The role of Beet Root ingestion on respiratory cardiovascular system of diving coaches

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Abstract: Aim of the research is to study the role of Beet Root ingestion on respiratory cardiovascular system of divers. **Materials, Methods:** Twenty four male diving coaches aged (22-25y), participated to the research. They were divided to two groups, placebo, experimental, experimental ingested 100g of Beet Root for 30 days as a supplement, they dive 45 min four times per week, in Melia Sharm, Reef Oasis, Some Respiratory and Cardiovascular variables were determined before and after the supplement, placebo. **Results:** Indicated a positive effect of Beet Root on Vital capacity VO_2 max, physical efficiency for respiratory variables together with increased blood cells, albumin, globulin fibrinogen and hematocrit values together with decreased pulse rate of the divers. **Conclusion:** Beet Root contents affects positively both respiratory and cardiovascular system leading to higher fitness and better health of the divers.
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1. Introduction and Research Problem

Beet Root

Latin: *Beta Vulgaris* or Betis, Amaranthaceae Family. Research stated that Beet root was used before Christ long ago, Medical personals reported their medical applications in liver inflammation and fatty liver, improve cases of anemia and jaundice inflammation, used in cases of hypertension due to its content of potassium. Beet root is useful in energizing the body, providing the body with energy, it is very useful for elderly specially improving osteoporosis. It is very important for neonatal due to its content of folic acid and iron also is a prophylaxis vegetable of atheroschlerosis and help to get rid of fat in case of obesity Beet Root contain antioxidants which retard fatigue ***(El Kolla, 2013).***

When human beings descend beneath the sea, the pressure around them increases tremendously, to keep lungs from collapsing, air must be supplied at very high pressure to keep them inflated. This exposes the blood in the lungs also to extremely high alveolar gas pressure, a condition called hyperbarism ***(Butler, 2001; Wang et al., 2002).***

A column of sea water 33 feet deep exerts the same pressure at its Bottom as the pressure of the atmosphere above the sea. Therefore, a person 33 feet beneath the ocean surface is exposed to 2 atmospheres pressure. Atmosphere of pressure caused by the weight of the air above the water and the second atmosphere by the weight of the water itself. At 66 feet the pressure is 3 atmospheres, and so forth. The more the depth (feet) of sea level the higher the atmosphere ***(Russi, 1998).***

The major function of Red blood cells, is to transport hemoglobin, which in turn carries oxygen from the lungs to the tissues. Rbcs have other functions such as responsible of acid-base buffering power of blood, expel of CO_2 from the tissues to the lungs. White blood cells are the mobile units of the body's protective system. They are formed in the bone marrow and lymph tissue. The real value of Wbcs is that most of them are transported to areas of infection and inflammation providing a potent defence against infectious agents. ***(Alexander and Granger, 2000; Blander and Medzhitov, 2004).***

Platelets are minute discs, formed in the bone marrow, they have many functional characteristics, they play an important role in hemostasis and blood coagulation, as it play a role in the conversion of prothrombin to thrombin because much of the prothrombin first attaches to prothrombin receptors of the platelets already bound to the damaged tissue ***(Brass, 2003; Khan Ginsberg, 2004).***

Hematocrit: The percentage of the blood that is cells, average in men 42, while that of women 38, it varies depending of having anemia, or reside in altitude, when increase it increases the viscosity of blood and the flow of blood in blood vessels in retarded ***(Badeer, 2001).***

There are few stresses to which the body is exposed that even nearly approach the extreme stresses of heavy exercise. In sports physiology, the discussion of the ultimate limits to which several of the bodily mechanisms can be stressed.

Guyton and Hall, (2006) stated that although only respiratory ability is of relatively little concern in the performance of sprint types of athletes. It is critical for

maximal performance in endurance athletics. They added that normal oxygen consumption for a young man at rest is about 250 ml/min. However, under maximal conditions, this can be increased to approximately for untrained male 360 ml/min. Male marathon runner 5100 ml/min.

Aim of the Research is to:

Study the role of Beet root ingestion on respiratory-cardiovascular system of divers.

Hypothesis:

It was hypothesized that Beet Root ingestion affect positively the respiratory cardiovascular system of divers.

2. Materials and Methods

Sample method: The experimental method was used of pre-post measurement.

