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The Influence of Physical Exercise on Well-being and Health

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ABSTRACT

Physical exercise is preventative against a plethora of ill-health conditions, psychological and somatic, endowers a protective agency to safeguard against illnesses whether intrinsic, environmental or age-related and provides a scaffolding of health, well-being, cognitive-emotional robustness that equips individuals to administer a variety of eventualities that fate may cast upon them. The achievement of these ambitions may require both a re-consideration and re-conceptualization of prevailing notions of 'health behavior versus health practice'.

Keywords: Exercise, Health, ill-health, Well-being, Psychological, Somatic, Domains

INTRODUCTION

Using twin-study empirical design, Böckerman et al. [1] have shown that unobserved family and genetic factors drive the cross-sectional correlations between schooling and many health measures, particularly in the case of female subjects. Their within-MZ twin-study results for male subjects indicated that high-school (or vocational/gymnasial) or lowest level tertiary education reduces body mass index and use of medication. High school (or vocational/gymnasial) or university graduated male subjects also exercised more than male subjects who had completed primary education only. Chronic stress and eventual depressive state are conditions of ill-health that present a major cause of psychological and somatic disability resulting serious public health problems. The unpredictable chronic mild stress model offers an established translationally-relevant condition for inducing behavioral symptoms commonly associated with clinical depression, such as anhedonia, altered grooming behavior, and learned helplessness in rodents whereby physiological (e.g., hypercortisolemia, hypertension) and neurological (e.g., anhedonia, learned helplessness) expressions that are linked with depressiveness in the clinic and these symptoms and biomarkers may be ameliorated through chronic, but not acute, treatment with administration of SSRIs [2-5]. Lee et al. [6] subjected rats to the unpredictable chronic mild stress condition, or control, over eight weeks and then after four weeks introduced the treadmill running exercise condition for half of these animals for four weeks. The exercise regime was shown to alleviate the depressive symptoms, restoration of sucrose-drinking and several biomarkers, including increased cell proliferation and decreased cell death due to apoptosis.

All the participants in a qualitative study of older adults (65-80 years) viewed a positive attitude as essential for healthy ageing: the necessity was to pursue activity, physical (exercise) and psychological, through otherwise sedentary activities such as reading and crosswords. Expressions such as: "Getting out of the house", "keeping busy", or 'following a variety of interests' were experienced as both important motivators and descriptions of the elderly participants' 'activeness'. Purposeful activities, e.g. 'still being engaged in paid or voluntary work', 'having caring responsibilities', or smaller incidental activities such as 'helping neighbors' or 'walking for transport' provided essential ingredients. These elderly reported also adapting previous, often lifelong, activity preferences and habits to their ageing bodies, or replacing them altogether with lower impact activities such as walking, as well as adaptation to the physical limitations

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of partners and friends which dictated the intensity and frequency of shared activities, all of which underlines the social context of physical activity [7]. Although caution is advised, Szabo et al. [8] have shown that a variety of physical exercises, such as “spinning” also known as indoor-cycling, generated positive changes in affective status after relatively short workouts, for example positive affect increased while negative affect decreased after both types of spinning workouts (with or without instructors). Exerted effort, measured through the heart rate, did not differ between the two conditions. Nevertheless, the participants enjoyed the instructor-led exercise sessions to a greater extent than they did the self-regulated workouts.

