Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 11, pp.61107-61112, November, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

EFFECTS OF AEROBIC EXERCISE ON MOOD STATE OF UNIVERSITY STUDENTS: A QUASI-EXPERIMENTAL APPROACH

***Oloo Micky Olutende, Jasper Situma Wekesa, Edinah Sabiri Mogaka and Issah WabuyaboKweyu**

Department of Health Promotion and Sport Science, School of Public Health, Biomedical Sciences and laboratory Technology, Masinde Muliro University of Science and Technology, Kakamega, Kenya

ARTICLE INFO

Article History:
Received 20th August, 2017
Received in revised form
26th September, 2017
Accepted 08th October, 2017
Published online 30th November, 2017

Key words:
Exercise,
depression,
POMS,
Mood Profile.

ABSTRACT

This study investigated the effects of acute aerobic exercise on mood state of university students. Male and female participants (N = 20; Mean age= 21.13, SD = 1.017 years) who were physically in perfect health and had no history of disease participated in the study. The participants were selected based on the temperament grades of the pre-test and were randomly divided into two groups of control (10 girls and 10 boys) and training (10 girls and 10 boys). The training group did rhythmic aerobic exercises for two weeks; each session lasted 60 minutes including 10 minutes as warm up exercises with basic aerobic movements, 40 minutes as the conditioning part (which started with the intensity of 140bpm and reached to 160bpm in final sessions), and 10 minutes of non-impact aerobics movements and stretching for cooling down, by which the training session ended. The control group did not participate in any training programs during the study but was given an exercise pep talk. Participants completed the Profile of Mood States (POMS) before and after exercise bouts, and scores were compared using repeated measures ANOVAs. Results showed a significant difference in mean mood state scores in the tension, anger, fatigue, depression, confusion subscales of the POMS and also in the overall total mood disturbance of the participants. The was a significant main effect for mood change over time (Greenhouse-Geisser 1.526, 76 =174.329, $p<0.05$, $\eta 2=0.821$), a significant main effect for groups (F (1,38) =78.993, $p<0.05$, $\eta 2=0.675$) and a significant Time × Group interaction effect (Greenhouse-Geisser 1.526, 76 =56.992, $p<0.05$, $\eta 2=0.600$). Pairwise comparisons were all significant in the tension, vigor, anger and confusion subscales of the POMS. In conclusion, exercise appears to be effective in improving mood and it is recommended that aerobic exercises can be performed as a mood enhancement strategy and should be included in public health programs.

Citation: Oloo Micky Olutende, Jasper Situma Wekesa, Edinah Sabiri Mogaka and Issah WabuyaboKweyu. 2017. "Effects of aerobic exercise on mood state of University students: A quasi-experimental approach", *International Journal of Current Research*, 9, (11), 61107-61112.

INTRODUCTION

Regular exercise has been associated with the reduction of physical and mental disorders across the lifespan and leads to increasedmentalwellbeing, psychologicalbenefitsand reductions in depressive symptoms (Hillman *et al.,* 2008; Lofrano - Prado *et al.,* 2012). Most studies have examined the effect of aerobic exercise on mood state and have found improved mood state following exercise (Bartholomew *et al.,* 2005; Osei-Tutu and Campagna, 2005; Silverstein, Barrett-Connor and Corbeau, 2001; Medina *et al.,* 2015). In healthy individuals regular physical exercise is associated with a decrease in emotional problems such as Temporomandibular disorders and tension, which limit daily functioning, as well as with an increase in the subjective feeling of vigour, emotional well-being and general health. An improvement in mood following physical activity is generally a common finding in the literature across multiple exercise settings in both healthy and clinical populations (Berger and Motl, 2000).

****Corresponding author:* Oloo Micky Olutende**
Department of Health Promotion and Sport Science, School of Public Health, Biomedical Sciences and laboratory Technology.Masinde Muliro University of Science and Technology, Kakamega, Kenya.

