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Effects of Toxicants on Physical Efficiency of Menopausal Women in Rural and Industrial Belt

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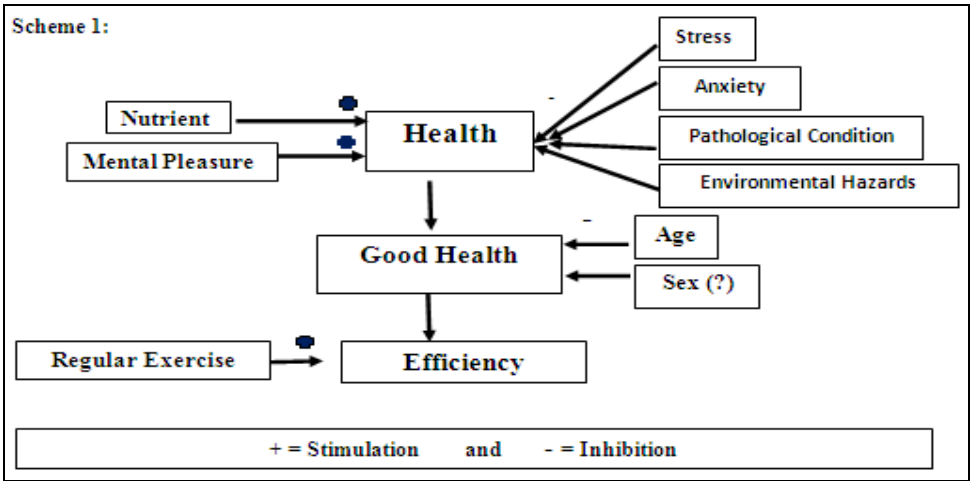
Abstract:
Present study evaluated the relationship of physical fitness, aerobic capacity and heart responses of Postmenopausal women (n=90) living in rural and urban area. Body fat percent was estimated by Siri equation putting the value of iliac skin fold thickness and arm skinfold thickness using Harpenden Skin fold Callipers. VO_2 max was determined by treadmill exercise with direct measurement of oxygen consumption. Blood pressure was measured by Sphygmomanometer and the radial pulse rate (Beats/Min) was measured. Anthropometric data (Height, body mass) was taken by using Anthropometer rod, weighing machine and data were compared among the subjects of both groups. Blood Haemoglobin of both groups was measured by spectrophotometrical technique and compared. Rural post-menopausal women had significantly ($p<0.05$) posses greater lean mass, physical efficiency and aerobic capacity than urban menopausal women. Urban menopausal women showed a significantly ($p<0.05$) lower cardio respiratory responses to exercise than women living in rural area. Insignificant ($p>0.05$) differences of hemoglobin concentration and body weight of rural women was noticed in respect to post-menopausal urban women. Good nutrients have stimulatory where as pollutants has some detrimental role on muscle strength and physical efficiency in either sex of human beings in all age group.

Keywords*: anthropometric, ergometry, nutrient, pollutant, post menopausal, haemoglobin*

1. 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 (Thawley et al., 1977; Pocock et al., 1989; Leggett, 1993; WHO,1996). Particularly Lead affects hemoglobin synthesis by inhibiting the □-Amino Leuvilinic Acid Synthase enzyme and creates anaemic condition. It causes lung disorder and arrest foetal development (Granick et al., 1973Klein et al., 1980; Lakatta, 1993). 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 60 □g of Arsenic and 40 □g 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 there by arrest respiration in aquatic animals. Other metals like Cobalt, Zn, Ni, Cu also cause different health hazards including Gastrointestinal disorders (Suttle and Mills,1966; Thawley et al., 1977). High concentration of CFCs and carcinogenic chemicals also affect health condition.

So, to protect our health condition preventive measure should be adopted immediately. Other factors like Age, Sex, regular physical exercise may affect the body efficiency (Londeree and Moeschberger,1982). Relationship between health and efficiency with some controlling factors is shown by following schematic diagram:



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 environmental hazards sufficient and good nutrients should be included in their daily diet.

