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The Assessment of Occupational Stress and Quality of Life in Teachers at the 2nd Level of Elementary Schools

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Abstract of the dissertation

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Table of Content

Summary (in Czech language)

Hodnocení pracovní psychické zátěže a kvality života učitelů 2. stupně základních škol

Úvod: Problematika posuzování pracovně psychické zátěže patří ke klíčovým otázkám ochrany veřejného zdraví
Cíl: Hlavním cílem práce bylo zhodnotit pracovní psychickou zátěž u učitelů 2. stupňů základních škol (ZŠ) standardní dotazníkovou metodou s vyšetřením slinného kortizolu. Dalším záměrem bylo zhodnotit kvalitu života (KŽ) učitelů.
Metodika: Provedli jsme anonymní dotazníkové šetření (průřezová studie) u 142 učitelů 2. stupně ZŠ (sledovaný soubor) a 136 hasičů (srovnávací soubor). Míru pracovního stresu jsme hodnotili pomocí Meisterova dotazníku. Subjektivně percipovaný stres jsme následně objektivizovali stanovením slinného kortizolu. Pro posouzení kvality života jsme použili zkrácenou verzi dotazníku WHO QoL- BREF 26.
Výsledky: Naše šetření prokázalo, že učitelé vnímají míru pracovní psychické zátěže hůře než hasiči. Provedená klasifikace psychické zátěže prokázala, že učitelé dosahují stupně 2 (může docházet k dočasnému ovlivnění zdraví), hasiči stupně 1. Vyšetření slinného kortizolu zcela odpovídalo výsledkům zjištěným dotazníkovou metodou. Dosažené diurnální křivky kortizolu (ranní hodnoty, večerní hodnoty, plocha pod křivkou) byly ve všech případech u učitelů signifikantně vyšší než u hasičů, což značí, že učitelé zvládají stres hůře. Kvalita života učitelů ZŠ byla ve všech čtyřech doménách statisticky významně nižší než KŽ hasičů, statisticky se však nelišila od české populační normy.
Závěr: Z naší studie vyplynulo, že učitelé patří mezi profese zvýšeně exponované pracovnímu stresu, a to se všemi negativními dopady na zdravotní stav. Šetření dále prokázalo, že v hygienické praxi standardně používaný Meisterův dotazník je dostatečně validní pro hodnocení pracovní psychické zátěže. Domníváme se však, že vyšetření slinného kortizolu by mělo být pro klasifikaci pracovního stresu využíváno častěji než dosud. Jde o objektivní indikátor reakce organismu na chronický stres, přičemž odběr vzorků slin je jednoduché neinvazivní vyšetření, které je možné provádět v průběhu sledovaného dne včetně pracovní směny. Za nezbytné ovšem považujeme vypracování referenční křivky kortizolu pro pracující českou populaci.

Summary (in English)

The assessment of occupational stress and quality of life in teachers at the 2nd level of elementary schools

Introduction: Problems of the assessment of occupational stress have belonged within one of the key issues of public health protection.
Aim: The main goal was to comprehensively assess the extent of occupational stress and quality of life of teachers at the 2nd level of elementary schools, using salivary cortisol as a possible objective marker. Another aim was to evaluate the quality of life of teachers.
Methods: We performed an anonymous survey (a cross-sectional study) in 142 teachers at the 2nd levels of elementary school (reference group) and 136 firefighters (comparison group). Rate of occupational stress was assessed by using of the Meister Questionnaire. Subjectively perceived stress was subsequently objectified by determining of salivary cortisol. For the evaluating of quality of life, we used shorter version of the questionnaire WHO QoL-BREF 26.
Results: Our investigation showed that teachers perceive the level of their occupational stress was worse than in firefighters. Completed classification of mental overload reached grade 2 (health effects may be temporary), firefighters achieved of grade 1. The examination of salivary cortisol was entirely consistent with the results observed by using questionnaires. The final diurnal cortisol curve (morning and evening values, area under the curve) were in all cases significantly higher than in firefighters, which means worse managing of stress in teachers. Quality of life in teachers in all four domains was also significantly lower than in firefighters, but not statistically different from Czech population norms.
Conclusion: Our study showed that teachers belong to professions increasingly exposed to work- related stress with all negative effects on health. The investigation also demonstrated that the hygienic standard practice used the Meister Questionnaire is sufficiently valid for the evaluation of occupational stress. We assume that examination of salivary cortisol should be for the classification of work – related stress level more common than ever. It is an objective indicator of body´s response to chronic stress, where taking of saliva samples is a non-invasive, which can be performed during all monitored day with including of the shift. However, we consider it's necessary to drawn up the reference curve of cortisol for Czech working population.