Exercise is a rather inexpensive strategy that has even been proven to reduce physical and cognitive symptoms in subsets of depressed patients (Manger and Motta, 2005; Daley, 2008).Mood states are relatively long-term emotional states that are often but not exclusively, either positive or negative (Mitchell and Phillips, 2007). According to Ekkekakis and Petruzzello (1999), there is a U-shaped association between aerobic exercise intensity and affective state, characterized by the interaction of behavioral factors like happiness, euphoria, relaxation and stress reduction in addition, there is also evidence suggesting that positive behavioral outcomes tend to occur after exercise at a self-selected intensity (Ekkekakis, 2009). Some studies have tried to differentiate the effect of different intensities of exercise on mood.Kennedy and Newton (1997) found that running at a relatively high intensity had a greater effect on fatigue and anger than running at a relatively low intensity. By disparity, Berger *et al.* (1997) found that swimming shorter distances are preferable to long distances when mood enhancement is a goal. LeBouthillier and Asmundson (2015) conducted an experiment showing that a single bout of aerobic exercise uniquely reduced anxiety sensitivity (AS), intolerance of uncertainty or distress intolerance while Dyer and Crouch (1987) found that while a bout of

exercise improved the mood of those who exercised regularly through running, the mood states of those who did not run regularly did not change significantly. Thayer *et al.* (1994) found that 44% of a sample from the general population reported that exercise was the most frequently used and most effective strategy to regulate mood and therefore learning more about how exercise affects mood may lead to an increased understanding of how exercise will affectmajor depressive disorder, persistent depressive disorder and other mood disorders. In this study we hypothesize that aerobic dance exercise will be associated with improved mood.The purpose of the current study was to examine the effects of exercise of mood of university students.

Theoretical framework

The positive effects of exercise on mood profile can be explained by several theories such as the theory of distraction, self-efficacy theory and the theory of social interactions. Distraction hypothesis states that exercise can divert the mind from unpleasant stimuli suchas worries and depressing thoughts (Leith, 1994). Exercise has been compared with other distracting activities such as relaxation, assertiveness training, health education, and social contact. (McNeil *et al.,* 1991, Doyne *et al.,* 1983, Martinsen *et al.,* 1989, Klein *et al.,* 1985). According to the theory of self-efficacy, exercise improves and instills a sense of confidence and self-value.The findings of the few studies that have examined this relationship have been equivocal as to whether exercise leads to an enhancement of generalized feelings of efficacy (Klein, 1985); finally, because communication is the essence of sports, sense of belonging to a group and being socialized and mutual support in sports will result in improved mood characteristics (Murphy *et al.,* 1990).

METHODS

Participants

This study is quasi-experimental, and to conduct it pre, post-tests were used. The population of current study was students at Masinde Muliro University of science and technology. The researcher used random sampling technique to recruit 60 (30 male and 30 females. Then the targets, sets of measures, exercise procedures, sampling days, and details of the study which were supposed to be conducted according to the study process, were explained to the subjects, and they were asked to hand in the consent form, and study and sign the written pledge. The inclusion criteria for the volunteers was that they had not participated in any form of exercise in the last four months and reported no medical condition that would be contraindicated when they start exercising. Researchers excluded potential participants who did not meet these criteria from the study.

After that 40 students 20males and 20 females (Mean age= 21.13, SD = 1.017 years) were divided into two groups: a control group (10male and 10 females) and a training group (10male and 10 females).It should be noted that the subjects were matched based on their mood scores in the pre-test and were randomly divided into blocks in their groups.The aerobics class chosen as the intervention took place at the same time of the day and the same music was used for each session to counter the mediation effects of music on mood change that was reported by Karageorghis and Terry (1997).

Exercise Intervention

The exercise intervention was an aerobic dance session that lasted for 60 minutes including a warm-up, main session, and cool-down. The main session involved rhythmic movements such as stepping, lunges, knee lifts, bicep-curls in addition to basis dance steps, it also included a section designed to increase abdominal muscle strength. The cool-down included a series of stretching and rhythmic breathing exercises.

Instrumentation

The researcher used the Profile of Mood States to asses' mood (POMS; Grove and, Prapavessis,1992). Grove andPrapavessis (1992) designed the POMS with seven sub scales to measure seven specific mood states; tension, anger, fatigue, depression, esteem-related affect, vigour and confusion. The tension subscale scores range from 0 to 24. The depression subscale score has a range from 0 to 8. The anger subscale score has a range from 0 to 24. The esteem related affect subscale score has a range from 0 to 24. The vigor subscale score has a range from 0 to 16. Finally, the fatigue and confusion subscale scores range from 0 to 20. Total mood disturbance (range 0 – 140) is a function of these seven scale scores. Grove andPrapavessis (1992) found that the modified POMS to be highly correlated (r = .95) with the original POMS which McNair, Lorr and Droppleman (1971) found to be valid and reliable in measuring mood. Shacham (1983) also modified the POMS items from the original POMS but the researcher felt that the modification eliminated key items which the researcher deemed necessary. Another reason why the researcher preferred the POMS adapted by Grove andPrapavessis (1992) is because it was originally designed for use with students or psychiatric populations.