Twenty four male divers aged (22-25 years), height (173-182 cm), weight (69-80 kg), with practical diving period (2-3 y), all participated to the research. They were free of diseases, they are refrained from medication, caffeine or vitamins. They all write an informed consent for participation. They were divided to two groups: (1) Experimental group ingested Beet root as a supplement, placebo group divers, they were instructed to dive 45 min four times per week. use Scuba, in Melia Sharm, Reef oasis.

5 ml of blood sample was withdrawn of veins before and after the nutri-diving program of 30 days.

- Tools and Devices.
- Balance weight, restameter.
- Scuba Apparatus.
- Syringes, cotton, plasters, Alcohol.
- Covered test tubes contain EDTA.
- Coulter counter for determination of blood picture.
- Spectrophotometer for plasma proteins determination.
- Kits for plasma proteins.
- Centrifuge, vortex.
- Spirometer for vital capacity.
- Colman, ice, Deep freezer.
- Hematocrit tubes.
- Pulse meter for pulse rate.
- Bicycle and astrand nomogram for VO_2 max.

Scuba (self-contained under water breathing apparatus diving: before the 1940, diving was done using diving helmet connected to the hose through which air was pumped to the diver from the surface. In ***(1943), Jacques Cousteau*** popularized a self contained underwater breathing apparatus known as Scuba.

The type of Scuba used in more then 99% of sports and commercial diving is the open circuit demand system, composed, one or more tanks of compressed air, reducing valve to reduce pressure, a combination inhalation valve and exhalation valve, and a mask, tubes system ***(Guyton and Hall, 2006).***

Beet Root administration and composition & nutritional value.

100 grams of Beet Root was cooked ingested by experimental group for 30 days to prevent any problem it was advised not to be eaten with other food items as Beet root in difficult to be digested by some individuals.

100 grams (Beet Root) contain:
43 Calories
17 Lipids
4,56 Carbohydrate
2,80 Fibers
6,76 Glucose, Sucrose, Fructose
1,61 Proteins

(Minister of US Agriculture)

Also 90% water
2.1% asches
Vit.: ABC, Folic Acid.

Mineral: Cupper, Zinc, Manganese, Cobalt, Iodine, Boron, Silicon, Barium, Brome and Betaine gives the red colour and balance of Ph in stomach.

(El Kolla, 2013)

Nutrient supplement

Statistical Analysis:

Statistical Data:

They were performed using SPSS:

1. Arythmatic mean.
2. Standard deviation of variables.
3. T-test before and after the program.
4. Level of significance was fixed at 5%, $p < 0.05$.

3. Results

Table (1): Denotes non significance differences between control and experimental groups in basic characteristic features of divers.

Table (2): Respiratory variables of placebo and experimental groups before beet root ingestion, non significance differences between them in vital capacity, VO2 max, physical efficiency.

Table (3): Respiratory variables between the experimental, placebo groups after beet root ingestion, denote significant differences in favour of the experimental groups.

Table (4): Cardiovascular variables of experimental and placebo groups of divers before Beet Root ingestion, revealed non significant changes.

Table (5): Cardiovascular variables of experimental and placebo groups of divers after Beet Root ingestion, revealed significant changes of the variables for the sake of the experimental group non significant changes.

Table (1): Basic characteristics features of the divers

Variables	Placebo		Experimental		Sig.
	M	SD	M	SD	
Age (y.)	23.1	2.4	22.8	3.6	NS
Height (cm)	175.1	5.8	176.2	6.7	NS
Weight (kg)	77.4	5.1	78.1	7.5	NS

P < 0.05

Table (2): Respiratory variables of experimental and placebo groups of divers before Beet root ingestion (n = 12)

Variables	Placebo		Experimental		Sig.
	M	SD	M	SD	
Vital capacity (L.)	4.1	0.4	4.2	0.5	NS
VO2 max (ml/kg/min)	35.2	2.2	34.8	2.1	NS
Physical effeciency	15.1	1.6	15.2	1.7	NS

P < 0.05

Table (3): Respiratory variables of experimental and placebo groups of divers after Beet root ingestion (n = 12)

