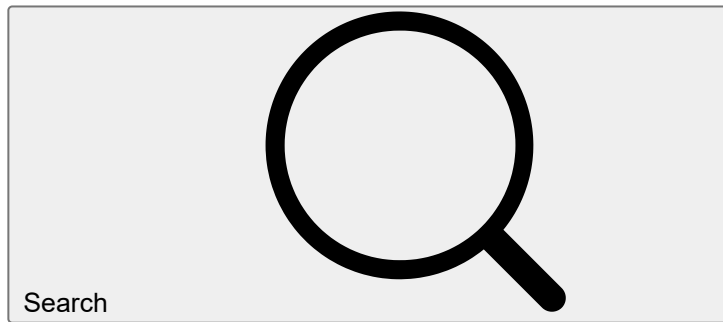


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Therapeutic and preventive effects of exercise training on metabolic regulators/markers in mouse colorectal cancer cells

- [Hossein Shirvani](#)  [ORCID: orcid.org/0000-0002-9465-0199](https://orcid.org/0000-0002-9465-0199)¹,
- [Behzad Bazgir](#)¹,
- [Mostafa Rahimi](#)²,
- [Amin Isanejad](#)³,
- [Mohammad Samadi](#)¹,
- [Vahid Sobhani](#)¹,
- ...
- [Ali Mohammad Alizadeh](#)⁴ &
- [Ehsan Arabzadeh](#)¹

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Abstract

Background

The enzymes and metabolic controllers of tumor cells are affecting by the regulation of physical activity and exercise training.

Aim

The aim of this study was to investigate the role of preventive and treatment of aerobic interval training in colon cancer with determining the protein values of MCT1, GLUT1, PFK-1 and expression of the p53 gene in tumor cells in the animal model.

Methods

Forty-eight male BALB/c mice (6–8 weeks old) participate in this study. Animals were equally randomized into 6 groups: I: control (C); healthy animals, II: Exercise (E), III: tumor induction (T); animals received AOM for inducing colon cancer, IV: AOM + exercise (TE); animals with colon cancer underwent 8 weeks of the exercise training protocol after tumor establishment, V: exercise + AOM (ET); animals received exercise protocol 1 week before AOM consumption, and (VI) exercise + AOM + exercise (ETE); animals received exercise protocol one week before and after AOM consumption (about 15 weeks) Groups III–VI were weekly-received AOM (as carcinogenic agent, 10 mg/kg s.c) in three consecutive weeks to induce colon cancer. Protein levels of GLUT1, MICT1 and PFK1 in solid colon tumor was measured by ELISA method. Also we used RTPcr for gene expression of P53. GAPDH were used as reference genes.

Results

The results showed that the tumor significantly increased MCT1 in the tumor group compared to the control group ($p = 0.001$). Also, exercise before and after tumor induction reduced MCT1 in the colon (respectively: $p = 0.02$ and $p = 0.01$). Levels of GLUT1 colon in the tumor group showed a significant increase compared to the control group ($p = 0.001$), that exercise after tumor induction was effective in reducing this protein ($p = 0.01$). PFK-1 had a significant decrease in ET and TE groups compare to T group ($p = 0.02$ and $p = 0.01$, respectively). While the p53 gene decreased significantly in the tumor group compared to the control group ($p = 0.01$) Exercise before tumor induction and after tumor induction increased significantly ($p = 0.01$ and $p = 0.04$, respectively) in this gene compared to the tumor group.

Conclusion

Long-term aerobic training can act as a preventive or inhibitor of tumor progression by acting as an adjunct in the treatment of colon cancer. It seems that this preventive and treatment effects exercise training can attribute to regulation of lactate and glucose transporters by up-regulation of p53 colorectal cancer cell.

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Fig. 1

Fig. 2

Fig. 3

Fig. 4

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Fig. 6

Fig. 7**Abbreviations**

MCT1:

Monocarboxylate transporter 1

GLUT1:

Glucose transporter 1

PFK-1:

Phosphofructokinase-1

P53:

Protein p53

AOM:

Azoxymethane

LDHA:

Lactate dehydrogenase-A

Unc5B:

Uncoordinated gene 5B

QF-PCR:

Quantitative fluorescence PCR

AMPK:

Adenosine monophosphate-activated protein kinase

TIGAR:

Glycolysis and apoptosis regulator

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Author information

Affiliations

1. Exercise Physiology Research Center, Life Style Institute, Baqiyatallah University of Medical Sciences, Tehran, Iran

Hossein Shirvani, Behzad Bazgir, Mohammad Samadi, Vahid Sobhani & Ehsan Arabzadeh

2. Department of Sports Science, Faculty of Humanities, Shahrekord University, Shahrekord, Iran

Mostafa Rahimi

3. Departments of Physical Education and Sport Sciences, Shahed University, Tehran, Iran

Amin Isanejad

4. Cancer Research Center, Tehran University of Medical Science, Tehran, Iran

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Corresponding author

Correspondence to [Hossein Shirvani](#).

Ethics declarations

Conflict of interest

The authors declare that they have no conflict of interest.

Ethical approval

All applicable international, national, and/or institutional guidelines for the care and use of animals were followed. The study protocol was approved by the Institutional Animal Ethics Committee of the University.

Informed consent

Animal study.

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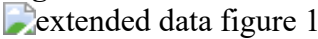
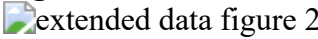
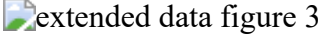
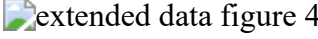
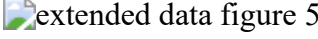
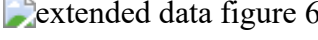
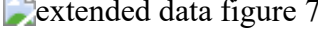
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