The POMS inventory assesses seven mood constructs: anger, confusion, depression, fatigue, tension, Esteem related affect and vigor. Examples of anger items include "furious" and "Resentful", confusion items include "forgetful"and "uncertain", depression items include "unhappy" and "downhearted", fatigue items include "worn out" and "tired", tension items include "Anxious" and "Nervous", Esteem related affect items include "Proud" and "Ashamed" and vigor items include "vigorous" and "energetic". Items are rated on a 5-point scale anchored by 0 ("not at all") to 4 ("extremely"). The total mood disturbance was found by adding the scores for tension, depression, anger, fatigue and confusion then substracting the sum of vigour and esteem related affect.

Statistical analysis

Descriptive statistics such as mean and standard deviation were used to describe data and to verify the normality of the data Shapiro-Wilk test was used. Then, to test the research hypotheses, seven repeated measures ANOVAs with two repeated measures factors and two between subject groups was used for statistical analysis. The between subjects factor was program (Exercise group and Pep talk group) and the within subjects factor was time (pre-and two post exercise sessions). In case of observing significant differences Bonferroni post-hoc test was used. Confidence level for all the computations was considered $p < 0.05$. Researchers used IBM SPSS version 23 for statistical analysis.

Table 1. Descriptive Statistics for POMS (N = 20)

		PRE		POST 1		POST 2	
		Mean	SD	Mean	SD	Mean	SD
TENSION	Aerobics Group	10.20	2.966	13.8	1.436	11.05	1.432
	Talk Group	12	3.87	14.65	2.7	13.75	1.970
ANGER	Aerobics Group	17.35	4.004	15.80	2.949	11.35	1.725
	Talk Group	13.05	2.966	11.35	1.725	14.30	2.055
FATIGUE	Aerobics Group	11.05	3.017	12.60	0.955	10.05	1.605
	Talk Group	13.85	3.588	13.60	2.393	12.65	1.755
DEPRESSION	Aerobics Group	16.30	3.326	15.20	2.687	11.75	2.197
	Talk Group	19.10	3.782	19.05	2.395	18.25	1.446
CONFUSION	Aerobics Group	13.55	1.538	11.15	2.661	8.15	1.565
	Talk Group	14.65	1.755	14.30	1.625	12.90	1.447
VIGOUR	Aerobics Group	7.90	2.315	10.15	1.268	11.20	1.005
	Talk Group	9.45	2.625	9.75	2.049	10.50	1.357
TOTAL MOOD DISTURBANCE	Aerobics Group	46.55	7.222	41.35	7.322	23.45	4.489
	Talk Group	55.10	8.717	56.55	6.533	49.60	4.581

Table 2: Results of Repeated Measures ANOVA

		f	df	p	η^2
TENSION	Time	32.801	2,76	0.00	0.463
	Groups	8.106	1,38	0.007	0.176
	Time × Group	2.848	1.740,76	0.72	-
ANGER	Time	34.306	1.626,76	0.00	0.474
	Groups	13.983	1,38	0.001	0.269
	Time × Group	34.306	1.626,76	0.536	-
FATIGUE	Time	13.270	1.529,76	0.00	0.259
	Groups	10.961	1,38	0.002	0.224
	Time × Group	4.126	1.529,76	0.031	0.098
DEPRESSION	Time	24.915	1.495,76	0.00	0.228
	Groups	35.740	1,38	0.00	0.485
	Time × Group	11.196	1.495,76	0.00	0.228
CONFUSION	Time	52.333	2,76	0.00	0.579
	Groups	55.250	1,38	0.00	0.592
	Time × Group	13.468	2,76	0.00	0.262
VIGOUR	Time	33.640	1.428,76	0.00	0.470
	Groups	0.089	1,38	0.768	-
	Time × Group	10.509	1.428,76	0.001	0.217
TOTAL MOOD DISTURBANCE	Time	174.329	1.526,76	0.00	0.821
	Groups	78.993	1,38	0.00	0.675
	Time × Group	56.992	1.526,76	0.00	0.600