For taking adequate calorific valued food good nutrient everyone has some idea about the computation of calorie requirement as well as nutrient requirement of an individual and it can be computed by the following ways:

If the individual's age -50 years, body weight- 50 kg, BMR- 60 Kcal/Hr.			
Activities	Duration	@KCal	Energy (KCal)
Sleep	8 Hrs.	90% of BMR	= 60 X 0.9 X 50
Non Occupational activities:			
Washing, bathing, Dressing, Eating	1.5 Hrs	2	15 X 1.5 X 2
Sitting, Standing	3 Hrs	1.4	50 X 3 X 1.4
Writing, Card Playing, Gossiping, Singing	2 Hrs	1.5	50 X 2 X 1.5
Walking, Running	1.5 Hrs	3	50 X 1.5 X 3
Occupational activities: Sedentary/Moderate/Heavy	8 Hrs.	4	50 X 4 X 8
Total = 2690 10% SDA = 169			
NUTRIENT REQUIREMENT			
Nutrient	Rate	Amount	KCal
Protein	1 gm/Kg/Day	50 gm	205
Fat	15% of total calorie	48 gm	444
Carbohydrate	Rest of calories (F+P) / 4.1	563 gm	2310

Table 1: Computation of Calorie requirement

2. Materials and Methods

For present study hundred (90) rural women from different villages of Midnapore districts and hundred (90) 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 -54 years).

Physiological parameters of such women were noted from anthropometric measurement i.e. height and weight using Standard 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 2.

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 3.

Resting and exercised heart rate of both groups 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 and measured data of the above experiments has been shown in Table 4.

3. Discussion of Results

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). Blood haemoglobin concentration of both rural women and urban women were measured but shows insignificant ($p>0.05$) variation (Table-3, 4). Regular physical exercise Increases oxygen uptake capacity (Dalsky et al., 1988), oxygenation of myoglobin and also increases oxygen consumption of muscle (Leggett, 1993; Landers and Petruzzewllo, 1994). 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). So, it may be concluded that the aged women are able to increase their heart rate and oxygen uptake to its maximum level 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 environmental pollutants may one of the major causes of fatigability of people living in urban area.

Variables	Rural women (n=40)	Urban Women(n=40)
Age (years)	51.21±1.98	50.27±0.63
Height (cm)	151.63 ±0.89	148.65±0.38
Weight (Kg)	52.25±0.36	50.27±0.63
Arm Circumference(cm)	22.61±0.69	24.62±0.39
Head Circumference (cm)	52.09±0.94	51.36±0.28
Chest Circumference (cm)		
Inspiration	80±1.02	72.22±2.21
Expiration	76.35±0.89	70.86±0.28
Total Skin fold Thickness (mm)		
Illiac	9.0±0.02	8.6±0.28
Arm	5.0±0.05	8.0±0.02
% of Body Fat	15.8±0.07	19.0±0.04

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

Variables		Rural Women	Urban Women	Level of Significance
Blood Pressure (mm of Hg)	Systolic	138.0±2.31	140.3±3.36	p>0.05
	Diastolic	80.12±2.30	82.30±2.20	p>0.05
Pulse Rate		68.0±1.10	72.26 ±1.39	p>0.05

Table 3: Heart response of Rural & Urban women. In vertical columns data are expressed as Mean ± SEM

Variables	Rural Women	Urban Women	Level of Significance
Resting Heart Rate (beats/min)	67.28±2.64	72.26±1.41	p>0.05
Maximum Heart Rate (beats/min)	148.0±1.04	168.0±1.11	P<0.05
Maximal Oxygen uptake (lit/min)	2.96±0.08	1.82±0.02	p<0.05
Physical Fitness Index	72.0±0.01	56.0±0.03	P<0.05
Hemoglobin Concentration (gm%)	10.2 ±0.84	10.8±1.02	p>0.05

Table 4: Cardio-respiratory response after exercise and blood Haemoglobin concentration. In vertical columns data are expressed as Mean ± SEM

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