Physical exercise prevents cell senescence, and active individuals are at lower risk of developing certain malignancies including cancer of the prostate and the colon, osteoporosis, depression and dementia. Individuals who exercise regularly extend their life expectancy by three to seven years [9]. Exercise was shown to produce a direct and positive impact upon quality-of-life in patients suffering from cancer, during and following medical intervention [10]. Arnold et al. [11] observed that short-term exercise bouts, using a foot shock-free treadmill exercise regimen, increased ageing-induced loss of glial cell line-derived neurotrophic factor (GDNF) receptor, GFR-α1, and tyrosine hydroxylase in the substantia nigra of 18-month-old male Brown-Norway/Fischer 344 F_1 hybrid rats. In this regard, a critical role for mitochondrial turnover in preserving muscle tissue during aging has been suggested whereby the cellular pathways responsible for the regulation of mitochondrial turnover including biogenesis, dynamics, and autophagy may become dysregulated during aging resulting in the reduced clearance and accumulation of damaged organelles within the cell with the consequence that with mitochondrial quality compromised and homeostasis awaiting re-establishment, myonuclear cell death is activated and muscular atrophy commences. Joseph et al. [12] have described how acute and chronic exercise ameliorate these cellular deficits thereby restoring mitochondrial turnover and promoting a healthier mitochondrial pool that avails the preservation of muscle tissue upon whose integrity the utilization of exercise is dependent. In aged mice, retinal thickness and number of cells in the ganglion cell layer of the naturally-aged mice were reduced compared young control mice. Kim et al. [13] found that following treadmill exercise (5 to 12 m/min, 30 to 60 min/day, 3 days/week for 12 weeks) the retinas from the aged mice showed carboxymethyllysine, 8-hydroxy-2'-deoxyguanosine, and nitrotyrosine immunostaining intensities were increased compared to young control mice. Their aged exercise group exhibited significantly lower CML levels and nitro-oxidative stress than their aged control group.

Advancing age is associated with a decrease in several factors, such as cardiovascular fitness and cerebral blood flow, modulating cognitive functioning that ultimately affects quality of life. Cardiorespiratory fitness is a strong predictor of cardiovascular disease and all-cause mortality, with increases in cardiorespiratory fitness associated with corresponding decreases in risk for this type of cardiac disease. Thus, the effects of exercise interventions upon the myocardium and vascular system are dependent upon the frequency, intensity and duration of the exercise. Wilson et al. [14] have reviewed this status: (1) the relationship between exercise and cardiac re-modeling; (2) the cardiac cellular and molecular adaptations in response to exercise, including the examination of molecular mechanisms of physiological cardiac growth and applying these mechanisms to identify new therapeutic targets to prevent or reverse pathological re-modeling and heart failure; and (3) vascular adaptations in response to exercise. Ageing is associated with a progressive decline in cerebral blood flow [15, 16], generally linked with cognitive functional decline [17-19]. Regular exercise has been shown to improve cognitive function, and we hypothesize that this occurs through beneficial adaptations in vascular physiology and improved neurovascular coupling [20]. Ogoh et al. [21] manipulated cerebral blood flow using hypercapnic gas to observe whether or not elevated cerebral blow flow improved cognitive functioning in a Stroop color-word test. Nevertheless, they found that changes in cerebral blood flow were unlikely to have affected cognitive function during exercise but that the observed improvements in cognition were likely due to cerebral neural activation associated with the performance of exercise itself.

Physical exercise exerts a positive impact on physical health through various different avenues, for example, exercise has been shown to affect positively cognitive performance based upon a relocation of cortical activity which seems to contribute the development of brain connectivity. Wollseiffen et al. [22] studied the effects of different types of breaks (work-pauses) upon the cognitive performance and related cortical activity among office-based employees. The working-day was organized such that breaks were filled with exercise, resting or a usual break compared with a control condition wherein employees continued working without any break. Cognitive performance was assessed using the d2-R test, a test of attention, and two commercially available cognitive tasks. Brain cortical activity was recorded using electroencephalography before and after the breaks. Each individual's mood was analyzed through the application of a profile of mood state. Their results indicated a positive effect of a 3-min ‘boxing intervention’ on cognitive performance, mirrored by a decrease in prefrontal cortex activity. Although perceived psychological state was increased after the usual break, this is reflected in neither cortical activity nor cognitive performance. Since bike activity resulted also in an increase in brain prefrontal regionα-2 activity, a positive effect of exercise on neuro-cognitive performance was concluded. Similarly, high-intensity interval training, as opposed to moderate-intensity continuous training, performed in a real-world gym setting improves cardio-metabolic risk factors and psychological health in physically inactive adults, as well as ensuring greater adherence and compliance [23]. Following a six-week exercise program, Wagner et al. [24] obtained an improvement of physical fitness in most subjects, healthy young adults with regard to cytokine and BDNF integrity, and a positive correlation between the degree of fitness improvement and increased brain-derived neurotrophic factor (BDNF) levels. Increased levels of biomarkers for BDNF, e.g. BDNF-positive cells and serum BDNF, are associated with improved cognitive performance and psychological health [25-27]. Executive functioning involves several of the highest levels of behavioral functions peculiar to homo sapiens, including complex planning, working memory, reasoning, task flexibility, abstract thinking, problem-solving and developing empathy and attachment [28-31]. Moderate-intensity continuous exercise has been found to promote acutely the facilitation of executive functioning likely through the selective activation of neurophysiological and psychological processes [32,33]. Tsukamoto et al. [34] studied the extent to which high-intensity interval exercise impacted upon post-exercise executive functioning immediately after and during post-exercise recovery in twelve healthy male subjects using cycle ergometer with executive functioning assessed by Stroop test, pre-exercise and post-exercise. Although the functional improvement was equivalent for both high-intensity interval exercise and moderate-intensity continuous exercise, the former improvement, concurrent with both physiological and psychological changes, was sustained during the 30-min post-exercise recovery in the former case whereas in the latter case functioning returned to pre-exercise levels.