Table 3: Pairwise Comparisons for Total Mood Disturbance

(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Pretest	Post test1	1.875*	.644	.018	.262	3.488
	Posttest 2	14.300*	1.031	.000	11.717	16.883
Post test1	Pretest	-1.875*	.644	.018	-3.488	-.262
	Posttest 2	12.425*	.775	.000	10.484	14.366
Posttest 2	Pretest	-14.300*	1.031	.000	-16.883	-11.717
	Post test1	-12.425*	.775	.000	-14.366	-10.484

RESULTS

Table 1 below indicates the descriptive statistics for the variables of interest. The Mauchly's test of sphericity indicated (0.690, p>0.01) that the differences of the variances of all possible pairs within groups in the total mood disturbance were not equal hence the researcher used Greenhouse-Geisser for epsilon correction. The Levene test of homogeneity was done and the results showed homoscedasticity of variances (Pretest f (1,38) =1.288, p>0.05, Posttest one f (1,38) =0.00, p>0.05,posttest two f(1,38)=0.160,p>0.05).Repeated measure ANOVA results are presented in table 2 below. As Table 2 indicates, a repeated measures ANOVA of mood scores (Time × Aerobics group / Pep Talk group) indicated a significant main effect for mood change over time(Greenhouse-Geisser $_{1.526,\ 76}$ =174.329,p<0.05,η^2=0.821), a significant main effect for groups (F(1,38) =78.993,p<0.05,η^2=0.675) and a significant Time × Group interaction effect (Greenhouse-Geisser $_{1.526,\ 76}$ =56.992,p<0.05,η^2=0.600) .The Bonferroni post hoc test for within subject effect showed that all pairwise comparisons were significant as indicated in table 3 meaning there was statistically significant difference in mood changes across all the different mood test conducted over time. As shown in figure 2 below the comparison plots of the Training and control groups differed and there's a considerable drop in total mood disturbance in the training group indicating that the aerobics exercise actually had an effect in reducing the overall mood disturbance of the participants. Figure 1 shows that the pretest mean scores of the two groups based on the different sub scales and as noted in the beginning of the study, the grouping of the participants was based on their pretest mood scores where by those with higher mood scores were placed in the training group and those with lower mood scores were placed in the

control group. Mood changes over time, univariate differences were evidenced for

Tension ($F(2,76) =32.801$, $p<0.05$, $\eta^2=0.463$),
Anger ($F(1.626,76) =34.306$, $p<0.05$, $\eta^2=0.474$),
Fatigue ($F(1.529,76) =13.27$, $p<0.05$, $\eta^2=0.259$),
Depression ($F(1.495,76) =24.915$, $p<0.05$, $\eta^2=0.396$),
Vigor ($F(1.428,76) =33.640$, $p<0.05$, $\eta^2=0.470$)
and confusion($F(2,76) =52.33$, $p<0.05$, $\eta^2=0.579$).

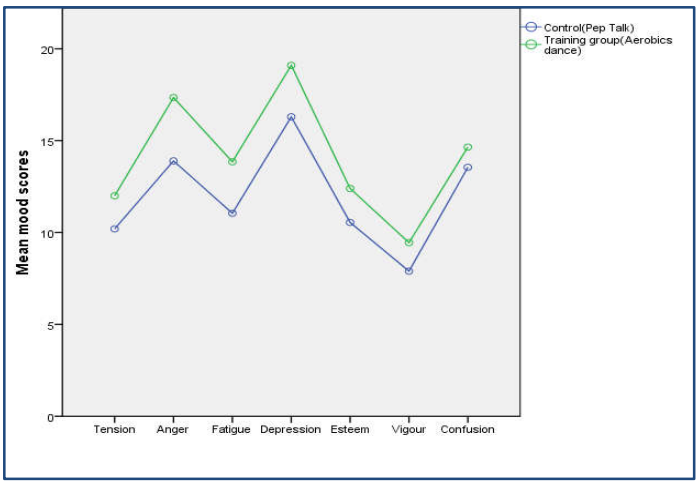
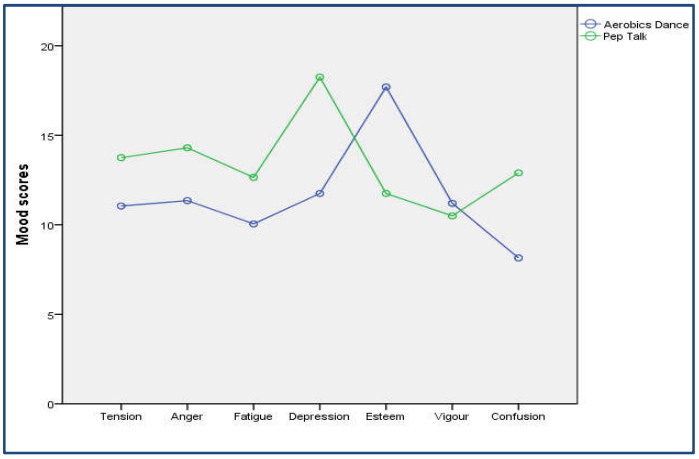