Variables	Placebo		Experimental		Sig.
	M	SD	M	SD	
Vital capacity (L.)	4.3	0.3	4.6	0.2	S
VO2 max (ml/kg/min)	35.6	2.4	39.3	2.6	S
Physical effeciency	14.8	1.5	13.1	1.2	S

P < 0.05

Table (4): Cardiovascular variables of experimental and placebo groups of divers before Beet root ingestion

Variables	Placebo		Experimental		Sig.
	M	SD	M	SD	
Hb (g/dl)	12.3	1.4	12.6	1.6	NS
Platelets Th. (mm)	231.2	6.7	227	7.1	NS
Rbcs Mi. (mm)	4.8	0.6	4.7	0.5	NS
Wbcs Th. (mm)	6.2	0.5	6.3	0.7	NS
Hematocrit (%)	39.6	2.1	40.2	3.4	NS
Albumin (g/dl)	4.8	0.4	4.7	0.5	NS
Globulin (g/dl)	2.5	0.3	2.3	0.2	NS
Fibrinogen (mg/dl)	0.92	0.04	0.90	0.05	NS
Pulse Rate (counts/min)	77	4.3	76	4.6	NS

P < 0.05

Table (5): Cardiovascular variables of experimental and placebo groups of divers after Beet root ingestion

Variables	Placebo		Experimental		Sig.
	M	SD	M	SD	
Hb (g/dl)	12.6	1.5	14.3	1.7	S
Platelets Th. (mm)	238.8	6.4	251.2	5.4	S
Rbcs Mi. (mm)	4.9	0.5	5.2	0.4	S
Wbcs Th. (mm)	6.4	0.4	6.7	0.5	S
Hematocrit (%)	39.8	2.3	42.1	2.6	S
Albumin (g/dl)	4.9	0.3	5.2	0.4	S
Globulin (g/dl)	2.6	0.2	2.9	0.3	S
Fibrinogen (mg/dl)	0.93	0.03	1.2	0.04	S
Pulse Rate (counts/min)	76	3.9	72	3.4	S

P < 0.05

4. Discussion

The abbreviation for the rate of oxygen usage under maximal aerobic metabolism is VO_2 max. Table (2, 3) shows the progressive effect of Beet root on VO_2 max in the experimental group pursuing Beet root ingestion for 30 days it is noticed that the VO_2 max increased for divers.

It was pointed out that VO2 max of Marathoners is about greater than that of untrained person, part of this greater VO_2 max probably is genetically determined, that is, those people who have greater chest sizes in relation to body size and stronger respiratory muscles select themselves to become marathoners. Also it is likely that many years of training increase the marathoners VO_2 max by values considerably greater than untrained persons ***(Chakravarthy and Booth, 2004; Booth et al., 2002; Myburgh, 2003; Schnermann, 2002)***.

The data of this research denoted an increase VO_2 max after Beet root ingestion for 30 days, as Beet root improved cases of anemia and it is useful in energizing the body, also due to its content of folic acid which affect positively Rbcs which is turn increase the oxygen diffusing capacity, as oxygen diffusing capacity is higher in case of swimmers and divers as reported by ***(Tschakovsky and Hughson, 1999).***

This result mainly from the fact that blood flow through many pulmonary capillaries is sluggish in the resting state, whereas in maximal exercise, increase flow flow through the lungs causes all the pulmonary capillaries to be perfused at their maximal rates, thus providing a far greater surface area through which oxygen can diffuse into the pulmonary blood. ***(Guyton et al., 1973; Delp and Laughlin, 1998).***

It is clear that those athletes who require greater amount of oxygen for minute have higher diffusing capacities, because people with higher diffusing capacities may be due to the training procedures which increase the diffusing capacities as in case of divers ***(Kraemer et al., 2002).***

Vital capacity equals the inspiratory reserve volume plus the tidal volume plus the expiratory reserve volume. This is the maximum amount of air a person can expel from the lungs after first filling the lungs to their maximum extent and then expiring to the maximum extent ***(West, 1994).***

West (2000) added that spirometry is only one of many measurement procedures that the pulmonary physician uses daily. Many of these measurement procedures depend heavily on mathematical computations. Also the respiratory system, demonstrate the respiratory passage ways. The air is distributed to the lungs by way of the trachea, bronchi and bronchioles. One of the most important problems in all the respiratory passage ways is to keep them open and allow easy passage of air to and from the alveoli ***(Hilaire and Duron, 1999).***

Table (2, 3) revealed that Beet root ingestion increase vital capacity compared to placebo group of divers, this was also reported to ***Lakhero and Kain, (1997) and Sudip et al., (2006).***

They concluded that lung function parameters have no or negligible positive effects on physical training, in response to the specific training planned of their study.

