stopping and heart rate recovery were included in the evaluation. The fitness level of the subjects was also calculated with the help of a preexisting formula.

All of the parameters were to provide information about the fitness status of subjects before and after the intervention in order to identify possible changes through the intervention.

In regards to the duration of the test, two subjects in the sport therapy group showed mild worsening. In the Drums Alive® group, only one subject showed mild worsening and two subject showed significant improvement and completed the full five minute test. Such an improvement was not evident in the sport therapy group. In total, the two groups improved and could increase the test duration after the intervention. The Drums Alive® group showed a mean improvement of 46 seconds and was thus significant. The average improvement of 23 seconds for the sport therapy group was not significant. It is questionable whether the significant improvement can be attributed to

Drums Alive® or, rather more, to the heterogeneity of the group and the small sample connected to it.

The following diagram shows that the median value for the heart rate upon stopping was lower for the Drums Alive® group post-test and higher for the sport therapy group compared to the pre-test values. In regards to the test duration discussed previously and the related

significant improvement in the Drums Alive® group, the result poses some questions. The increased duration should result in higher exertion accordingly, through which higher heart rates can come about. If the maximum achieved heart rate (HRPeak) is still lower than in the pretest in spite of longer duration, this could indicate a better fitness level among the subjects. Numerous studies have shown a reduction in heart frequency through endurance training (Hollmann/Hettinger, 2000). Regarding the increase in HRPeak with simultaneously less increase in the test duration for the sport therapy group, it could be an indication of a poorer fitness level of these subjects after the intervention. If one looks at the exercise units of both groups during the intervention, the portion of aerobic training in the Drums Alive® group appears to be noticeably greater and also more intense. This could explain the increase in the physical fitness, and thus lower HRPeak values, during increased test duration in the Drums Alive® group and the opposite tendency in the comparison group. However, a significantly larger sample would be needed to generalize this assumption to the overall population.

Figure 30:

The following diagrams show the recovery heart rates at three different measuring time points for both groups before and after the intervention. It is noticeable that the values of the recovery heart rate in the sport therapy group are higher at all three measuring time points than in the pre-test. Recovery is understood to be the stopping of the effects of a physical activity until the starting level at rest has been reached. Here, a distinction is made between active and passive recovery (Hollmann/Hettinger, 2000). In the present test, the subjects sit down on a bench directly after ending the test, which corresponds to a passive recovery. In this case, the heart frequency drops in just a few seconds after the exertion. The recovery heart rate can indicate the fitness level of a person. The faster the heart-circulation system recovers from the prior exertion, the better the fitness is. The drop in rate is dependent on the length and intensity of the prior exertion. In the first minute of the recovery phase, the heart frequency drops the fastest, and after three minutes, it usually reaches a value below 100 beats per minute for a well-trained endurance athlete. The reduction down to the baseline value can take hours (Hottenroot/Urban, 2011).

The drop in the heart beat frequency was the highest after one minute for both groups and slowed down over the following two minutes. The subjects in the Drums Alive group reached an average HR value of below 100 beats per minute after 3 minutes; and in the post-test, even after 2 minutes. In the comparison group, this was not the case pre-test or post-test. As already mentioned, the recovery heart rate in the sports therapy group in the post-test for all three measuring time points was higher than in the pre-test. This is because, for one, the

median value for the heart rate upon stopping among the subjects during the post-testing was also higher than in the pre-testing, which indicates that the subjects were under more stress. In addition, the degree that the hear rate dropped after the exertion was bigger in the post-test which means that the heart-circulation system among the subject could recover better from the prior exertion after the intervention, which in turn could indicate better physical fitness.

Figure 31:

Figure 32:

The following tables consider the difference in the heart rate recovery in relation to the heart rate at stopping. In the last table it is clear that the extent of the drop in heart frequency after exertion in the sport therapy group is bigger after 2:15 min. and 3:15 min. than in the pre-test. In the Drums Alive® group, the amount is less at all three measuring time points in the post-testing. This means that in spite of higher HR peak values, the relative drop in heart rate after exertion in a sports therapy group is bigger than in the Drums Alive group, which could indicate a better recovery behavior for the heart-circulation system in the sports therapy group after the intervention.

