

# THE ASSESSMENT OF THE IMPACT OF THE GENETIC AND SOCIOECONOMIC DETERMINANTS ON SCHOOLAGE CHILDREN

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**Keywords:** *psychical stress, ear drum temperature, core temperature, thermoregulation, socio-economic factors, genetic factors*

**Abstract:** *The study aims at investigating the role of the genetic and socioeconomic factors on the core temperature as a measure of psychological stress impact on thermoregulation, taking into account the involvement of the hypothalamus on thermoregulation and psychological stress. I studied a number of 203 school pupils from the two secondary schools of the city of Sibiu (no. 6 and 21), personally investigated by measuring the ear drum temperature and by applying a questionnaire. I measured the ear drum temperature during two different periods of time, on the first day after vacation, seen as a normal activity period of time and during knowledge evaluation period of time, of maximum stress. The conclusion of my study was that psychical stress, as a result of knowledge evaluation, determines the decrease of the core temperature, observed through the ear drum temperature.*

**Cuvinte cheie:** *stresul psihic, temperatura măsurată la nivelul timpanului, temperatura centrală, termoreglare, factori socio economici, factori genetici*

**Rezumat:** *Studiul nostru urmărește investigarea rolului factorilor genetici și socioeconomici asupra temperaturii centrale ca o măsură a impactului stresului asupra termoreglării luând în considerare implicarea hipotalamusului în termoreglarea organismului și în stresul psihologic. Am studiat 203 elevi din 2 școli generale din Sibiu (numarul. 6 și 21) prin măsurarea temperaturii la nivelul timpanului și prin aplicarea unui chestionar. Temperatura de la nivelul timpanului a fost măsurată în 2 perioade diferite de timp, în prima zi după vacanță în perioada de activitate normală și în timpul perioadelor de evaluare a cunoștințelor, perioadă cunoscută ca fiind foarte stresantă. Concluzia studiului a evidențiat scăderea temperaturii centrale ca urmare a stresului psihic datorat evaluării cunoștințelor, observată prin măsurarea temperaturii la nivelul timpanului*

## INTRODUCTION

Stress is a syndrome, a constellation of non-specific responses, with a non-specific adaptation character, according to Selye (1). During stress, processes such as, wear or even lesions may occur, which are generally preceded, accompanied or brought about by physiological adaptation reactions, mediated by the neuro-vegetative-endocrine chains.

Disruptions in homeostasis (stress, for instance) generate the activation of two systems, within the organism: hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (SNS). The activation of these two systems results in a series of neural and endocrine adaptations, known as “stress response” or “stress cascade”, necessary for the homeostatic equilibrium. The stressor initiates the release of corticotropin-releasing hormone (CRH) from the hypothalamus, which in turn results in the release of adrenocorticotropin hormone (ACTH) into general circulation. ACTH then acts on the adrenal cortex resulting in the release of a specific corticoid. The glucocorticoid acts in a negative feedback in order to terminate the release of CRH. (2) The neurons in the hypothalamic paraventricular nucleus synthesize CRH, as a response to the internal and external stimuli. CRH then reaches the median eminence through the axonic projections of the neurons. Subsequently, CRH is released in the portal blood and controls the transformation of ACTH into pituitary corticotropes. Blocking the actions of CRH with an antibody for this peptide or with a receptor-antagonist will prevent the stress-

induced release of ACTH .(3)

In 1912, Isenschmidt and L. Krehl drew the attention on the role played by the nervous system in temperature regulation. (4) The thermoregulation centres which preserve the thermal balance are placed in hypothalamus. (5) The afferences that activate the thermoregulatory centres come either from the thermosensitive neurons in the anterior hypothalamus, or from the cutaneous receptors. The thermosensitive neurons in the anterior hypothalamus are placed on a restricted area in the preoptic region .(4, 6, 7) Ear drum temperature is an indicator of the temperature of hypothalamus and of the body core temperature, the ear drum being strongly vascularized. (8, 9, 10) Even if the ear drum is not in direct contact with the brain, it may perceive its temperature. The correlation between the tympanic temperature and the cerebral temperature was progressively validated, the tympanic temperature not being influenced by that of the environment or cutaneous . (11)

## WORKING HYPOTHESIS

The research of stress led to the conclusion of the existence of overstress in the school pupils – situation in which the school pupil finds himself in the secondary school, which makes the transfer from the school system with one teacher to that including more professors and disciplines, unequal in terms of importance and extension, with a large heterogeneity of the teaching staff – psychical stress generator factors.

The school pupil’s overstress in general and in special,

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the overstress recorded in the secondary school takes place during the knowledge evaluation.

The attempts made by the education establishments in order to reduce the school overstress by interposing intermediary holidays along the school year and through a permanent reorganization, still remain uncertain.

Having in view the part played by hypothalamus in stress pathogeny and in thermoregulation, I had in mind to supervise the part of the genetic and environmental factors in the changes of the core temperature during stress.