Fig. 1. Pre-test moods scores for the training and control groups



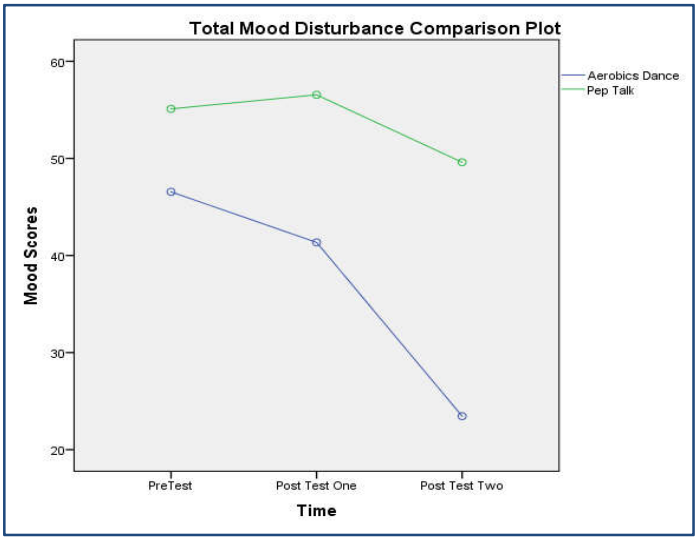


Figure 2. Total mood disturbance comparison plot

Significant interaction effects were found for scores of

Fatigue ($F(1.529,76) =4.126$, $p<0.05$, $\eta^2=0.098$),
Depression ($F(1.495,76) =11.196$, $p<0.05$, $\eta^2=0.228$),
Vigor ($F(1.428,76) =33.640$, $p<0.05$, $\eta^2=0.470$)
and Confusion ($F(2,76) =13.468$, $p<0.05$, $\eta^2=0.262$).

There was no statistically significant interaction in the sub scales of Tension ($F(1.740,76) =2.848$, $p>0.05$) and Anger ($F(1.626,76) =0.565$, $p>0.05$). The group's main effect was attributed to the differences between the group's scores of

Tension ($F(1,38) =8.106$, $p<0.05$, $\eta^2=0.176$),
Anger ($F(1,38) =13.983$, $p<0.05$, $\eta^2=0.269$),
Fatigue ($F(1,38) =10.961$, $p<0.05$, $\eta^2=0.224$),
Depression ($F(1,38) =35.74$, $p<0.05$, $\eta^2=0.485$)
and confusion ($F(1,38) =55.250$, $p<0.05$, $\eta^2=0.592$),

However there was no statistically significant group main effect in Vigor ($F(1,38) =0.089$, $p<0.05$). The Bonferroni post hoc test of within subjects effects indicated that all pairwise comparison for the sub scales tension, anger, vigor and confusion were statistically significant, however pairwise comparisons in the subscale fatigue indicated that (pretestandposttest one $p>0.05$, pretest andposttest two $p<0.05$, posttest one andposttest two $p<0.05$) while the Depression sub scale indicated(pretestand posttest one $p>0.05$,pretest and posttest two $p<0.05$,posttest one and posttest two $p<0.05$)