Table 18:

Table 19:

Table 20:

The Harvard Step Test used here was a modified form of the original test developed at Harvard in 1943. The height of the bench was 50.8 cm in the original test. For this study, the difference in the bench height was 40 cm for men and 35 cm for women. The interpretation and meaning of the fitness index used here is questionable since it is not the original test. In addition, the Harvard Step Test was originally developed for soldiers and the evaluation of the fitness index was probably difficult to generalize to patients. Values under 55 mean a poor level of fitness among subjects. In both groups, the fitness index among subjects was clearly below 55.

However, the Drums Alive group could significantly improve their median fitness level with the intervention

from 23.9 to 34.7 points. In the sport therapy group, the

improvement was only 1.2 points and was thus not significant. The fitness index is calculated from the test duration and the sum of the heart rate recovery. Both parameters have already been discussed.

If one looks again at the achieved HRPeak values more closely, it is questionable whether

the patients were even completely physically stressed. Most probably not. If one assumes the maximum heart rate from the formula 220 - age according to Rost and Hollmann (de Marees, 2003) in the calculation, the intervention group, with 177min-1, must have shown slightly higher maximum heart rates than the comparison group (175 min-1). This formula is only an index value and cannot be viewed as a standard formula since it does not take any individual factors which could have an influence on the heart rate into account. Influential factors which could play a role could be, for instance, gender, training/fitness level, food intake, time of day, specific type of activity and medications (Weineck, 2010). However, if one assumes this index value, it is evident that the patients in both groups were under the expected maximum heart rate in the pre-testing. In the post-testing, the subjects in the sport therapy group with an average of 176 beats per minute were in the range of expected value, which could indicate a workout. The Drums Alive group were clearly below that with 155 beats per minute. The effects on depression symptoms on the physical fitness of patients was also verified by Hottenroot (2002). In studies of the heart rate variability and its possibilities for application, he was able to show a relationship between emotional well-being, experience of stress and sympathetic activation of depressive patients. A negative mood and increased experience of stress is accompanied by an increase in sympathetic activity. This in turn is expressed in an increased standing heart rate as well as lowered heart rate variability which has a reduction in the physical fitness
as a result. Reduced physical fitness among depressed patients could also be shown in a study by Oelze (2010).
In their totality, the viability of the results from the Harvard Step Test should be critically viewed. The largest influential factor here is the size of the sampling. For 5 or 6 subjects per group, one subject can significantly influence the average value for the group. If, then, there is such a heterogeneity in the group, influential deviations very probably exist and results must to be interpreted with caution in every case.

5.1.2 Reaction Stick Test

The reaction stick test measures the reaction time of subjects before and after the intervention. The reaction ability is a coordinative ability and

is the competence to quickly initiate a motor action and carrying it through. This can happen based on visual, tactical or kinesthetic signals. It is important to react as quickly as possible and to carry out the movement with the desired result (Burkl, 2008). Reaction ability is not

only important for situational types of sport but also for work and day to day activities; for example, reaction time is increasingly important in traffic situations (Meinl, 2006 in Prätorius, 2008). Depressive people usually behave passively, which results in a reduction of their motor and particularly their coordination abilities. Regular physical activity is above all important for maintaining healthy functions among older depressive adults. The increase in coordinative abilities can also take on a preventative character for falling (Custal, 2011).
The reaction stick test is based on an visual signal to which the patient must react as soon as the test leader lets go of the stick. The goal of the patients was to catch the stick as quickly as possible. The reaction time was given in terms of centimeters.
The results showed a significantly better reaction ability after the intervention in the Drums Alive® group. The average improvement for the comparison group was not significant.
The reason for this, in fact, could be the intervention itself. Drums Alive® trains the coordination ability to a high degree which includes reaction time. Patients must react acoustically to changes in the music as well as pay attention visually to the exercise leader and react quickly. In the comparison group, the training of reaction time was limited to the execution of small athletic games. It can be assumed that the reaction time in the sport therapy is not trained to the same extent as in the Drums Alive® intervention. Moving to music itself also indicates a greater demand for coordination, whereby here, one's own movements are to be coordinated with the music. Furthermore, it needs to be coordinated with the physical conditions of the room. Dance or similar forms of movement to music could also contribute to an improved body relationship for people with motor inhibitions as is often the case for patients with depression (Roghmann, 2009).