Physical exercise offers both ontogenetic and epigenetic propensities that attest to benefits within several health domains affecting neurobehavioral, brain regional, cellular and physiological mechanisms. Psychological well-being, cognitive, emotional, motor, behavioral, clinical, recuperative, epigenetic and health domains all make considerable impact upon individuals' propensity for and compliance with regular exercise and physical activity and *visa versa* throughout the lifespan development [35-49]. Generally, four types of well-being are considered: (i) Hedonic well-being which consists of deriving pleasure and happiness from different aspects of life ("feeling good"), (ii) Eudaimonia which consists of a mature and actively virtuous life-style ("doing good"), (iii) Wellness which consists of the absence of disease or infirmity ("good physical health"), and (iv) Prosperity which consists of consisting of success in endeavors and good fortune ("prosperity"). In contrast, ill-being has been defined as the absence of health, happiness and prosperity due to infirmity or physical disability, unhappy or dissatisfied, socially isolated or alienated, unsuccessful or unfulfilled. Health has been described variously to conform with a state of physical, mental and social well-being through which individuals apply their own abilities, cope with the normal stresses of life, live and work productively, fruitfully and constructively, with adequate community contribution [41].

CONCLUSION

Physical exercise, whether partaken as maintenance of prevailing health or acquiesced due to ill-health avoidance, promotes well-being through: the restriction of negative affectivity to the advantage of positivity, the promotion of functional and biomarker manifestations during ageing and cellular senescence, the optimal performance of cognitive tasks, including executive functioning, the advancement of individuals' ontogenetic and epigenetic propensities and the facilitation of the various domains of psychological well-being thereby permitting individuals to attain previously unrealized levels of empowerment. It is possible that re-conceptualizing the efforts invested by individuals as the procurement of health practices, rather than health behavior, captures the emergent and contingent properties of individuals' activities in those particular situations [50] is critical to correct decision-making for the assurance of well-being.

REFERENCES

1. Böckerman P, Maczulskij T (2015) The Education-health Nexus: Fact and fiction. Soc Sci Med 150: 112-116.
2. Dang R, Cai H, Zhang L, Liang D, Lv C, Guo Y, Yang R, Zhu Y, Jiang P (2016) Dysregulation of Neuregulin-1/ErbB signaling in the prefrontal cortex and hippocampus of rats exposed to chronic unpredictable mild stress. Physiol Behav 154: 145-150.
3. Frisbee JC, Brooks SD, Stanley SC, d'Audiffret AC (2015) An Unpredictable Chronic Mild Stress Protocol for Instigating Depressive Symptoms, Behavioral Changes and Negative Health Outcomes in Rodents. J Vis Exp 106.
4. Han J, Wang LU, Bian H, Zhou X, Ruan C (2015) Effects of paroxetine on spatial memory function and protein kinase C expression in a rat model of depression. Exp Ther Med 10:1489-1492.
5. Vega-Rivera NM, Ortiz-López L, Gómez-Sánchez A, Oikawa-Sala J, Estrada-Camarena EM, et al. (2015) The neurogenic effects of an enriched environment and its protection against the behavioral consequences of chronic mild stress persistent after enrichment cessation in six-month-old female Balb/C mice. Behav Brain Res 301: 72-83.

