NR2B Gene Expressions of Aerobic Exercise on Wistar Strain Male Rat

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Abstract

Physical inactivity is now identified as the fourth leading risk factor for global mortality. Exercise enhances hippocampal neurogenesis a process that may contribute to cognition. NR2B gene is a marker to measure the neurogenesis. The objective of the research is to measure the effect of aerobic activity to neurogenesis which NR2B gene is a marker, done in July-December 2011 at Faculty of Medicine universitas Padjadjaran. Mice were divided into two groups, control and exercise, exercise was done with animal treadmill training with the speed 18-20 m/minute for 30 minutes during 14 days. Gene expressions of control and exercise groups were 3.8 and 4.6 respectively, and difference of both were significant (p<0.001). In conclusion, two weeks treadmill exercise can increase the amount of NR2B, cause increasingly apoptosis of brain cells.

Key words: Aerobic exercise, NR2B, treadmill

Introduction

Physical inactivity has been identified as the fourth leading risk factor for global mortality (6% of deaths globally). This follows high blood pressure (13%), tobacco use (9%) and high blood glucose (6%). Overweight and obesity are responsible for 5% of global mortality. Levels of physical inactivity are rising in many countries with major implications for the general health of people worldwide and for the prevalence of noncommunicable diseases (NCDs) such as cardiovascular disease, diabetes and cancer and their risk factors such as raised blood pressure, raised blood sugar and overweight. Physical inactivity is estimated as being the principal cause for approximately 21–25% of breast and colon cancer burden, 27% of diabetes and approximately 30% of ischaemic heart disease burden. In addition, NCDs now account for nearly half of the overall global burden of disease. It is estimated currently that of every 10 deaths, 6 are attributable to noncommunicable
conditions. Global health is being influenced by three trends: population-ageing, rapid unplanned urbanization, and globalization, all of which result in unhealthy environments and behaviours. As a result, the growing prevalence of NCDs and their risk factors has become a global issue affecting both low- and middle-income countries. Nearly 45% of the adult disease burden in these countries is now attributable to NCDs. Many low- and middle-income countries are beginning to suffer the double burden of communicable and noncommunicable diseases, and health systems in these countries are now having to cope with the additional costs of treating both. It has been shown that participation in regular physical activity reduces the risk of coronary heart disease and stroke, diabetes, hypertension, colon cancer, breast cancer and depression. Additionally, physical activity is a key determinant of energy expenditure, and thus is fundamental to energy balance and weight control.\textsuperscript{1} The focus of the \textit{Global Recommendations on Physical Activity for Health} is primary prevention of NCDs through physical activity at population level, and the primary target audience for these recommendations are policy-makers at national level.\textsuperscript{1}

Persons with lower health risks tend to live longer than those with higher health risks, but there has been concern that greater longevity may bring with it greater disability.\textsuperscript{2}

The functional benefits of exercise have been well studied in young adult animals. Wheel running and treadmill training improve spatial learning in rodents. In addition, exercise enhances hippocampal neurogenesis, a process that may contribute to cognition. Moreover, synaptic plasticity, neurotransmission, and growth factor gene expression are increased in the hippocampus of physically active rats and mice. Similar changes in the brain and behavior of older animals may occur with exercise.\textsuperscript{3}

Aging leads to functional changes in the hippocampus, a brain structure that is important for learning. The ability to learn new tasks decreases with age. On the cellular level, synaptic contacts, synaptic strength, and plasticity are reduced. In addition, hippocampal neurogenesis is diminished with aging. In elderly humans, imaging studies have shown hippocampal atrophy. These deleterious consequences of aging may be prevented or reversed by exercise. Indeed, older adults who exercised throughout life had less brain tissue loss than sedentary individuals. Moreover, physically fit aged individuals performed better on cognitive tests than their sedentary counterparts.\textsuperscript{4,5}

\textbf{Method}

Subject were 13 Wistar Strain Male Rat, body weight 200-250g.

Rat was divided into two groups, control and exercise, exercise was done with animal treadmill training with the speed 18-20 m/minute for 30 minutes during 14 days. After that rat were
terminated and measure the level intensity of its fluorescent, finally the data were examined with student t.

**Result**

Expression of NR2B gene of control and exercise groups in table 1 below.

**Table 1 Expression of NR2B Gene of Control and Exercise Groups**

<table>
<thead>
<tr>
<th>No. of Rat</th>
<th>Groups (Number of Gene Expression)</th>
<th>The Difference average between two groups (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Exercise</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
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<tr>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>Rata-rata</td>
<td>3.8</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Table 1 showed control NR2B gene expressions were from weak to medium. While exercise group has NR2B gene expressions were increasing from weak to strong.

Gene expressions of control and exercise groups were 3.8 and 4.6 respectively, and difference of both were significant (p<0.001).

![Control Group Gene Expression](image1)

![Exercise Group Gene Expression](image2)

**Figure 1 Expression of NR2B Gene of Control and Exercise Groups**
**Conclusion**

Two weeks treadmill exercise can increase the amount of NR2B, treadmill exercise cause increasingly apoptosis of brain cells.

**Reference**