1. Background

In the European Union, work-related stress is the second most common work-related problem, after back pain. To this time, 28% of workers have been affected [1]. Stress at work can affect anyone at any level, any sector in any size of organization. People experience stress when they perceive that it is "a disbalance between the demands made on them and the resources they have available to cope with those demands". The experience of stress can alter the way a person feels, thinks and behaves. Stress becomes a risk to safety and health when it is protracted. Reactions to the same circumstances vary between individuals. Regarding coping, some people cope better with high demands than others. [2]. Research on teacher stress has become a major area of international research area. Teacher stress may be defined as the teachers' experience of unpleasant, negative emotions, such as anger, anxiety, tension, frustration, or depression, resulting from some aspects of their work as teachers [3]. According to the European Trade Union Committee for Education (2011), there exist five "top stressors", and these are workload/working intensity, role overload, increased class size per teacher, unacceptable pupil behavior, and bad school management or lack of support from management [4].

The present hygienic regulations in the Czech Republic provide a general framework for the evaluation of psychic load at work by specifying stressogenic factors. The application of questionnaires offers a possibility for the assessment of factors, which include monotony, enforced pace, time pressure or requirements in social interactions. Their advantages in the field studies embrace a rapid insight into the problem, the possibility to examine large cohort of persons and subsequent statistical evaluation [5].

Another possibility is the measure of stress response in various biological fluids. Stress exposure activates a variety of physiological coping systems including the hypothalamic- pituitary- adrenal (HPA) axis. Adrenal glucocorticoids released during stress-induced HPA activation exert profound effects on immune system [6]. Saliva has an old history of study, but its physiological importance has only been recognized recently [7]. Salivary steroids, such as cortisol, reflect a part of the free serum biologically active steroids. Salivary cortisol is recommended for routine investigation of Cushing´s syndrome and might be potential parameter for diagnosis of adrenal insufficiency [8]. Cortisol is thought to enter saliva by passive diffusion or by other means independent of an active transport mechanism [9].

Cortisol levels in saliva are partly dissociated from levels of paraventricular corticotrophin releasing factor (CRF), arginine vasopressin (AVP), adrenocorticotropic hormone (ACTH), and cortisol in blood or in urine [10].

Most studies consider salivary cortisol levels a reliable measure of HPA axis adaption to stress. Salivary cortisol measures are increasingly being incorporated into large-scale, population-based, or epidemiological research, in which participants are selected to be representative of particular communities or populations of interest [11]. Researchers are focusing on the marked diurnal rhythm in the release of cortisol, with various elements of this rhythm viewed as essential indicators of indicators of HPA axis functioning. The function of this axis is thought to require the presence of strong diurnal patterning (characterised by high levels upon waking, a substantial increase in cortisol concentration in the 30-45 minutes after awakening - cortisol awakening response CAR, and subsequent decline over the remainder of the day, reaching a low point or nadir around midnight). Deviations from the typical diurnal cycle provide valuable information regarding environmental influences on the HPA axis and the role in disease processes [12]. For example, the size of CAR has been correlated with variety a psychosocial processes and health outcomes [13]. Both, the absence of a CAR, or a typically large CAR have been found in past research to associate with negative health outcome. Flattening of the diurnal cortisol slope, indicated by a slower rate of decline in cortisol across the day, has been related to either chronic or acute stress [14] or sub-clinical disease [15].

In occupational health, salivary biomarkers offer a novel approaches in practice with potentially wide scope for application. Currently, they are beginning to be established in the assessment of occupational stress. [16].

Life expectancy and causes of death have traditionally been used as key indicators of population health. This increasing phenomenon has also highlighted the need for other measure of health; especially those that capture the quality of years lived. The World Health Organisation recognized the importance of evaluating and improving people quality of life [17]. When quality of life is considered in the context of health and disease, it is commonly referred to as health-related quality of life (HRQoL) to differentiate it from other aspects of quality of life. Since health is a multidimensional concept, HRQoL is also multidimensional and incorporates domains related to physical, mental and emotional and social functioning. Another related concept to HRQoL is well-being.

Measures of well-being typically assess the positive aspects of a person's life such as positive emotions and life satisfaction. While one or two questions related to well-being have been included on public health surveillance in the past, the use of additional and extensively tested measures that are now available can help to highlight differences between groups insufficiently examined in past [18].