5.1.3 Flamingo Balance Test

The passivity that most patients with depression exhibit, as already described, affects the coordinative abilities of patients as well. This also concerns equilibrium. A poor equilibrium affects not only the emotional well-being but also frequently leads to falls, which in turn causes a stronger feeling of

insecurity on a day to day basis and even more passivity. The results are increased inhibitions, anxiety and depression (Steidle, 2009).
In the present study, the equilibrium of patients was measured with the Flamingo Balance test whereby the number of approaches to the wooden benches used were counted. In general it can be said that the equilibrium of the patients, especially in the sport therapy group, was very poor. In regards to the intervention, the subjects in this group however

improved greatly in the post-test results (+23.9%). In the Drums Alive® group, improved equilibrium could also be found after the intervention, although it was not so intensively distinct (+9.5%). There was no significant difference in any of the two groups.

Müller (2009) investigated the influence of dance activities on equilibrium and was able to verify a positive influence. Many scientific studies exist which concern the causes of falling. Among the most important indicators of risk are lack of muscle and equilibrium disturbances as well as depression and cognitive limitations (Deutscher Turnerbund, 2010). That shows that depression patients belong to the high risk group. Hui et al. (2008) investigated the effect of dance on the physical and psychological well being of the elderly in a study with 97 subjects. The subjects were distributed among an intervention group/dance group (n=42) and a control group (n=45). After the

12 week intervention, the equilibrium of the intervention group showed a significant improvement of the dynamic balance and mobility. This significant result cannot be confirmed by the present study even though the Aerobic Dance Intervention from Hui et al. is comparable to the Drums Alive intervention. Similarly significant results regarding equilibrium in studies which investigated the effect of dance were found by Evigor et al. (2007) and Shigematsu et al. (2002).

In both groups, equilibrium was specifically trained and both groups improved. Several intervention studies (Fetz, 1990; Ziganek-Soelke, 1997; Kirchner, 1994) came to the conclusion that even short exercise periods (3 minutes per week) can have positive effects on equilibrium. At the same time, an improvement in the mental state and feeling of self-worth could also be observed. To prevent falls as much as possible, not only equilibrium training but also adequate strength training plays an important role. In the sport therapy group, a strength training circle was held once a week where muscle strength was trained more specifically than in the Drums Alive group. Since the one-legged stance on

a wooden beam, as was done for the Flamingo Balance Test, also requires leg muscle in order to not fall from the beam, the targeted strength training in the comparison group could be the explanation for the better results here. But here too, the small sample and the dubious generalization of the results need to be mentioned.

5.1.4 Measurements During the Intervention

Physical testing during the intervention were the subject of a bachelor thesis, but they should be included in the discussion in the present work.

Heart Rate

The pre-exertion, exertion and post-exertion heart rates were measured during the units. Each subject participated in the intervention for 3 weeks and the parameters were tested for

each group one time a week. Thus, three pre-exertion, exertion, and recovery heart rates each were recorded per subject. The data was a distribution of normals for both groups.

The following diagram shows the median values and standard deviations for both groups for all three measuring time points. For the Drums Alive® group, a median value of 77 beats per minute was recorded for the pre-exertion heart rate, 132 beats per minute for the exertion heart rate, and an average of 94 per minute for the post-exertion heart rate of this group.

In the comparison group, the pre-exertion value was 85 beats per minute, the exertion value was 130 beats per minute and the average recovery heart rate was 99 beats per minute.