### MATERIAL AND METHOD

The study was carried out on a number of 203 school pupils from two secondary schools (V<sup>th</sup>-VIII<sup>th</sup> forms), of the city of Sibiu, whom I personally supervised between 2006 and 2007. The batch comprises 96 school pupils coming from the General School No. 6, having German as the teaching language, a school which is placed in the centre of the city of Sibiu, with children with high social and socio-economic status, with a stable number of school pupils and with good learning results. There is a number of 107 school pupils, coming from the General School No. 21, with Romanian as the teaching language, which is also placed in the centre of the town, but with school pupils coming from families with less favoured economic situation and with a more reduced interest towards the training requirements regarding their own children.

The study was approved by the Schools Ethical Committee and took place after having obtained the parents' consent regarding the participation of their own children in the study.

The individual study was accomplished based on an individual questionnaire including the identification data, school, form, domicile, age, parents' profession and age, age and number of brothers, the age at which the school pupils went to school and timetable.

I have duplicatedly measured the ear drum temperature as the core temperature, as it is considered an index of the hypothalamus temperature, being more reliable than the axial temperature and it is not exposed to the fluctuations of the environment temperature.

The ear drum temperature was measured using a digital thermistor thermometer (Metron DP 10332) 90 seconds after its insertion into the external auditive channel and sensor application on the ear drum of the left ear.

I personally measured the ear drum temperature during a period of maximum stress, as a result of the evaluation programme tests.

The results were statistically processed, using the plurifactorial ANOVA variance analysis, the Kruskal Wallis nonparametric test and Spearman's rank correlation coefficient (12).

I considered  $p \leq 0,05$  as being statistically significant.

### RESULTS

As it has been observed, ear drum temperature presents statistically significant variances ( $p=0,001$ ) according to the form, at the beginning of the semester (13). Measuring the ear drum temperature in the conditions of maximum stress, following the evaluation tests, showed a decrease of the ear drum temperature, from  $35,674 \pm 0,038$  °C to  $35,390 \pm 0,038$  °C, with the maintenance of the variation ( $p=0,038$ ) between the school classes. The correlation between the temperature measured during the relaxation period of time and that measured in stress conditions was highly significant ( $r=0,63$ ).

#### Role of the genetic factors

The involvement of the genetic factors regarding the

impact of stress on the ear drum temperature was supervised taking into account the parents' age.

The age of the mother and of the father did not produce core or after stress variances of the ear drum temperature (Table 1.1.).

Role of the social-economic factors

The economic and social factors were analyzed based on the parents' occupation and on the number of brothers, as indicators of the financial situation of the family. The occupation of the father indicated the predominance (52,2%) of intellectuals with higher education, followed by workers (20,7%), managers (6,5%), unemployed (4,3%), pensioners or without employment, each with 1,1%, regarding the General School No. 6.

As for the General School No. 21, the fathers were mainly workers (52%), followed by intellectuals (27%), technicians (11%), managers (6%), unemployed and without occupation, each of them with 2%. The large majority (95%) of the fathers were employed in a permanent professional activity.

Ear drum core temperature did not present any variances ( $p=0,492$ ) in relation to the father's occupation, regarding the General School No. 6, while the variances of the core temperature in relation to the father's occupation are highly significant ( $p=0,005$ ) in the school pupils of the General School No. 21.

The response of the ear drum temperature to stress in the school pupils of the General School No. 6 did not present any variances ( $p=0,641$ ) in relation to the father's occupation. The variances of the ear drum temperature of the school pupils of the General School No. 21 remained significant ( $p=0,041$ ) in relation to the father's occupation.

The occupation of the mothers indicated a permanent source of income in 88,7% of the families of the school pupils of both schools. The core temperature did not record any variances in relation to the mothers' occupation in both schools, the decrease of the ear drum temperature as a result of the stress arising from the evaluation tests proved the presence of significant variances ( $p=0,01$ ) in relation to the mother's occupation, only at the General School No. 6.

The number of brothers did not produce any variances of the basal core temperature ( $p=0,477$ ) or after stress conditions ( $p=0,365$ ), most of the school pupils (89,6%) were single or had only one brother.

Regarding the social factors, I analysed the influence of the hours spent for offering help in different activities developed at home, watching TV, sports and going to discotheque.

The help given for the development of different domestic activities at home lasted from 30 minutes up to 6 hours and it was encountered in 92% of the children, out of which, the majority, that is 85,6% assigned 1-2 hours for such activities. The core ear drum temperature and the temperature after stress was not influenced by the number of hours spent for domestic activities. The number of hours spent for domestic activities did not produce any variations of the core or after stress ear drum temperature, in relation to the school form.

Sports' practising outside the school hours was registered only in 47,8% of the school pupils, mainly in those coming from the General School No. 6. Mention must be made of the fact that none of the schools had sports profile. Sports' practicing is an important component part of lifestyle, both in children and in adults. It has been observed that the number of hours spent on sports practicing is relatively reduced, and this attitude may be changed through the health education of the population and of the school pupils. In this respect, web sites specially designed for this issue may be created (14).