DISCUSSION

The present study examined the influence of exercise on mood changes. It was testing the hypotheses that exercise influences mood, results show a significant effect for the influence of exercise on mood changes. The study tried to follow the recommendations put forth by (Lane and Lovejoy, 2001) that a study to be done involving an intra-individual design in which mood changes following exercise examined over time would be assessed This result is consistent with previous research showing that exercise reduces negative mood (Abele and Brehm, 1993; La Forge , 1995; Bartholomew,1999; Lane and Lovejoy, 2001; Sakurayi and Sugiyama, 2006;Yektayar *et al.,* 2012.) Previous research has found evidence to suggest that exercise is an effective strategy for treating clinically depressed individuals (Biddle, 1995; Craft and Landers, 1998; La Forge, 1995). However other studies done in the past had different results Morgan *et al.* (1987) and Flinn *et al.* (1997) following a 6-week period of aerobic exercise observed no significant change in the mood profile of the participants.(Yektayar *et al.,* 2012) tried to explain why the studies did no see any significant differences in mood and he attributed the drop in mood profiles in these studies to the sudden increase in trainings, which can also be a sign of over training. In this study the researcher ensured this did not happen by recruiting subjects who were nonprofessional and as reported by (Yektayar *et al.,* 2012) other studies which found improved mood, subjects were not professional athletes, therefore, no heavy training was done and the increased training time was based on the principle of overload and the ability of athletes. Another reason that may lead to not getting significant changes could be as a result of 'Losing performance' as said by (Lane and Lovejoy, 2001).To counter the effects of losing performance found by research to be associated with negative mood (Abele and Brehm, 1993),the researchers ensured the aerobic dance exercise session was relatively free of interpersonal competition. Berger and Moll (2000) emphasized that if mood-enhancement is the goal, the exercise session

should be free of interpersonal competition. Our results showed that the total mood disturbance in the training group reducedsignificantly from the pretest, posttest one and posttest two. This is consistent with results from a study done by Weinstein *et al.,* (2017) that showed improvements in short-term overall mood responses to individual bouts of exercise were detected after a single exercise bout in week 1 of training, as well as at weeks 4 and 12. Results revealed that tension scores changed consistently from pretest to posttest two and this supports the findings from a study done by Roth (1989) where active and inactive participants performed 20 minutes aerobic exercise on a bicycle ergometer, and researchers used the POMS to examine any exercise- induced changes in mood. Results indicated exercise activity significantly altered mood, with reductions in tension specifically evident.In another study Fumoto *et al.* (2010) submitted 10 healthy physically active young (nine men and one woman) to 15 minutes at moderate intensity on a cycle ergometer and found a significant reduction of tension and confusion, and a tendency to increase vigor factor and reduce depression factor. This is consistent with another study done by Woo et al. (2009) who submitted 16 young women to moderate intensities (61.4% VO2max) in three different durations (15, 30 and 45 minutes) and found a higher score after a half hour vigor activity. In contrast(Teixeira Guimaraes *et al.,* 2014) found no significant differences regarding tension, depression, hostility, vigor, fatigue and confusion in moderate effort. Results also showed women had significantly reduced total mood disturbance. This is consistent with results from Aganoff and Boyle, (1994) that showed women who undertake regular, moderate, aerobic exercise showed significantly lower levels of negative mood states, (anger, contempt, disgust, sadness, hostility, fear, shame, shyness, and guilt), than non- exercisers. Findings from the present study showing that exercise had a significantly greater mood-enhancing effect in the training group could be attributed to participants using exercise as a mood-regulating strategy.Negative mood in the present study was likely to have been caused by lifestyle issues such as daily hassles of the students' lives.(Ravindran *et al.* 1996). Exercise served to direct attention from these hassles through focusing on the demands of the exercise session, thus reducing the negative focus associated with negative moods.

Limitations

Findings of the present study show that exercise might be a useful method of improving mood for individuals feeling depressed mood. A limitation of this study is that the stability of improved mood from exercise is unknown and the researcher suggests that there is need for further research to examine the longevity of the effects of exercise on mood.The researcher suggests that the mechanisms through which individuals learn to use exercise to improve mood should be investigated. In assessing the findings of the current study, readers should note the limitation that the participants were all college students who experienced fluctuating personal stress levels during the period of data collection, which may have affected mood state scores.

Conclusion and Recommendations

Generally, results of this study showed that rhythmic aerobic exercise improves mood.Therefore, based on the findings of this study, and as rhythmic aerobic exercise is applicable at any age and in any physical condition, incorporating these types of exercises in university and public health programs is highly recommended.

REFERENCES

Abele, A., Brehm, W. 1993. Mood effects of exercise versus spoils games: fin- dings and implications for well-being and health. *Int J Health Psychol.,* 2,53-81.

Aganoff, J. A., and Boyle, G. J. 1994. Aerobic exercise, mood states and menstrual cycle symptoms. Journal of Psychosomatic Research, 38 (3), 183–192. http://doi.org /10.1016/ 0022-3999(94) 90114-7.

