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International Journal of Recent Scientific Research
Vol. 5, Issue, 10, pp.1791-1793,October, 2014

International Journal of Recent Scientific Research

ISSN: 0976-3031

RESEARCH ARTICLE

EFFECT OF CHEMICAL TOXICANTS ON PHYSICAL EFFICIENCY OF POST MENOPAUSAL WORKING WOMEN IN INDUSTRIAL AREA (INDIA)

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ARTICLE INFO

Article History:

Received 12th, September, 2014
Received in revised form 21st, September, 2014
Accepted 11th, October, 2014
Published online 28th, October, 2014

Key words:

Anthropometry, Post menopausal, Pollutant, Blood pressure, Haemoglobin, Cardio-respiratory responses

ABSTRACT

Present investigation evaluated the effects of Industrial effluents on and Body Fitness and Cardio- respiratory responses of Postmenopausal working Women (n=100) living in rural and Industrial belt. Anthropometric data of Vertical Height and Body mass of Urban and rural women were measured by Anthropometer Rod, Weighing machine and compared. Body fat percent was estimated of the subjects of both group by Siri Equation putting the value of arm skin fold thickness and iliac skin fold thickness using Harpenden Skin Fold Calipers. VO_2 max was determined by treadmill exercise with direct measurement of oxygen consumption. Pulmonary minute ventilation (VE) of the subjects of both group were measured by Electronic Spirometer. Blood Pressure was measured by Sphygmomanometer and Radial Pulse rate (beats /min) was measured. Blood Haemoglobin Concentration was measured by spectrophotometrical technique and compared. Erythrocyte count of the subjects of both rural and Industrial area was taken by Automatic Coulter Counter. Working post menopausal women living in rural area showed significantly greater lean mass, physical efficiency and aerobic capacity than women in Industrial area. Menopausal working women living in Industrial Area showed a significantly ($p<0.05$) lower cardio-respiratory responses to exercise than women living in rural area. Insignificant ($p>0.05$) difference of R.B.C count, blood haemoglobin concentration (gm %) and body mass of rural subjects in respect of post menopausal working women of Industrial area was observed. Industrial toxicants have detrimental role on oxygen transport to tissues, muscular strength and physical efficiency in either sex of human beings.

INTRODUCTION

Health is nothing but a state of complete physical, mental developed social well beings and not merely the absence of diseases or infirmity (WHO, 1996).Good health causes better efficiency to combat the pollution tide in world. Health mainly depends on food nutrients. Deficiency of nutrient creates ill health. Besides that mental pleasure is also an important factor for health condition. On the other hand anxiety, stress, manmade pollutants affect the health condition of people living particularly in urban area affected mainly by vehicle exhaust, unburned hydrocarbons, industrial wastes, municipal sewage, nuclear waste and water pollutants which coastally increases the concentration of Lead, Chromium, Mercury, Arsenic, Fluoride, Silicon and other toxic metals in surrounding areas (WHO,1996; Leggett, 1993; Pocock *et al*., 1989;Thawley *et al*., 1977). Particularly

Lead affects hemoglobin synthesis by inhibiting the δ-Amino Leuvilinic Acid Synthase enzyme and creates anaemic condition. It causes lung disorder and arrest foetal development (Lakatta, 1993; Klein *et al*., 1980;Granick *et al*., 1973).

Alongside it causes fatigue condition in Urban people. The metallic contaminant destroys soil bacteria and other organisms acting on water to impure it, resulting death of animals and plants. Arsenic and Lead particularly make the water undrinkable and also their toxicity damage the chromosome and process of heredity. It is mentioned that

50 μg of Arsenic and 40 μg Lead/100 mL of blood cause of damaging brain cells (National Academy of Sciences/Institute of Medicine, 2003). Slight increase in mercury level can prevent the movement of Gill filament and thereby arrest respiration in aquatic animals. Other metals like Cobalt, Zn, Ni, Cu also cause of different health hazards including Gastrointestinal disorders (Thawley *et al*., 1977;Suttle and Mills,1966). So to protect our health condition preventive measure should be adopted immediately. Other factors like Age, Sex (?) and regular physical exercise may affect the body efficiency (Londeree and Hschberger,1982). Health is related with body fitness in terms of physical efficiency and it may be expressed either Gross efficiency or Net efficiency.

Gross Efficiency (%) = (External work output/ total energy used for work) X 100
Net Efficiency (%) = (External work output/ total energy used – Basal requirement) X 100
Mechanical Efficiency (%) = (Actual Mechanical work /input of energy) X 100

So, to combat the effect of environmental toxicants sufficient good nutrients should be included in their daily diet.

RESEARCH METHODOLOGY

For present study hundred (100) rural women from different remote villages of Midnapore districts and hundred (100) urban women from Howrah district (Industrial belt) were selected. Some physiological parameters were taken on those subjects participating in exercise including Harvard Step test and Trade mill test. The subjects were randomly chosen and belong to menopausal and post-menopausal group (Age between 45 -55 years).

Physiological parameters of such women were noted from anthropometric measurement i.e. height and weight using Standard

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laboratory techniques (Maiti *et al*., 2011). Arm circumference, Chest circumference during inspiration and expiration were also measured by standard laboratory methods (Singh and Bishnoi, 2005). Skin fold thickness of subjects of both group were measured by Harpenden Skin fold Callipers (Jason and David, 2010). And the experimental data collected from rural and urban women group has been shown in **Table 1.**

Blood pressure (systolic and diastolic) of rural women and urban women were measured by sphygmomanometer and radial pulse rate of both groups were also recorded. Measured data has been shown in **Table 2.**

Resting and exercised heart rate of both the subjects group were measured from carotid pulsation, maximal oxygen uptake of both groups was measured during continuous Treadmill exercise, blood Haemoglobin concentration of both rural women and urban women was determined by Spectrophotometrical technique. Pulmonary minute ventilation (VE) of the subjects of both group was measured by Electronic Spirometer, Erythrocyte count was determined by Automatic Coulter Counter and measured data of the above experiments has been shown in **Table 3**.