## PUBLIC HEALTH AND MANAGEMENT

**Table no. 1. Ear drum temperature (°C), core temperature and the temperature during the knowledge evaluation, taking into account the parents' age group**

Age group	Father			Mother		
	n	BT	TS	n	BT	TS
25-29	-	-	-	1	36,0±0,0	35,9±0,0
30-34	14	35,529±0,441	35,221±0,437	29	35,634±0,495	35,179±0,513
35-39	53	35,742±0,518	35,404±0,542	74	35,631±0,540	35,345±0,554
40-44	70	35,671±0,667	35,407±0,595	59	35,668±0,672	35,434±0,617
45-49	30	35,663±0,605	35,320±0,469	28	35,775±0,554	35,464±0,450
50-54	16	35,719±0,421	35,462±0,606	6	35,883±0,492	35,650±0,521
55-59	5	35,660±0,503	35,4±0,469	1	35,6±0,0	35,700±0,0
60-64	1	35,7±0,0	35,5±0,0	-	-	-
<b>P</b>		<b>0,873</b>	<b>0,718</b>		<b>0,601</b>	<b>0,168</b>

*n* pupils' number who have their mother in each age group, *p* *p*-value, *BT* Basal Temperature, *TS* Temperature after stress

**Table no. 2. Core basal temperature (C) and the temperature during the evaluation period of time, according to the number of hours spent on watching TV**

TV	n	BT	TS
0	5	35,560±0,477	35,340±0,456
1	39	35,821±0,472	35,431±0,583
2	69	35,558±0,528	35,335±0,542
3	45	35,664±0,644	35,309±0,513
4	29	35,783±0,554	35,510±0,459
5	9	35,533±0,515	35,289±0,605
6	6	35,933±0,186	35,867±0,535
7	1	35,5±0,000	36,000±0,000
<b>p</b>	<b>203</b>	<b>0,199</b>	<b>0,236</b>

*TV* Number of hours spent on watching TV, *n* pupils' number, *BT* Basal Temperature, *TS* Temperature after stress, *p* *p*-value

The use of the internet in the field of health promotion is more efficient in the young people (15). Web applications may also be developed in order to assess the health status of the population, mainly influenced by lifestyle (16).

The core and after stress ear drum temperature did not present variances related to the number of sports hours in any of the schools.

Watching TV by 97,5 % of the school pupils for 1-7 hours/day did not bring about variances of the core temperature ( $p=0,199$ ) or of the temperature after stress ( $p=0,236$ ), in relation to the number of the hours spent for watching TV. The large majority (89,6%) of the school pupils of the V<sup>th</sup> and VIII<sup>th</sup> forms used to watch TV 1-4 hours per day (Table 1.2.).

Discotheques were frequented by 14,8% of the school pupils, mainly by those learning at the General School No. 6. The core and after stress ear drum temperature did not register statistical significant differences, regarding the children who frequented or not the discotheques.

### DISCUSSIONS

The analyzed genetic factor showed that the current age of the father and mother is not involved in the oscillations of the temperature after stress.

Regarding the specialized literature, I did not encounter any publication in relation to the involvement of the parents' age in thermoregulation.

Parents' occupation is an important indicator of children's life quality (17).

The psychical stress on the ear drum temperature was not influenced by the economic situation of the family, the large majority of the school pupils benefiting from the material support, as a result of the operational incomes of both parents, and by the number of brothers, which was small. Thus, the

material concerns were not stress generators. Although, it was not the case of the school pupils coming from the investigated schools, the poor economic conditions of a family (parents with low incomes, crushed by the uncertainty of tomorrow, without any continuity in their professional work or those who cannot find an employment) prove to be extremely inconvenient for the development of the child's personality and most of the times, lead to failure or even school abandon, resulting in antisocial conditions.

The analysis of the social factors proved that a large number of the school pupils in both schools assigned an important number of hours for the development of different activities in their household, for watching TV and sports practicing, what explained the late hours for going to bed at their age.

Some parents see their children as a simple support for them in the household activities. Overstressed by all sorts of domestic activities, the child does not have the necessary time to do his home works. This represents the starting point for the fear of taking low grades or for the anxiety of going to school the next day. There are also situations in which some of these children, despite the hostile conditions within the family and in their wish for studying, use for learning a part of the time which they normally should spend on sleeping. They go to school tired, are usually inattentive and are not able to concentrate and do not always use their capacity at maximum. (32, 33, 34, 35, 36)

This extracurricular activity did not influence the ear drum temperature in stress conditions, questioning the large capacity of self defence of the core temperature in stress conditions, or a higher level of the thermoregulation centres.

The relaxing role of watching TV and doing sports of their own initiative should not be forgotten (18, 19, 20).

### CONCLUSIONS

- The economic situation of the family, where both parents are working represent a protection factor of thermoregulation towards the psychical stress.
- Sports, domestic activities, watching TV represent a protection factor towards the psychical stress, if they are well-balanced.

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