Asmundson, G.J.G., Fetzner, M.G., DeBoer, L.B., Powers, M.B., Otto, M.W., and Smits, J.A.J. 2013. Let's get physical: A contemporary review of the anxiolytic effects of exercise for anxiety and its disorders. Depression and Anxiety, 30(4), 362–373. http://doi.org/10.1002/da. 22043.

Bartholomew, J. B. 1999. The effect of resistance exercise on manipulated pre-exercise mood states for male exercises. *J Sport Exerc Psychol.,* 21, 39-51.

Bartholomew, J. B., Morrison, D., andCiccolo, J. T. 2005. Effects of acute exercise on mood and well-being in patients with major depressive disorder. *Medicine and Science in Sports and Exercise,* 37(12), 2032-2037.

Bergcr, B.G., Grove, J.R., Prapavessis, H., Butki, B.D. 1997. Relationship of swimming distance, expectancy, and performance to rnood states of competitive athletes. Percept Motor Skills, 84,1199-210.

Berger, B.G., Motl, R.W. 2000. A selective review and synthesis of research employing the Profile of Mood Slates. *J Appl Sport Psychol.,12*, 69-92.

Biddle, S.J.H. l995. Exercise and psychosocial health. *Res Quart Exerc Sport.,* 66,292-7.

Craft, L.L., Landers, D.M. 1998. The effect of exercise on clinical depression and depression resulting from mental illness: a meta-analysis. *J Sport ExercPsychol.,* 20,339-57.

Daley, A. (2008) Exercise and depression: a review of reviews. *J. Clin. Psychol. Med. S,* 15, 140–147.

Doyne, E.J., Chambless, D.L., Beutler, L.E.1983. Aerobic exercise as a treatment for depression in women. *BehavTher,* 14,434–440.

Dyer, J.B., Crouch, J.G. 1987. Effects of running on moods: a time series study. *Percept Motor Skills,* 64,783-9.

Ekkekakis, P. 2009. Let them roam free? Physiological and psychological evidence for the potential of self-selected exercise intensity in public health. *Sports Med,*39(10),857–88.

Ekkekakis, P., Petruzzello, S.J. 1999. Acute Aerobic Exercise and Affect. JSM, 28(5),337–74.

Flinn, M.V., England, B.G. 1997. Social economics of childhood glucocorticoid stress response and health. *Am J Phys Anthropol,*102(1),33-53.

Fumoto, M., Oshima, T., Kamiya, K., Kikuchi, H., Seki, Y., Nakatani, Y., et al. (2010). Ventral prefrontal cortex and serotonergic system activation during pedaling exercise induces negative mood improvement and increased alpha band in EEG. *Behav Brain Res*, 213(1),1–9.

Grove, J.R., andPrapavessis, H. 1992. Preliminary evidence for the reliability and validity of an abbreviated Profile of Mood States. *International Journal of Sports Psychology,* 23,93-109.

Hillman, C.H., Erickson, K.I. and Kramer, A.F. 2008. Be smart, exercise your heart: exercise effects on brain and cognition. *Nat. Rev. Neurosci.,* 9,58– 65.

Karageorghis, C.I., Terry, P.C. 1997. Psychophysical effects of music in sport and exercise: a review. *J Sport Behav,* 20, 54-68.

Kennedy, M.M., Newton, M. 1997. Effect of exercise on intensity on mood in step aerobics. J Sports Med Phys Fitness, 37,200- 4.

Klein, M.H., Greist, J.H., Gurman, A.S., et al. 1985. A comparative outcome study of group psychotherapy vs. exercise treatments for depression. *Int J Ment Health,* 13,148–177.

LaForge, R. (1995). Exercise associated mood alterations: a review of interactive neurobiologic mechanisms. *Med ExercNutr Health,*4,17-32.

Lane, a M., and Lovejoy, D. J. 2001. The effects of exercise on mood changes: the moderating effect of depressed mood. The Journal of Sports Medicine and Physical Fitness, 41(4), 539–45. Retrieved from http://www.ncbi.nlm.nih.gov/ pubmed/11687775.

Leith, L.M. 1994. Foundations of Exercise and Mental Health. Morgantown, WVa: Fitness Information Technology.

Lofrano-Prado, M., Hill, J. O., Silva, H. J., Freitas, C. R., Lopes-de-Souza, S., Lins, T., and do Prado, W. 2012. Acute effects of aerobic exercise on mood and hunger feelings in male obese adolescents: a crossover study. International *Journal of Behavioral Nutrition and Physical Activity,* 9(1), 38. http://doi.org/10.1186/1479-5868-9-38.

