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LETTER TO THE EDITOR

EFFECT OF EXAMINATION STRESS ON SOME METABOLIC PARAMETERS

Sir,

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Stress response is characterised by biochemical, physiological and behavioural changes in the body. Changes in serum lipids have been reported during examination stress (2, 3, 4). Though emotional stress is known to affect the metabolic rate through alteration in homeostasis (5), yet examination stress has not been implicated as one of the factors influencing metabolic rate which inturn is governed by oxygen (O_2) consumption and carbon dioxide (CO_2) output (6). Hence the present study was undertaken.

Twelve healthy medical students including eight males (mean age 21.11 yrs) and four females (mean age 19 yrs) were selected for the study. Exclusion criteria were habit of tobacco chewing, smoking or addiction to any drug and anxiety neurosis. Written informed consent was obtained from all students. The students were instructed to take isocaloric diet of 2000 calories with maximum of 50 g fats in 24 h arbitrarily for two days prior to each measurement to avoid the influence of diet on metabolic parameters. All the subjects were called in the laboratory with empty stomach each time for measurement of metabolic parameters. They were put on bed rest for 1 h and were asked to breathe comfortably during the rest period. O_2 uptake and CO_2 output (ml/min/kg) were measured by NOYON's diaferometer (Kipp and Zonen, Delft, Holland). Respiratory exchange ratio (RER) and resting metabolic rate (RMR in Calories/day) were calculated from the measurements of O_2 uptake and CO_2 output (7).

The first measurement was made two months before the examination when students were busy participating in college cultural week and it served as control. The second and third measurements were done two days prior to third terminal and then first professional examination and labelled as preterminal (preterm) and preprofessional (preprof) samples respectively. The fourth measurement was done 20 days after the professional examination following declaration of results (postprofessional sample) and found to be similar to control values. All the participants were declared successful in examination.

The mean of difference of values at four occasions were calculated and statistically analysed by utilizing paired 't' test. An attempt was also made to find out relationship, if any, between the degree of stress and metabolic parameters by determining Pearson's coefficient of correlation.

The mean O_2 uptake decreased from control to preterm but increased from preterm to preprof period. When mean of difference of individual values were

compared, the change in O_2 uptake from preterm to preprof was highly significant (P<0.001, Table I). Yet significant correlation could not be seen between level of stress and O_2 uptake.

The mean CO_2 output increased from control to preterm but then decreased upto postprof period. The initial increase of CO_2 output was significant (P<0.01, Table I) in terms of mean of difference of individual values. Moreover, a significant positive correlation between CO_2 output and degree of stress was observed from control to preterm (P<0.01) and control to preprof periods (P<0.05).

The Respiratory Exchange Ratio (RER) exhibited pattern similar to CO_2 output. However, the alterations in RER were insignificant when mean of difference of individual values was compared. To add, no significant correlation was observed between degree of stress and RER.

The Resting Metobolic Rate (RMR) also increased from control to preprof period. When mean of difference of individual values was compared, there was no significant change in RMR, however, significant correlation was observed between level of stress and RMR from preterm to preprof (P<0.001), and control to preprof (P<0.001), periods (Table I).

It has been observed that during period of stress, there is an increase in metabolic demand of tissue to combat the situation. There is a rise in corticotropin releasing factor from hypothalamus. It can simultaneously activate and co-ordinate metabolic, circulatory and behavioural responses that are adaptive in stressful situations (8). There is also an increase in level of various hormones viz. epinephrine, norepinephrine, glucagon, growth hormone and ACTH due to stimulation of pituitary adrenocortical axis. These hormones are lipolytic in nature and increase lipid levels by mobilizing the lipid stores to meet extra metabolic demand of body (9). The catecholamines affect the metabolic rate as well (5). However, Letton et al. (10) observed lipogenesis with increased CO_2 production even at reduced caloric intake during surgical stress and this was responsible for increase in metabolic energy expenditure by 50%. Muza et al. (11) observed an increase

TABLE I: Mean ± SD of difference of some metabolic parameters between various degrees of examination stress and their correlation (r) with it in medical students (n = 12).

	O_2 uptake		*CO_2 output*		*RER*		*RMR*	
	ml/min/kg	*r*	*ml/min/kg*	*r*		*r*	*Cal/day*	*r*
Control vs Preterminal Examination	0.29±0.58	−0.271	0.59±0.20*	+0.802^{aa}	0.18±0.19	+0.277	33.89±76.69	+0.529
Preterminal vs Preprofessional Examination	0.49±0.14**	+0.164	0.13±0.29	+0.484	0.13±0.13	+0.091	59.66±152.39	+0.847^{aa}
Control vs Preprofessional Examination	0.17±0.02	+0.471	0.41±0.20	+0.623^{a}	0.06±0.06	+0.027	44.83±50.60	+0.922^{aaa}

*P<0.01; **P<0.001 (Paired 't' test)
^{a}P<0.05; ^{aa}P<0.01; ^{aaa}P<0.001

in O_2 consumption and pulmonary ventilation during cold stress. Hildsheimer et al. (12) observed 30% increase in metabolic rate and low PO_2 during emotional stress.

Therefore, it may be speculated that the change in pulmonary mechanics and metabolic rate which are interdependent might be responsible for the significant correlation between level of stress and metabolism. Thus, the changes in metabolism in response to examination stress appears to be due to increased lipolysis secondary to hypersecretion of stress related hormones. However, since adaptive changes occur quickly, the correlation between examination stress and metabolic parameters seem to be variable.

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