6. Lee TH, Kim K, Shin MS, Kim CJ, Lim BV (2015) Treadmill exercise alleviates chronic mild stress-induced depression in rats. J Exerc Rehab 11: 303-310.
7. Guell C, Shefer G, Griffin S, Ogilvie D (2016) 'Keeping your body and mind active': an ethnographic study of aspirations for healthy ageing. BMJ Open 6: e009973.
8. Szabo A, Gáspár Z, Kiss N, Radványi A (2015) Effect of spinning workouts on affect. J Ment Health 24: 145-149.
9. Dhutia H, Sharma S (2015) Playing it safe: exercise and cardiovascular health. Practitioner 259: 15-20.
10. Gerritsen JK, Vincent AJ (2015) Exercise improves quality of life in patients with cancer: a systematic review and meta-analysis of randomised controlled trials. Br J Sports Med.
11. Arnold JC, Salvatore MF (2015) Exercise-Mediated Increase in Nigral Tyrosine Hydroxylase Is Accompanied by Increased Nigral GFR-α1 and EAAC1 Expression in Aging Rats. ACS Chem Neurosci.
12. Joseph AM, Adhihetty PJ, Leeuwenburgh C (2015) Beneficial effects of exercise on age-related mitochondrial dysfunction and oxidative stress in skeletal muscle. J Physiol.
13. Kim CS, Park S, Chun Y, Song W, Kim HJ, et al. (2015a) Treadmill Exercise Attenuates Retinal Oxidative Stress in Naturally-Aged Mice: An Immunohistochemical Study. Int J Mol Sci 16: 21008-21020.
14. Wilson MG, Ellison GM, Cable NT (2016) Basic science behind the cardiovascular benefits of exercise. Br J Sports Med 50: 93-99.
15. Liu S, Sheng H, Yu Z, Paschen W, Yang W (2015) O-linked β-N-acetylglucosamine modification of proteins is activated in post-ischemic brains of young but not aged mice: implications for impaired functional recovery from ischemic stress. J Cereb Blood Flow Metab.
16. Nahirney PC, Reeson P, Brown CE (2015) Ultrastructural analysis of blood-brain barrier breakdown in the peri-infarct zone in young adult and aged mice. J Cereb Blood Flow Metab.
17. Gregg NM, Kim AE, Gurol ME, Lopez OL, Aizenstein HJ, et al. (2015) Incidental Cerebral Microbleeds and Cerebral Blood Flow in Elderly Individuals. JAMA Neurol 72: 1021-1028.
18. Ighodaro ET, Abner EL, Fardo DW, Lin AL, Katsumata Y, et al. (2016) Risk factors and global cognitive status related to brain arteriolosclerosis in elderly individuals. J Cereb Blood Flow Metab.
19. Simpson BN, Kim M, Chuang YF, Beason-Held L, Kitner-Triolo M, et al. (2015) Blood metabolite markers of cognitive performance and brain function in aging. J Cereb Blood Flow Metab.
20. Barnes JN (2015) Exercise, cognitive function, and aging. Adv Physiol Educ 39: 55-62.
21. Ogoh S, Tsukamoto H, Hirasawa A, Hasegawa H, Hirose N, Hashimoto T (2014) The effects of changes in cerebral blood flow on cognitive function during exercise. Physiol Rep 2: e12163.
22. Wollseiffen P, Ghadiri A, Scholz A, Strüder HK, Herpers R, et al. (2015) Short Bouts of Intensive Exercise During the Workday Have a Positive Effect on Neuro-cognitive Performance. Stress Health.
23. Shepherd SO, Wilson OJ, Taylor AS, Thøgersen-Ntoumani C, Adlan AM, et al. (2015) Low-Volume High-Intensity Interval Training in a Gym Setting Improves Cardio-Metabolic and Psychological Health. PLoS One 10: e0139056.
24. Wagner G, Herbsleb M, de la Cruz F, Schumann A, Brünner F, et al. (2015) Hippocampal structure, metabolism, and inflammatory response after a 6-week intense aerobic exercise in healthy young adults: a controlled trial. J Cereb Blood Flow Metab 35: 1570-1578.
25. Kim K, Sung YH, Seo JH, Lee SW, Lim BV, et al. (2015b) Effects of treadmill exercise-intensity on short-term memory in the rats born of the lipopolysaccharide-exposed maternal rats. J Exerc Rehabil 11: 296-302.
26. Takamatsu Y, Tamakoshi K, Waseda Y, Ishida K (2015) Running exercise enhances motor functional recovery with inhibition of dendritic regression in the motor cortex after collagenase-induced intracerebral hemorrhage in rats. Behav Brain Res 300: 56-64.
27. Xiong JY, Li SC, Sun YX, Zhang XS, Dong ZZ, et al. (2015) Long-term treadmill exercise improves spatial memory of male APPswe/PS1dE9 mice by regulation of BDNF expression and microglia activation. Biol Sport 32: 295-300.
28. Monsell S (2003) Task switching. Trends Cogn Sci 7: 134-140.
29. Rhodes SM, Booth JN, Palmer LE, Blythe RA, Delibegovic M, et al. (2016) Executive functions