Manger, T.A. and Motta, R.W. 2005. The impact of an exercise program on posttraumatic stress disorder, anxiety, and depression. *Int. J. Emerg. Ment. Health, 7*,49–57.

Martinsen, E.W., Hoffart, A., Solberg, O.1989. Comparing aerobic and nonaerobic forms of exercise in the treatment of clinical depression: a randomized trial. *Compr Psychiatry,* 30,324–331.

McNair, D. M., Lorr, M., and Droppleman, L. F. 1971. Profile of Mood States Manual. San Diego, CA: Education and Industrial Testing Service.

McNeil, J.K., LeBlanc, E.M., Joyner, M. 1991. The effect of exercise on depressive symptoms in the moderately depressed elderly. *Psychol Aging,* 6,487–488.

Medina, J.L., Hopkins, L.,Powers, M.B., Baird, S.O., and Smits, J.A.J. 2015. The effects of a hatha yoga intervention on facets of distress tolerance. Cognitive Behaviour Therapy, 44(4), 288–300. http://doi.org/10.1080/16506073. 2015.1028433.

Osei-Tutu, K. B., and Campagna, P. D. 2005. The effects of short vs. long-bout exercise on mood, VO2max and percent body fat. Preventive Medicine: *An International Journal Devoted to Practice and Theory,* 40(1), 92-98. doi: 10.1016/j.ypmed.2004.05.005.

Morgan, W.P., Brown, D.R., Raglin, J.S., O'Connor, P.J., Ellickson, K.A. 1987. Psychological monitoring of overtraining and staleness. *Br J Sports Med.,* 21,107-114.

Murphy, S.M., Fleek, S.J., Dudley, G., Callister, R. 1990.Physiological and performance responses to overtraining in elite judo athletes. *J appl Sport Psychology,* 2, 34-50.

Ravindran, A.V., Griffiths,J.,Merali, Z., Anisman, H. 1996. Primary dysthymia: a study of several psychosocial, endocrine and immune correlates. *J Affect Disor,* 40,73-84.

Roth, D. L. 1989. Acute emotional and psychophysiological effects of aerobic exercise. Psychophysiology, 26(5), 593-602. doi:10.1111/1469-8986.ep11034551.

Sakurayi, S., Sugiyama, Y. 2006. Effects of daily walking on subjective symptoms, mood and autonomic nervous function. *J Physiolanthropol.,* 4, 281-9.

Shacham, S. 1983. A shortened version of the profile of mood states. *Journal of Personality Assessment,* 17, 493-506.

Silverstein, D., Barrett-Connor, E., Corbeau, C. 2001. Cross-sectional and prospective study of exercise and depressed mood in the elderly: The Rancho Bernardo study. *American Journal of Epidemiology,* 153(6), 596-603.

Teixeira Guimaraes, T., Macedo da Costa, B., Silva Cerqueira, L., de Carlo Andrade Serdeiro, A., Augusto Monteiro Saboia Pompeu, F., Sales de Moraes, H., … Camaz Deslandes, A. 2014. Acute Effect of Different Patterns of Exercise on Mood, Anxiety and Cortical Activity. Archives of Neuroscience, 2(2), 1–7. http://doi.org/10.5812/ archne - urosci.18781.

Thayer, R.E., Newman, R., McClain, T.M. 1994. Self-regulation of mood: strategies for chancing a bad mood, raising energy, and reducing tension. *J Person Social Psychol.,* 67,910-25.

Weinstein, A. A., Chin, L. M. K., Collins, J., Goel, D., Keyser, R. E., and Chan, L. 2017. Effect of Aerobic Exercise Training on Mood in People With Traumatic Brain Injury. *Journal of Head Trauma Rehabilitation, 32*(3), E49–E56. http://doi.org/10.1097/HTR.0000000000000253.

Woo, M., Kim, S., Kim, J., Petruzzello, S.J., Hatfield, B.D. 2009. Examining the exercise-affect dose-response relationship: does duration influence frontal EEG asymmetry? *Int J Psychophysiol.,*72(2),166–72.

Yektayar, M., Saham, M., Ahmadi, S., Khodamoradpoor, M., Appl, A., and Res, S. 2012. Effect of Rhythmic Aerobic Training on Mood Status Profile and Salivary Alpha Amylase in Non-athlete Students, *Arch. Appl. Sci. Res.,* 4(2184), 2184–2190.

****