2. Objectives

The primary aim:

- comprehensive evaluation of occupational stress and quality of life in chosen professions

The secondary aims:

- the assessment of occupational stress by available legislative methods
  (measured by the Meister questionnaire);

- the development of objectification method for occupational stress using salivary cortisol as an indicator of chronic stress;

- the assessment of quality of life level in relation to performed profession (measured by the questionnaire WHOQoL-BREF 26);

- the overall evaluation of achieved results and recommendations for practice.

3. Material and methodology

For the purposes of dissertation thesis, cross-sectional epidemiological study was made. Before start of collecting data, detailed reference background with similar interest was done. It was important because of initial proposal and design of prepared work.

3.1 Study population

With regard to previous works of the Department of Hygiene and Preventive Medicine (Faculty of Medicine in Hradec Králové) about socioeconomic inequalities in attitudes to own health in various professions and self-perception of own health status in teachers at all levels of schools, we chose teachers at the 2nd level of elementary schools as the main exposure group. With respect to similarity of performed occupation and inclusion between groups characterised by high exposure to mental overload, firefighters were taken into an account as the comparative group. Our participants learned about the main goal of this work during the interviews before every data collection.

The participants entered the study voluntarily and confirmed this fact by signing the informed consent. The study, with statistical analyses, ran from October 2010 until June 2013.

3.2 Questionnaires

Two sets of questionnaires were created; one version for the teachers and the other version, with minor variations, for the firefighters. After creating of the first rough version, the questionnaires were reviewed by independent people and comments were implemented.

All participants were asked to answer the questions concerning their general health status with stating the use of any drugs (in women use of contraceptives).

They were asked about information on their personal history (age, gender, residency, number of children, marital status), level of education and their position at work. Information about their self-perception of mental load was taken by the Meister questionnaire for the Evaluation of Psychic Load. . This type of investigation gives information about differences in occupational psychic load perception among workers. It consists of 10 questions divided into 3 sections (overload, monotony and non-specific stress reaction). Respondents expressed their subjective feelings in questions which were assessed by scale from 1-5; “1- no, I fully disagree”, “3- undecided, sometimes yes, sometimes no”, and “5- yes, I fully agree”. Every item has its own computed critical median.

We wanted to know about their perception of the particular profession, relationships at the workplaces, between colleagues and self- assessment of themselves as of professional workers. We also wanted to show information about their coping of stress
The last part of the questionnaire was Quality of Life WHOQoL-BREF 26. It assesses the individual perceptions in the context of culture and value systems, their personal goals, standards and concerns. This instrument comprises 26 items, which measure the following broad domains: physical health, psychic health, social relationships and environment. In our study, a shorter version was used because of its better convenience in large research studies or clinical trials. At present, Czech version of this questionnaire is available, too [19].

3.3 Collection of biological material from respondents

At first, the start-up study for obtaining important information from saliva was carried out. Ten health respondents took part in this experiment. We obtained details about time of sampling, collecting material, transport of material to laboratory, required volume of saliva and storage temperature.
In accordance to results of this experiment, a pilot study in real conditions was carried out. The main goal was to find out a suitable method for processing of samples and verification of questionnaires. After the overall evaluation, we decided to use the competitive radioimmunoanalysis (the RIA method) instead of the high performance liquid chromatography (the results have been not available to this time). Time of sampling and the content of questionnaire stayed in original version. The third and the last phase of study was the main epidemiological study. Participants of every group were informed of the main purpose of this study. Subsequently, they received instructions on how to perform saliva collection. In addition, they were given a sampling schedule. Further, the respondents were asked not to brush their teeth before collecting the first sample in the morning, not to perform physical activity during the collection, not to smoke, use a chewing gum or consume alcohol. Rinsing of teeth with pure water to remove food residues during the sampling period was allowed. Salivette Cortisol Tubes (Sarstedt, Germany) were used for saliva collection mentioned above. In the teachers, a decision about five samples was made (30 minutes after awaking at 7 a.m.; at 11 a.m.; at 15 p.m.; and at 10 p.m.). They were asked to do the collection during their busiest day. In firefighters, collecting was carried out on a day without real emergencies (impossible to provide).