Leach et al., (1998) added that respiratory pressures and respiratory muscle strength are the main determinants, after height, of FVC and FEV1, PEF., ***Quanjer et al., (1997)*** reported that from the physiological factors that effect vital capacity besides the dimensions of airways, lung volumes are the force generated by expiratory muscles and their force-velocity properties.

Wells et al., (2005); Sonetti et al., (2001) stated that respiratory muscles as other skeletal muscle can be trained as several authors have observed changes of respiratory muscle strength and FVC and FEV1 due to specific respiratory muscle training within 5-12 months.

Clanton et al., (1987) reported that respiratory muscle can be trained by every physical acitivity that increases demand for oxygen and make them contract stronger to increase lung ventilation. It is found that athletes of different sports and specially swimmers and divers, whose respiratory muscles should overcome additional water resistance have higher FVC and FEV_1.

Chenge et al., (2003) reported correlations between miles walked or jogging and FVC, FEV_1.

Holmen et al., (2002) showed positive dose response relationship between physical exercise and lung function. They have found stepwise increase in levels of FVC with physical exercise and statistical significant differences between the highest and lowest level of exercise in never smoking adolescent. ***Rumaka et al., (2006)*** concluded that skeletal muscles which are main determinants of the fat free body mass influence Forced Vital Capacity (FVC), persons with higher handgrip strength might have stronger respiratory muscles and larger respiratory volumes and higher FVC.

Table (2, 4) revealed that physical efficiency and pulse rate in favor of the experimental group (Beet root ingestion) compared to placebo group. As physical efficiency increased in experimental group, while pulse rate decreased significantly.

Pawlowska and Woznieski, (1999) reported that one of the most important elements of human health is physical efficiency, it means the ability to perform work without increasing signs of fatigue. The beneficial influence of physical activity on general efficiency of

the body is widely documented. The effect of rational and systematic physical activity is the decrease in frequent of heart rate and the increase in maximal oxygen uptake ***(Kaikkonen et al., 2000).*** Physical training, specially aerobic exercises, as an adaptation process leads to continuous improvement of individual activity of tissues and organs and increased effort abilities. This was also showed in (Table 4, 5) as pulse rate decreased together with elevated VO_2 max in case of the experimental group.

Multiple studies have shown that people who maintain appropriate physical fitness, using judicious regimens of exercise and nutrients as complement have the additional benefit of fitness together with health. As body fitness and health reduce cardiovascular diseases, low blood pressure, low pulse rate, these changes all work together to reduce heart attacks and brain strokes. Also, the fit athletic has more body reserves to call on when become sick ***(Blair et al., 2004).***

So, it is of importance to keep the body fit and better health for a better life.

Table (4, 5) indicated a significant changes in experimental group after Beel root ingestion compared to the placebo group of divers, in Rbcs, Wbcs, Hb, platelets and also in albumin and globulin, fibrinogen variables which indicated a positive effect of Beet root in the field of gas transport, and body defence against disease and protection against anemia this was also reported by many investigators ***(Lakatta, Levij, 2003).***

As for plasma protein, the major types present in the plasma albumin, globulin, fibrinogen.

Table (4, 5) indicated an increased concentrations of plasma protein which is positive action of Beet root in case of the experimental group by providing colloid osmotic pressure in the plasma which prevent plasma loss from the capillaries, due to the action of albumin, as for globulins which perform a number of enzymatic functions in the plasma and responsible of the natural and acquired immunity against invading organism, for fibrinogen which help in blood clots and repair leaks in the circulatory system as reported also by ***Altenberg (2003), Tessari (2003), Penchars and Ball, (2004).***

Conclusion

It may be concluded that:

Beet root affects positively respiratory and cardiovascular system, due to its content of vits, minerals, antioxidants, energy producing substances, leading to higher fitness and better health of divers.

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