Thus the pre-exertion and recovery heart rates in the Drums Alive group was slightly under the values of the comparison group (-8 min-1 and -5 min-1). The average exertion heart rate in the middle of the unit was somewhat higher for the Drums Alive group (+2 min-1). The differences between the groups were not significant. Thus it can be assumed that belonging to a group had no influence on the heart frequency behavior during the intervention.

If one considers the difference between the pre-exertion values and the exertion values, the difference in the Drums Alive group is 11 beats per minute higher than in the comparison group. This could be due to the higher intensity of the training. The difference between the exertion rate and recovery rate is one beat per minute higher in the Drums Alive group. This fact could be possibly due to a more intensive recovery phase at the end of the unit or due to better

fitness among the subjects in this group. In total, there was a larger heart rate variability in the Drums Alive® group, which could be due to various factors. The heterogeneity of the group, caused by the randomization and the small sample, could also be an explanation.

Figure 33:

Before beginning the exercise unit, during it, as well as in the recovery phase, blood was taken from the subjects ear lobes to determine the lactate values. The blood sampling happened at the same time as the heart rate measurement. The following diagram shows the median progression of the lactate curve in both groups. Before the physical exertion, the lactate values were the same for both groups. Thus, the starting point was the same for all. During the main phase, the lactate values increased exponentially in both groups, as expected. The increase in the sport therapy group was significantly higher with 3.9mml/l than in the Drums Alive group (2.2mml/l). The difference was 1.7mml/l. After the recovery phase as well, the lactate levels in the sport therapy group were 1.7mml/l higher than in the Drums Alive group. The lactate level falls 0.6mml/l for both groups in the recovery phase. The differences between the groups were not significant.

The Drums Alive exercise unit consisted primarily of a continuous endurance exertion with

short active pauses in which the intensity is temporarily lowered. Thus, this training is within the range of long-term endurance, which all exertions over 8 minutes include, and is thus almost exclusively in the range of aerobic energy burning (Weineck, 2004). The aerobic threshold corresponds to an exertion according to Mader with a lactate concentration of 2mmlo/l (Knechtle, 2002). With 2.2mml/l the subjects in the Drums Alive® group were in this range. The subjects in the sport therapy group with 3.9 mml/l, were on the border of the anaerobic threshold, which Mader set at 4mml/l. The contents of conventional sport therapy consists of strength training and small athletic games. The latter frequently consists of quick accelerations and short-term high speeds. The strength training in this group serves primarily to strengthen the entire muscular system or the large muscle groups by using overall physical exercise with and without additional weights (Badtke, 1995). The interval method is used. Because of the repeated intensive exertion, increased temporary lactate levels can occur. The lactate values for this group confirms this.

In a study by Wright et al. (2010), the subjects achieved significantly higher, and in the range of anaerobic, thresholds during the Drums Alive intervention with 3.99 mml/l (for 30-65 year olds). The same applies to the heart rate values in comparison with this present study. The subjects were healthy adults, and it is probable that the depression patients were not as strongly physically stressed as the healthy ones because of their physical limitations. Furthermore, attention was given to not over-exerting the subjects in this pilot study. The groups were also so heterogeneous, in their level of physical fitness as well, that the more fit subjects could not be so strongly challenged. This is confirmed by Herter (2008) in his dissertation on the physical fitness level of depressed patients. 51 healthy and
51 patients performed a bicycle ergometer test. The maximum watts as well as the lactate level values clearly indicated the low level of physical fitness among the depressed patients.

The differences in the lactate concentrations between the groups could also be explained by the heterogeneity of the group and the small sample. Some of the subjects in the Drums Alive® group appeared to be more fit from the beginning on, which could also lead to lower lactate levels during the exertion and better heart rate variability, as seen in the results for the Harvard Step Test.

Figure 34:

The subjective, rated perceived exertion (RPE) values behave differently from the lactate values for subjects. These were recorded during the exertion and after recovery at the same time as the heart frequency and lactate levels. The following diagram shows that the rated perceived exertion in the Drums Alive group was 14.2 and 14.0, which was slightly higher than in the comparison group (13.3 and 13.4). Both groups thus were in the range between 'somewhat strenuous and strenuous'. This contradicts the lactate levels in the comparison group where the subjective perceived exertion could be higher. In a study by Wright et al.

