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THE INFLUENCE OF CLIMATE ON EXERCISE CAPACITY IN PATIENTS WITH CARDIOVASCULAR AND RESPIRATORY DISEASES – A CASE STUDY

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ABSTRACT. In many temperate countries there is a very obvious seasonal variation in mortality, so winter death rates are 10-25% higher than in summer. The main causes of death in winter are cardiovascular pathologies, cerebrovascular, circulatory and respiratory. We believe that if we establish a relationship between alternating warm and cold seasons and exercise intensity and volume, in people with cardiovascular and respiratory diseases, then we can improve their exercise capacity and can prevent cardiovascular accidents. A patient 56 years old, female, diagnosed with angina of effort and asthma, followed a structured program of Physical Activity in an aquatic environment for 8 months (July 2014 - February 2015). Vital Capacity was evaluated by means of spirometry 2 times during the warm season and 2 times in cold weather. The workload declined by 50% in winter, and P.V.C. by 20%, while the intensity of effort perceived by the patient showed a slightly upward curve. Exercise capacity of a patient with significant restrictions on the cardio-respiratory system is reduced by up to 50% during the cold season versus values recorded during warm season.

Key words: *physical activity, exercise capacity, climate, cardio-respiratory diseases.*

REZUMAT. ***Influența climei asupra capacității de efort la pacienți cu patologii cardiovasculare și respiratorii – studiu de caz.*** În multe ţări temperate există o variație sezonieră a mortalității foarte evidentă, astfel încât ratele de deces din timpul iernii sunt cu 10-25% mai mari decât cele din timpul verii. Principalele cauze de deces iarna sunt patologiile cardiovasculare, cerebrovasculare, circulatoare și respiratorii. Stabilirea unei relații între alternanţa anotimpurilor călduros și rece și intensitatea, volumul efortului și capacitatea pulmonară la persoanele cu restricții ale sistemului cardio-respirator. Studiul a fost desfășurat pe un pacient în vârstă

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de 56 de ani, de sex feminin și diagnosticat cu anghină pectorală de efort și astm bronșic mixt persistent moderat, căruia i s-a creat un program personalizat de activitate fizică în mediul acvatic pe care l-a urmat pe o perioadă de 8 luni (iulie 2014 - februarie 2015). Și a fost evaluată Capacitatea Vitală prin metoda spirometriei astfel: 2 măsurători vara și 2 iarna (inițială, 2 intermediare și finală). Volumul de lucru a scăzut cu până la 50% în perioada sezonului rece. Capacitatea vitală a pacientului a scăzut în anotimpul rece cu 20%, Intensitatea efortului percepută de către pacient a înregistrat o curbă uşor ascendentă. Capacitatea de efort a unui pacient cu restricţii semnificative la nivelul aparatului cardio-respirator, se reduce cu până la 20% pe timpul sezonului rece faţă de valorile înregistrate în lunile călduroase.

Cuvinte cheie: *activitate fizică, capacitate de efort, climă, patologii cardio-respiratorii.*

Introduction

Population vulnerability and adjusting reaction: Researches on potential health effects caused by weather, climate variability and climate changes requires a great deal and is exposure of interest. Although often terms such as weather and climate are used interchangeably, but in fact they are different sides of the same spectrum. Weather is the complex and continuously changing the state of air taken into account, habitually, on a time scale of minutes, weeks and months. Researches on the impact of health influenced by variability and climate change aims to increase understanding of the potential risks and identify effective options for adaptation of human body to the surrounding environment. As a result of climate change extreme events are expected to become increasingly common, can have devastating effects on human society (Sakamoto, M.M., 1977). In many temperate countries there is a very obvious seasonal variation in mortality, so winter death rates are 10-25% higher than in summer (Laake, K. & Sverre, J.M., 1996). The main causes of winter deaths are cardiovascular pathologies, cerebrovascular, circulators and respiratory (Donaldson, G.C. et al., 1998). Social and behavioral adaptations to cold plays an important role in preventing deaths from cold weather in countries at high latitudes (West, R.R. & Lowe, C.R., 1976). Although it is well established that summer heat waves are associated with increased short-term mortality, degree of mortality associated cold season directly attributed to stress caused by bad weather is difficult to be determined and currently is intensely debated. „ Whoever wishes to investigate medicine properly, should do so: first consider the seasons and what effects they produce each, are not all the same and differ greatly from one another in terms of changes that occur" (Hippocrates, 1978). Greek physician Hippocrates (400 b.J.)