Table 1 Anthropometric measurements of rural women and urban women. In each vertical column data are expressed as Mean ± SEM

Variables	Rural women (n=100)	Urban Women(n=100)
Age (years)	49.21±1.98	48±0.63
Height (cm)	150.65 ±1.17	148.±0.89
Weight (Kg)	51.20±1.94	52.27±0.66
Arm Circumference(cm)	23.62±0.60	21.00 ± 0.39
Head Circumference (cm)	51.09±0.93	52.24±0.30
Chest Circumference (cm)		
Inspiration	79±1.02	73.21±2.21
Expiration	74.00±0.88	72.06±0.78
Total Skin fold Thickness (mm)		
Illiac	9.0±0.02	8.7±0.23
Arm	6.0±0.05	8.0±0.02
% of Body Fat	16.0±0.01	18.0±0.03

Body density = 1.0764-(0.3081) X illiac Skin fold -0.3088 X Arm Skin Fold

Percent of body fat ={(4.570/BD)-4.142}X 100

Total Fat (Kg)= (Body weight (Kg) X Percent of fat)/ 100

Table 2 Heart and Lung response of Rural & Urban women (normal). In vertical columns data are expressed as Mean ± SEM

Variables		Rural Women (n=100)	Urban Women (n=100)	Level of Significance
Blood Pressure (mm of Hg)	Systolic	142.0±2.31	146.3±3.36	p>0.05
	Diastolic	82.92±2.30	80.12±1.99	p>0.05
Pulse Rate (beats /min)		68.0±3.10	72.26 ±2.39	p>0.05
Breathing rate (breaths/min)		10.0 ±0.29	12.0± 0.26	P>0.05

Table 3 Cardio-respiratory response after exercise and blood Haemoglobin concentration. In vertical columns data are expressed as Mean ± SEM

Variables	Rural Women (n=100)	Urban Women (n=100)	Level of Significance
Resting Heart Rate (beats/min)	68.28±2.64	72.26±1.41	p>0.05
Maximum Heart Rate (beats/min)	148.0±1.02	168.0±2.43	P<0.05
Maximal Oxygen uptake (lit/min)	2.74±0.08	1.65±0.02	p<0.05
Pulmonary minute ventilation after exercise (VE) (lit/min)	12 ± 0.13	09± 0.36	p>0.05
Physical Fitness Index (%)	70.0±0.02	57.0±0.32	P<0.05
RBC Count (million/mm^3)	4.5±0.28	4.2±0.33	P<0.05
Hemoglobin Concentration (gm%)	10.8 ±1.02	9.6±0.84	p>0.05

FINDINGS AND DISCUSSIONS

The present study shows for the first time to our knowledge that physical efficiency of post-menopausal Women decreased with advancing age. As lower concentration of oestrogen may affects muscular calcium metabolism that also may cause of decrement of physical efficiency in women (Aloia *et al*., 1991).

Our present investigation on post-menopausal women living in Urban and rural area provides an impressive evidence that muscular efficiency can be restored by physical exercise ignoring lower concentration of sex hormones and food nutrients (Pocock *et al*., 1989).

Good nutrients have enormous role on production of sufficient energy for muscular contraction in this Physiological State of women (WHO, 1996).

But higher concentration of heavy metals develop toxicity that decreases oxygenation of haemoglobin in blood and aerobic respiration of tissues of human body that also one of the reason of lower physical efficiency of women living in urban area (National academy of Sciences/Institute of Medicine, 2003).

Interesting findings in our investigation are that the measured data of body mass, Arm circumference, iliac, chest circumference during expiration higher in menopausal women living in rural area in comparison to that data collected from women living in urban area. But body fat percent and skin fold thickness of post-menopausal women of urban zone is higher than that of post-menopausal women in rural area (**Table-2**).

Another finding was observed that myocardial strength, maximal oxygen uptake or vital capacity of rural menopausal women is higher than that of urban menopausal women (Landers and Petruzzewllo, 1994; Gaffney *et al*., 1990). Pulmonary minute ventilation (VE) of rural menopausal women is higher than that of women in industrial area (Moore *et al*.,1982; Robinson *et al* .,1982). Blood haemoglobin concentration, R.B.C count of both rural women and urban women were measured but shows insignificant (p>0.05) variation (**Table-3,** Regular physical exercise Increases oxygen uptake capacity (Dalsky *et al*., 1988; Farrel *et al*.,1983), oxygenation of myoglobin and also increases oxygen consumption of muscle (Landers and Petruzzewllo, 1994; Leggett, 1993). In spite of regular consumption of sufficient quality nutrients postmenopausal women living in Industrial belt shows lower physical efficiency due to greater concentration of

environmental pollutants (Leggett, 1993). The enhanced functional pulmonary ventilation is due to partly increase in aerobic enzymes level and oxidative capacity of the ventilator muscles with physical exercise.

CONCLUSION AND RECOMMENDATIONS

The overall findings in this study have revealed that the aged women are able to increase their heart rate and oxygen uptake to its maximum level as well as Pulmonary ventilation like other women belonging to lower age groups, if they involved in regular physical exercise like yoga, Meditation in a suitable environmental condition. Rise of concentration of Industrial toxicants may one of the major causes of muscular fatigue and detrimental effect of physical efficiency of people living in urban area.

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