predict conceptual learning of science. Br J Dev Psychol.

30. Vernon-Feagans L, Willoughby M, Garrett-Peters P, Family Life Project Key Investigators (2016) Predictors of Behavioral Regulation in Kindergarten: Household Chaos, Parenting, and Early Executive Functions. Dev Psychol.
31. Ware AL, Kulesz PA, Williams VJ, Juranek J, Cirino PT, et al. (2016) Gray Matter Integrity Within Regions of the Dorsolateral Prefrontal Cortical-Subcortical Network Predicts Executive Function and Fine Motor Dexterity in Spina Bifida. Neuropsychology.
32. Ando S, Hatamoto Y, Sudo M, Kiyonaga A, Tanaka H, et al. (2014) The effects of exercise under hypoxia on cognitive function. PLoS One 8: e63630.
33. Uc EY, Doerschug KC, Magnotta V, Dawson JD, Thomsen TR, et al. (2014) Phase I/II randomized trial of aerobic exercise in Parkinson disease in a community setting. Neurology 83: 413-425.
34. Tsukamoto H, Suga T, Takenaka S, Tanaka D, Takeuchi T, et al. (2016) Greater impact of acute high-intensity interval exercise on post-exerciseexecutive function compared to moderate-intensity continuous exercise. Physiol Behav 155: 224-230.
35. Archer T (2011) Physical exercise alleviates debilities of normal aging and Alzheimer's disease. Acta Neurol Scand 123: 221-238.
36. Archer T (2012a) Influence of physical exercise on traumatic brain injury deficits: scaffolding effect. Neurotox Res 21: 418-434.
37. Archer T (2012b) Influence of physical exercise on traumatic brain injury deficits: scaffolding effect. Neurotox Res 21: 418-434.
38. Archer T (2014) Health benefits of physical exercise for children and adolescents. J Novel Psychother 4: 203.
39. Archer T (2015a) Physical exercise as an epigenetic factor determining behavioral outcomes. Clin Exp Psych 1: 1.
40. Archer T (2015b) Exercise alleviates aurism spectrum disorders. Autism Open Access 5: 2.
41. Archer T (2015c) Exercise as therapy: health and well-being. J Intellect Disabil-Diagnos Treatm 3: 76-81.
42. Archer T (2015d) Exercise influences in depressive disorders: symptoms, biomarkers and telomeres. Clin Depress 1:1.
43. Archer T, Garcia D (2014) Physical exercise influences academic performance and well-being in children and adolescents. Int J School Cogn Psychol 1: e102.
44. Archer T, Garcia D (2015a) Exercise and dietary restrictions for promotion of neurohealth benefits. Health 7: 136-152.
45. Archer T, Garcia D (2015b) Exercise intervention in traumatic brain injury. Trauma Acute Care 1: 1-3.
46. Archer T, Kostrzewa RM (2012) Physical exercise alleviates ADHD symptoms: regional deficits and development trajectory. Neurotox Res 21: 195-209.
47. Archer T, Kostrzewa RM (2015) Physical Exercise Alleviates Health Defects, Symptoms, and Biomarkers in Schizophrenia Spectrum Disorder. Neurotox Res 28: 268-280.
48. Archer T, Josefsson T, Lindwall M (2014) Effects of physical exercise on depressive symptoms and biomarkers in depression. CNS Neurol Disord Drug Targets. 13: 1640-1653.
49. Garcia D, Archer T (2014) Positive affect and age as predictors of exercise compliance. Peer J 2: e694.
50. Cohn S (2014) From health behaviours to health practices: an introduction. Sociol Health Illn 36: 157-162.