described the link between certain epidemics and climate changes caused by the seasons. He wrote that physicians should take into account the seasons and the diseases they produce, characteristics and country-specific wind intensity and its water quality.

Exercise capacity is changing with the seasons, so that human body requiring longer periods to accommodate and adaptation to thermal values characteristic of the new season. Physical activity programs oriented to subjects diagnosed with diseases affecting the cardiovascular and respiratory systems, should be doing so patient to feel the same intensity as in previous season, thus require an adjustment of workload.

Hypothesis

We believe that if we observe the influence of alternating seasons on human body then we can adapt (modify) indicators of effort adaptation according to observed reactions. We believe that large differences temp may significantly change physiological parameters of effort elderly people.

Purpose

Establishing a relationship between the alternation of seasons and the intensity, volume of effort and pulmonary capacity to persons with restricted at cardio-respiratory system level. Improving patient's exercise capacity and prevention of cardiovascular accidents.

Objectives

1. scientific records search area
2. medical history of the patient review
3. setting intervention protocol
4. programming assessment
5. periodization and planning sessions
6. monitoring heart rate and distance
7. observing seasons influence on physiological indices
8. comparing intensity and workload between mezocicles
9. centralization results
10. analysis and conclusions of study

Methods and means

The study was conducted on a patient aged 56 years, female, that after a cardiac rehabilitation and respiratory recovery program in the aquatic environment last 12 months (Pîrvan, A., 2015). The subject was diagnosed with angina of effort and moderate persistent mixed bronchial asthma, which there was created a Physical Activity program in the aquatic environment (Stănescu, F.M., 2014), at a dose of 3 sessions / week, 90 min. each other, followed a period of 8 months (July 2014 - February 2015).

Pulmonary Vital Capacity was evaluated by means of spirometry 4 times, as follows: 2 measures summer and 2 winter (initial, 2 intermediate and final). Exercise intensity was monitored with a Heart Rate watch set by the subject data: sex, age, height, weight. The volume was measured in meters- distance covered during recovery and rehabilitation swimming sessions.

Had planned aerobic activity character, it is framed in bioenergy lipolytic zone, with a maximum intensity of effort between 130- 135 bpm and 150 bpm, having as main energy substrate fatty acids. The workload was between 1000 and 1400 meters swim session.