(2010), the median RPE value for subjects of similar age was 16±1 (strenuous/very strenuous). This could again be related to the low interest of depressed patients to exert themselves more strenuously. According to Borg, intensities of (9) 'very slight' to (13) 'somewhat strenuous' are to be recommended for recreational sport. For untrained people, a value of 14 should not be exceed in the endurance range. In relation to this point of reference, the subjects in both groups were in or slightly over this range.

Figure 35:

In regards to the results of the physiological measurements, the low physical fitness frequently described in the literature (Hottenroot, 2002; Herter, 2008; Oelze, 2010; Custal, 2011) for depressive
patients can be generalized to the subjects as a group in the present study, and that different forms of physical activity can improve the fitness level in regards to coordinative and conditioning parameters. The type of training appears to play a subordinate role in this or could not be clearly differentiated in this study.

5.2 Psychological Test Procedures

5.2.1 HEALTH 49

As already described in the methodology, the Hamburg Modules for the Assessment of Psychosocial Health (Health-49) (Rabung et al., 2007) is a self-evaluation tool with 49 items developed to record general aspects of psycho-social health. Values <40 indicated a below-average impairment, values >60 an above-average impairment and values between 40 and 60 an average exertion. Difference of more than 10 T-units are to be valued as clinically relevant changes.

The following table gives an overview of the T-units achieved in the pre- and post-testing for both groups. Clinically relevant differences of more than 10 T-units have been highlighted in bold. The following modules are named again, more for the sake of interpreting the results.
Module A: Mental and somatoform complaints (3 scales + sum, 18 items)
Module B: Mental well-being (1 scale, 5 items) Module C:
Interaction difficulties (1 scale, 7 items) Module D: Self-
efficacy (1 scale, 5 items)
Module E: Activity and participation (1 scale, 6 items)
Module F: Social support/social stress (2 scale, 8 items)

Table 21:

In Module A, the differences in both groups were statistically significant but not clinically relevant. In Module B, there were significant differences in both groups. In the Drums Alive® group, the change was highly significant at p=0.006 and with a difference of 11 T-units also clinically relevant. In Module C as well, the differences in the Drums Alive® group was clinically relevant. In the comparison group, by contrast, the difference was clinically relevant in only one module (E).

If one looks at the median values of the differences for all of the modules, the Drums Alive® group, with 7.2 and the comparison group with 7.5 T-units are in, or respectively, below the range for clinical relevance. The average improvement thus is somewhat higher for the comparison group.

In view of the extent of the impairment, the subjects in the sport therapy group before the intervention were in the range of average exertion (values between 40-60) for Modules A, D, E and F and on the lower limit for over-average exertion (values >60) in Modules B and C.

After the intervention, the subjects showed average exertion for all modules.

In the Drums Alive® group, the subjects were in the range of average exertion only for Module F before the intervention. In all other modules, an above-average exertion could be found. After the intervention, only Module D, with 61.5 T-units, was in the range of above-average impairment while all other modules improved in the average range.

In general, it can be said that hardly any difference exists among the groups regarding the variability, and that the depressive perception of discomfort among all subject changed in similar ways through the intervention.

But, if one looks at the standard deviations in both groups in the individual modules, it becomes clear that there is a large heterogeneity. This poses the question of what the results would look like with a large sampling and again makes generalizing the results questionable.

Furthermore, the extent to which the experience of discomfort by the patients changed due to other therapy forms during the rehabilitation and what the specific effects of the sport therapy could be should be taken into consideration.