Upon completion, saliva samples were centrifuged and stored at -20° C until analysis. Salivary cortisol (nmol/l) was measured by radioimmunoanalysis with radio ligand I^{125} (a commercial kit Spectria Cortisol radioimmunoassay (RIA) (Orion Diagnostica, Espoo, Finland). The processed samples were measured by a gamma counter (Berthold Company, Bad Wildbad Germany). The measurements were done by the Department of Steroids and Proteofactors of the Institute of Endocrinology in Prague, Czech Republic, in the certified laboratory. The results for internal controls (low, medium and high) were also included in the assay.

3.4 Statistical analysis

The statistical analyses of obtained data were performed at the international workplace (Department of Occupational and Environmental Medicine; University of Gothenburg, the Sahlgrenska Academy, Sweden) by the statistical software IBM SPSS Statistic version 20 (SPSS Inc., Chicago USA). Means and standard deviation (SD) were used in descriptive statistics. Mann Whitney testing was used for purposes of comparisons between two groups, chi-square test in contingency tables for qualitative data, Fisher test for small number of respondents and Kruskal-Wallis analysis of variance was used for multiple comparisons.

In all analyses, cortisol values were transformed using the natural logarithm (ln) due to skewed data. The results are also presented as back-transformed values. Diurnal cortisol level (slope) was measured as the difference between morning and evening saliva cortisol. The ratio, the relative counterpart of the slope, was defined as the ratio between evening and morning values. Area under the curve with respect to ground and AUC_i were calculated according to Pruessner et al. [20]. Population intervals were calculated as mean ± 1.96 SD. These intervals were then transformed into nmol/l values. Confidence intervals were calculated as mean ± 1.96 SEM. These intervals were then transformed into nmol/l. To analyze occupational differences, regression analysis was performed, with post hoc tests for group comparisons. The outcome was Ln-transformed cortisol values. Explanatory variables were occupational group and gender (three categories: female teachers, male teachers, and male firefighters), age, physical activity, and smoking habits. All tests were two-sided and statistical significance was set at $p<0.05$.

Assessment of possible confounders

General information as gender, age, place of residence, marital status, educational level, and years of work experience, were obtained from the questionnaire. Participants were divided into two age groups: <40 years and ≥40 years.

Smokers were divided according to their smoking habits as current smokers and non-smokers. Physical activity was categorized into three subgroups, based on the question regarding level of physical activity: higher physical activity (more than 4 days/week), healthy physical activity (more than 1 and less than 4 days/week), and lower physical activity (less than 2 days/week).

4. Results

4.1 The general information about study population

The sample consisted of 142 elementary school teachers and 136 firefighters. Eight teachers were excluded from the study due to presence of contraindication (allergy treated by corticosteroids).

Group of teachers consisted of 102 women (72%) and 40 men (28%). The majority representation of women in this occupation was confirmed. With regard to age, younger respondents (< 40 years) represented larger group - 103 respondents (72.9%), compared to the group of older respondents (> 40 years) - 39 people (27.5%). The average age of women teachers was 40.63 years (95 % CI [39.8; 43.4]); men teachers were in average older than women - 45.0 years (95 % CI [41.1; 48.6]).

As we presumed, 59% of teachers had a university degree from pedagogical faculties and 37% had a university degree from other faculties.

Remaining 4% of teachers had high school education only. In a case of firefighters, this professional group consisted of men only. . Their average age was 36.23 years (95 % CI [34.84; 37.62]); it means that 93% of them were younger (< 40 years). The most of them (81%) had high school education and 19% of the respondents had university degree.

4.2 Assessment of the Meister Questionnaire in both groups

The obtained results in whole set of teachers group showed the following exceeded items: a time pressure, a responsibility, exhaustion, fatigue and decrease of long performance. In firefighters, only the median of time pressure item was exceeding.

In the age groups of teachers, statistical significance was confirmed in question 3 - "responsibility". Younger respondents better perceived their mental psychic load than older respondents (p=0.028); in question 10 - "decrease of long work performance", worse perception was confirmed in women teachers (p=0.037). The final grade of the classification for this profession was **grade 2** - possibility of regular occurrence of temporary influencing of subjective status or more precisely effectiveness (see Table 1).