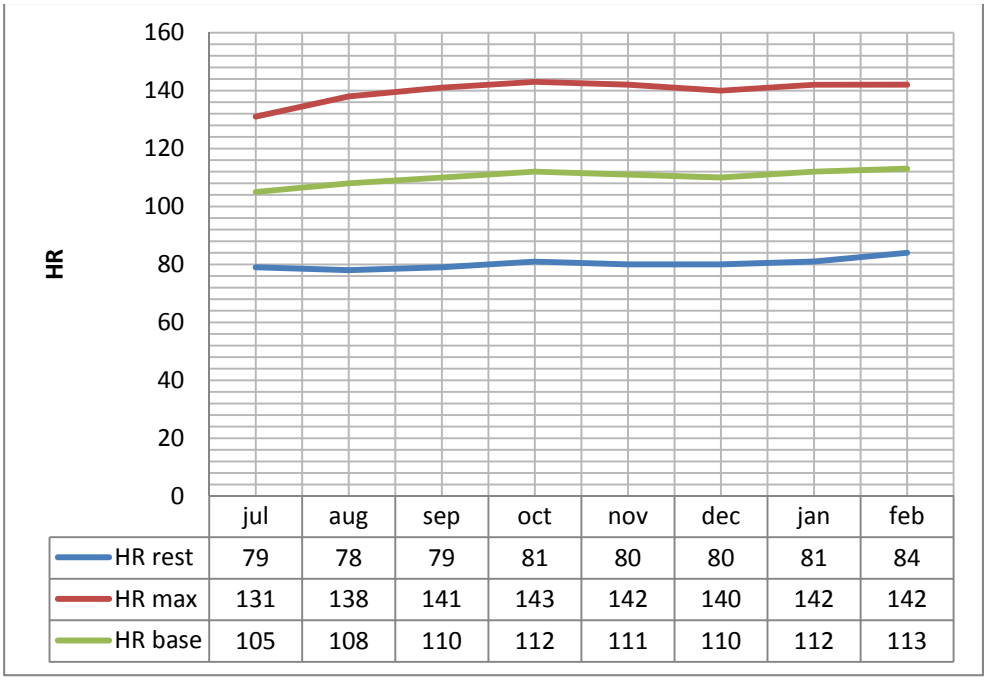
The PA program model was one of "waves" volume, which followed a "staged" protocol progression mezocicle level, taking into account the circadian rhythms of the patient and to avoid a forced adaptation to effort (see Table no. 1). Were used as swimming auxiliary materials as: kickboards, fins and hand paddles, pullbuoy etc… The activity was deployed in a moist and warm environment, from a semi-olympic sized swimming pool, where the ambiental temperature is 25° C and the water is 30° C, and the concentration of chlorine in water is 1.5 grams / liter.

Table no. 1- Model of progression

micro 1	micro 2	micro 3	micro 4
development	maintenance	development	recovery

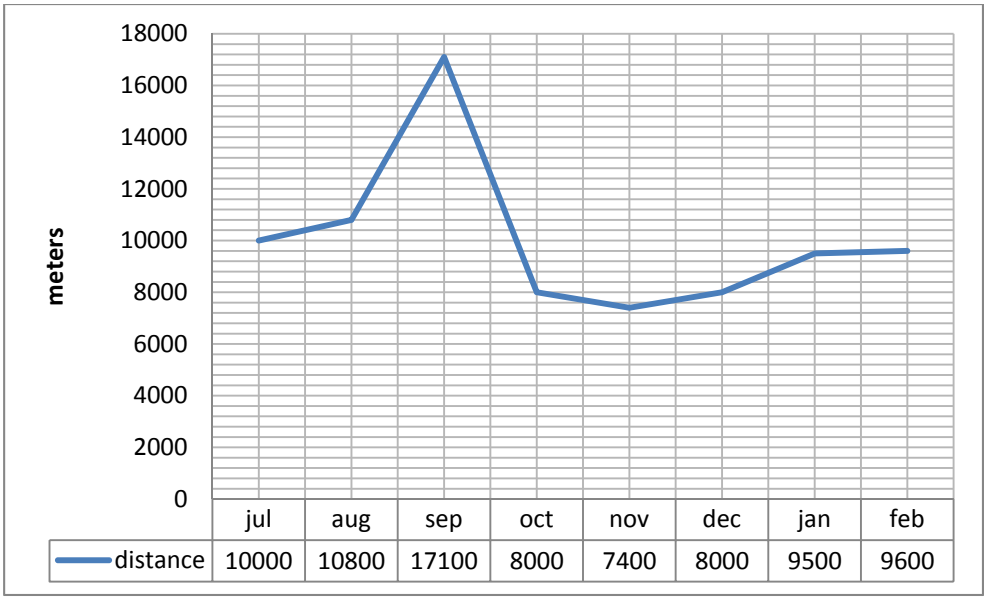
Results

Volume in the covered swimming distance on mezocicles, decreased by 60% during the cold season (see Graph no. 2). Exercise intensity expressed by the HR three indices (minimum, maximum and basal) not registered significant changes, as follows: HR at Rest remained unchanged throughout the program, the other two showed a slightly upward curve (see Graph no. 1). Patient PVC decreased in cold weather up to 20% compared to maximum peek recorded in warm weather (see Graph no. 3).