5.2.2 ICF AT-50 Psych

This is an ICF compliant questionnaire for self-evaluation of activities and participation under psychological disturbances. The values of the scale are interpreted as follows: 0.0-0.4: no problems

0.5-0.9: mild problems

1.0-1.4: moderate problems

1.5-2.4: significant problems

2.5-4.0: difficult problems

A relevant improvement or worsening is to be assumed for a change of more than 0.5.
The following six scales were used for measuring:

- Executing requirements (A)
- Social relationships and activities (B)
- Verbal competence (C)
- Fitness and well-being (D)
- Intimacy in relationships (E)
- Social consideration for others (F)

In the Drums Alive® group, a worsening occurred after the intervention in the areas for social consideration for others and verbal competence. These each had 0.1 points, which does not correspond to a relevant worsening. The area of intimacy in relationships showed no change. The subjects in this group improved on all other scales. The fitness and well-being scale showed an improvement of 0.5 points, which is significant with p=0.046. All other scales showed no relevant improvements.

The comparison group also had no relevant changes. Improvements here, however, were on all scales. If one looks at the median values of both groups, it is evident that the average improvement on all scales is higher for the comparison group with 0.3 points than for the Drums Alive® group with 0.1 points.
According to the statistics, however, there was no significant difference between pre-test and post-test in the sport therapy group. The only significant difference between the groups was in the area of verbal competence with p=0.021. The improvement in the Drums Alive® group was significantly higher. This difference is difficult to attribute to the intervention. It can be assumed that it is a result of other therapy forms or is again due to the small sample. This probably concerns all changes in the ICF AT-50 Psych since none of the two interventions could bring about relevant changes, and the role of the interventions needs to be more closely analyzed in further studies.

Table 22:

Table 23:

5.2.3 Beck Depression Inventory (BDI-II)

The classification of the degree of intensity of depression symptoms were rated as medium-intensity depressive symptoms, with an average sum value of 21.2, for the patients in the

sport therapy group before the intervention and showed remission, with an average sum value of 9.6, afterwards. This improvement for the sport therapy group was significant with 55% and p=0.042.

In the Drums Alive® group, the average sum value before the intervention was 19.5 and afterwards 15.5 which is an improvement of 21%. Thus, the patients before and after the intervention showed depressive symptoms in the mild range. In the Drums Alive group there was no significant difference and also there was also no significant difference between the groups (p=0.067).

To what extent the significant improvement in the comparison group can be attributed to the intervention is dubious. It could be that other forms of therapy play a much more important role, whereby the difference in treatment between the groups is not known. In regards to the conventional sport therapy, the exercise units which were conducted were more versatile than in the Drums Alive® group. If the improvement could be attributed to the sport therapy, it would then be questionable exactly which content could be primarily responsible for that improvement. Further studies would be needed in this case as well with larger samples in order to better limit the causes of the effects.

5.2.4 FUN Scale

The FUN scale was the subject of another thesis, but, because of its link to mental well-being, should be included in the discussion in the present work.

This scale was designed in relation to the RPE scale 2009 in collaboration with the professors of sport medicine and media communication at the TU Chemnitz and is meant to record the level of fun being experienced. It ranges from (6) 'no fun at all' to (20) 'a huge amount of fun'. The ratings should be subjective and spontaneously made. The diagram shows clearly higher levels of fun in the Drums Alive® group. The difference between the groups is significant with p=0.004.

Figure 36:

Based on the results of the FUN scale and the statements by subjects, it can be assumed that a Drums Alive® intervention can trigger positive emotions, feelings of happiness, stress reduction and fun among patients. Furthermore, the

motivation to be physically active is clearly higher and thus better compliance among patients can be assumed.

5.2.5 Conclusion

In regards to the results of the physiological measurements, the low physical fitness

frequently described in the literature (Hottenroot, 2002; Herter, 2008; Oelze, 2010; Cuatal, 2011) for depressive

patients can be generalized to the subjects as a group in the present study, and that different forms of physical activity can improve the fitness level in regards to coordinative and conditioning parameters. The type of training appears to play a subordinate role in this or could not be clearly differentiated in this study. Thus, an intervention with Drums Alive® showed no significantly better influence than conventional sport therapy in regards to physical fitness, equilibrium and reaction ability.