Tab 1 The assessment of the Meister Questionnaire in teachers by a standard assessment method

Teachers (N=142)	**whole set**	**Women**	**Men**	**p-value**	**<40 years**	**≥ 40 years**	**p-value**	**critical value of median**
FACTOR I. OVERLOAD								
Time pressure	**3**	**3,5**	**3**	0.064	**3**	**4**	0.251	**3**
Responsibility	**3**	**3**	**3**	0.520	**3**	**3**	**0.028**	**3**
Interpersonal conflicts	2	2	2	0.429	2	2	0.137	**2,5**
FACTOR II. MONOTONY								
Dissatisfaction	2	2	2	0.094	2	2	0.089	**2,5**
Tedious work	2	1	2	0.064	2	2	0.312	**2,5**
Monotony	1	1	1	0.124	1	1	0.172	**2,5**
FACTOR III. STRESS FACTOR								
Nervousness	2,5	2	**3**	0.966	2	**3**	0.296	**3**
Exhaustion	**3**	**3**	**3**	0.386	**3**	**3**	0.116	**3**
Fatigue	**3**	**3**	**3**	0.814	**3**	**3**	0.139	**3**
Decrease of long work performance	**4**	**4**	**3**	**0.037**	**4**	**3**	0.432	**2,5**
Final degree:	**2**	**2**	**2**					

In firefighters, the only differences between age groups were in question 4 "tedious work" (p=0.040), question 7" nervousness (p=0.031) and also in question 10 "decrease of long work performance" (p=0.017).

In the process of the classification, they reached **grade 1**-level of stress, at which health influencing, subjective states and effectiveness are not likely to appear (see Table 2).

Tab 2 The assessment of the Meister Questionnaire in firefighters by a standard assessment method

Firefighters (N=136)	**whole set**	**<40 years**	**≥ 40 years**	**p-value**	**critical value of median**
FACTOR I. (OVERLOAD)					
Time pressure	**3**	**3**	**3**	0.852	**3**
Responsibility	2	2	2	0.972	**3**
Interpersonal conflicts	1	1	1	0.784	**2,5**
FACTOR II. (MONOTONY)					
Dissatisfaction	1	1	1.5	0.070	**2,5**
Tedious work	1	1	1	**0.040**	**2,5**
Monotony	1	1	1	0.658	**2,5**
FACTOR III. (STRESS FACTOR)					
Nervousness	1	1	2	**0.031**	**3**
Exhaustion	1	1	1	0.190	**3**
Fatigue	1	1	1.5	0.628	**3**
Decrease of long work performance	**1**	1	2	**0.017**	**2,5**
Final degree:	**1**	**1**	**1**		

4.3 Salivary cortisol levels

4.3.1 Occupational differences and cortisol levels in both groups

At first, the difference between professions was made. The results indicated statistical significances in all measurements of salivary cortisol. Overall, teachers had higher morning cortisol (c= 7.69 nmol/l; p=0.001) and evening salivary cortisol (c=0.27 nmol/l; p=0.001), higher hormonal output (p=0.000) and higher sensitivity to potential stressors (p=0.000).
On the contrary, firefighters showed lower value of diurnal slope (c=5.05 nmol/l) than teachers (c=6.42 nmol/l).

There is a probability of higher exposure to momentary acute stress during a working day. All respondents were in range of healthy subjects (see Table 3).

Tab 3 The average concentrations of salivary cortisol in both professional groups

	Teachers (N=142)		**Firefighters (N=136)**		
concentration (nmol/l)	**mean**	**95%CI**	**mean**	**95% CI**	**p-value**
morning cortisol samples	7.69	7.242;8.264	5.64	5.296;6.061	**0.000**
evening cortisol samples	0.27	0.187;0.386	0.18	0.126;0.265	**0.001**
diurnal slope	6.42	5.906;6.986	5.05	4.618;5.479	**0.000**
ratio	0.02	0.02;0.05	0.03	0.02;0.04	**0.010**
AUC(g)	48.42	29.341;54.434	33.44	30.938;36.161	**0.000**
AUC(i)	31.19	29.165;34.636	25.03	23.034;27.248	**0.000**

4.3.2 Salivary cortisol levels in relation to gender and age groups

A cortisol level usually decreases from the morning through the day and is at its lowest level in the evening.
In the group of teachers, the measured pattern seemed to be consistent with a normal diurnal cortisol rhythm.

Morning cortisol value was similar among women teachers (c=7.9nmol/l) and men teachers (c=8.2nmol/l). Men teachers had significantly higher evening cortisol levels (c=0.5 nmol/l) compared to women teachers (c=0.2 nmol/l).
Diurnal cortisol levels in absolute values were close to equal in male (c=6.6 nmol/l) and women teachers (c= 6.4 nmol/l).
The relative diurnal change- ratio was 0.02nmol/l for women teachers, which was significantly lower than the ratio for male teachers 0.05 nmol/l.