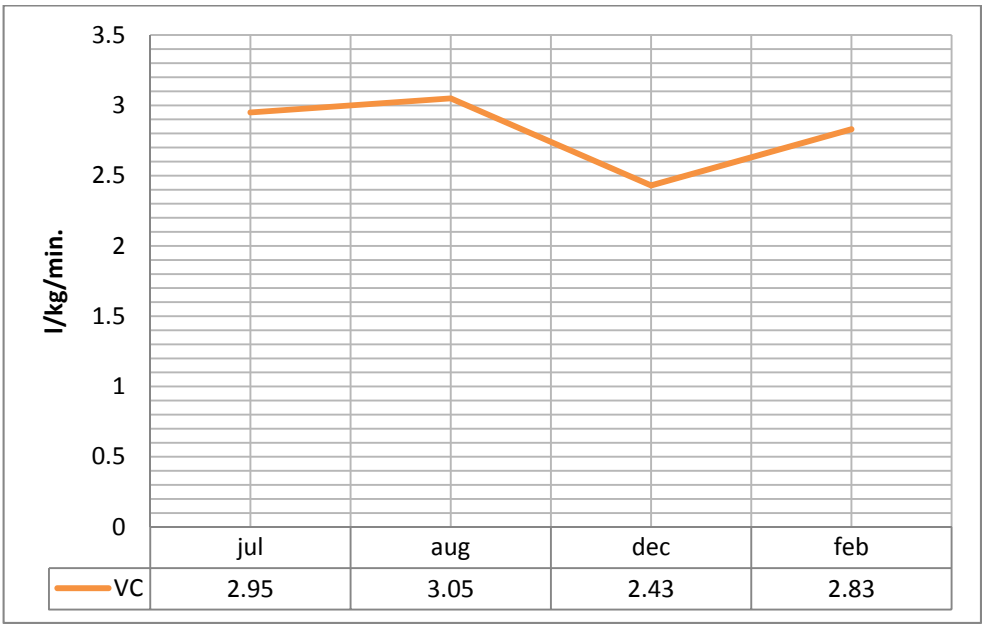
	jul	aug	sep	oct	nov	dec	jan	feb
HR rest	79	78	79	81	80	80	81	84
HR max	131	138	141	143	142	140	142	142
HR base	105	108	110	112	111	110	112	113

Graph no. 1- Intensity



	jul	aug	sep	oct	nov	dec	jan	feb
distance	10000	10800	17100	8000	7400	8000	9500	9600

Graph no. 2- Volume



Graph no. 3- Pulmonary Vital Capacity

Discussions

The workload declined by 60% in winter, and P.V.C. by 20%, while the intensity of effort perceived by the patient showed a slightly upward curve. In warm season the patient is able to bear a double workout volume at the same intensity of effort in cold season. There is an obvious relationship between the volume decrease and reducing PVC between seasons, this is the main factor influencing the patient's exercise capacity. During the cold season is slower progression, functional adaptations to exercise need a longer time, and post exercise recovery periods are longer.

Conclusions and suggestions

Exercise capacity of a patient with significant restrictions on the cardio-respiratory system is reduced by up to 20% during the cold season versus values recorded during warm season.

It is very important that observation when planning PA to a subject with such characteristics, forcing specialist who creates the program to take into account the season in which it is to operate. This will be reflected in the value it

will have workload volume. To check the correctness of sessions planned load is recommended to continuously monitor cardiovascular response during exercise. A valid and reliable indicator is HR which can be controlled with a HR watch.

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