In regards to the psychological investigation results, it is doubtful to what extent the results of the psychological tests can be attributed to the athletic interventions because the subjects received numerous other therapies during the rehabilitation. This includes, among others, drug therapy, cognitive behavioral therapy, relaxation techniques, social therapy and ergotherapy. The influence of athletic interventions can therefore not be completely delimited, which is also based on a lack of control group. With this, it can be said that Drums Alive® could not cause any significantly larger changes in the psychological parameters of psycho-social health, intensity of depression or subjective participation and activity than conventional sport therapy. However, if the level of perceived fun as well as the emotional and motivational aspects of the interventions are taken into account, these were significantly higher in the Drums Alive® group. For this reason, Drums Alive® seems to be particularly suitable for patients with symptoms of depression.

6 Summary

The positive effect of physical activity on mental well-being, in addition to the physiological effects which can naturally be expected, have been established through many studies, especially in regards to depression. Scientific studies also exist which have investigated different forms of movement, such as jogging, strength training and dancing, in regards to the type of physical training. Positive effects could be verified for all types of physical activity. However, it is still unclear whether one form of movement is particularly suitable.

The goal of this study was to analyze the physiological and psychological effects of a Drums Alive® intervention for depression patients compared to conventional sport therapy. Up until now, no general guidelines regarding the contents of sport therapy for depression exist, whereby the question presents itself, whether or not certain interventions can have greater effects than others and are particularly to be recommended.

Drums Alive® seems to be particularly suitable for this population because of its unique combination of motivating movement to music and the energy-making drumming.

In regards to all study results of physiological and psychological tests, no significant difference between the groups could be observed. The results for the Drums Alive® group

significantly surpassed the comparison group only in the subjective perception of fun.

In their totality, there was a subjectively better mental well-being and a reduction of the symptoms of depression among the subjects of both groups during the intervention time period. Since there was no significant difference between the groups, a direct influence of one of the two interventions cannot be verified. In the literature, improvements of mental well-being through physical activity is frequently described whereby the type of training appears to play a subordinate role, which is confirmed in this study as well. Most studies were concerned with jogging, which, in addition to the predictable physiological changes, also led to changes in certain personality factors. The patients could relax better, felt happier and had less anxiety. Furthermore, it was verified that among 100 participants in a popular 'fun-run' in the US, there were significantly fewer runners who were depressed or at risk of depression compared to the average population (Heinrichs, 2009). But more intensive physical activity in the anaerobic area could also have positive effects attributed to it.

In regards to this study, it is questionable to what extent the results of the psychological tests are to be attributed to the intervention since the subjects were also exposed to numerous other forms of therapy (cognitive behavior therapy, ergotherapy, drug therapy, social therapy, etc.) during their rehabilitation. The effect of the physical activity can, therefore, not *per se* be clearly verified, which is also due to the lack of a control group.

Regarding all study results, the small sample, with its inherent heterogeneity in the groups, presented a limiting factor for the generalization of the results to the overall population.

In conclusion it can be said that Drums Alive®, in comparison to conventional sport therapy, triggered greater enthusiasm and appears to be linked to higher motivation, which, in turn, can result in better patient compliance in regards to physical activity.

The effect of the individual intervention forms should be investigated in further studies using a significantly larger sample and increased homogeneity among the groups of subjects, whereby an alternative to the Harvard Step Test is recommended for the physical fitness test because of its poor transferability to patients.

The essential results of the pilot study were:

1. A positive influence on the physical fitness (condition and coordination) could be verified for both conventional sport therapy as well as for Drums Alive®.
2. Compared to conventional sport therapy, Drums Alive® has a significantly greater fun and motivation factor which can contribute to better compliance among depression patients.
3. In regards to physical fitness, there was no significant difference between Drums Alive® and conventional sport therapy.

4. The coordination abilities of equilibrium and reaction could not be significantly increased with a Drums Alive® intervention compared to conventional sport therapy.
5. Regarding the psycho-social health, there was no significant difference between the two forms of intervention.
6. The perception of discomfort from symptoms of depression showed no significant difference between Drums Alive® and conventional sport therapy.
7. No significant difference could be verified for the self-evaluation of activities and participation for depressed patients.