The total daytime output of cortisol seemed to be higher for male teachers compared to women teachers, but no statistically significant, while the daytime measured by AUC_i was much closed comparing male and women teachers.
When we took to an account age groups, higher cortisol levels were recorded in older men and women compared to younger subjects.

4.3.3 Salivary cortisol levels and items of the Meister Questionnaire

For better comparison, the answers of the Meister Questionnaire were divided into the three groups: "no, I disagree with occupational stress"; "yes, I agree with occupational stress" and "undecided answer". Each of these groups was subsequently divided into three subgroups: "rough or unadjusted results"; "adjusted by confounding factors" and "the undecided respondents". Because of large dimension of results, only the statistically significant data were presented.

Factor I: Overload
Statistical differences in salivary cortisol measurements were recorded with question "responsibility" in morning cortisol (p=0.033). The result was more visible in women teachers, where the value of ratio (p=0.046) predicted higher probability of chronic stress, mainly in the answer "undecided". In firefighters, there were no significant changes.

Factor II. Monotony
In teachers, monotony did not distinctly show any significant results (neither did in gender and age groups). In firefighters, the cortisol values were significant in morning cortisol (p=0.05), diurnal cortisol slope (p=0.040), AUC_g (p=0.039) and AUC_i (p=0.007).

Factor III. Non-specific stress reaction
In the last part of questionnaire, which is interested in non-specific stress reactions, statistical significance was more reflected in question 8 - "exhaustion". There was statistical significance in most cortisol measurements: morning cortisol (p=0.003); diurnal cortisol slope (p=0.005); AUC_g (p=0.003) and AUC_i (p=0.017). With regard to gender, women teachers clearly exceeded the men teachers in evening cortisol (p=0.016), diurnal slope (p=0.016); ratio (p=0.026) and AUC_g (p=0.0105). In men teachers, differences were not recorded, just in morning cortisol (p=0.014).

In question 10 “decrease of long work performance”, only AUC_g ($p=0.001$) was significant.
In firefighters, it was without any changes in salivary cortisol concentrations.

4.4 Quality of Life Assessment

This survey was focused on level of quality of life in both professional groups. We formed a hypothesis about determination of quality of life by performed profession. In general, statistically significant differences between them were found.
Teachers showed in all domains and items of this questionnaire values statistically lower than population standard norms or worse ($p=0.001$). They assessed their “physical health, mental health, social relationships, living condition (environment) and quality of life” similarly to norms measured for the Czech population. Only in the item “satisfaction with own health” was the result worse than in a standard population ($p=0.002$).
In contrast, firefighters rated values higher than population standard norms or better than population norms. From this fact, we can state disproval of our hypothesis.
Regarding the gender and age divergence, the whole set of our respondents was monitored. In addition, the impact of negatively perceived occupational stress on their quality of life was taken into account.
Combination of profession, age and gender was obviously statistically significant in all domains and items. Men (especially firefighters), reached better results ($p=0.001$) than women or older men teachers. The influence of negatively perceived occupational stress was recorded just in teachers. In firefighters who negatively perceived work stress, better results than in the standard population were demonstrated.

The results in particular domains, according to subjective statements, were mentioned, too.

I. domain- physical health
Our respondents view their physical health more or less as good or very good. Teachers more complained about “pain” ($p=0.001$), “impaired mobility” ($p=0.001$) and more “need for medical care” ($p=0.001$). Firefighters had more of sufficient “energy” than teachers did (31% to 7%); perfect activities of daily living ($p=0.001$) and better satisfaction with work performance ($p=0.001$) and quality of sleep ($p=0.003$).

II. domain- mental health

Firefighters reported better assessment of mental health and greater "enjoyment of life" - 48% than teachers did - 18 %(p=0.001). The questions about "learning thinking, memory and concentration" together with bigger "self-esteem" and "identity", firefighters were more satisfied (p=0.001).

On the opposite side, teachers experienced more "negative feelings" such as depressions, anxiety, blue mood and despair (p=0.001).

III. domain- social relations

The achieved results pointed to better evaluation of satisfaction with "personal relationships" in firefighters - 30% in comparison with teachers – only 10% were very satisfied (p=0.001); "sexual life "- very satisfied 39% of firefighters and only 14% of teachers (p=0.001).

IV. domain- environment

In this section, in majority of the items, dealing with living conditions, statistical significances were observed. In studied groups, 9% of firefighters and 3% of teachers (p=0.001) are completely satisfied with "financial situation". With "attending hobbies, conditions of living place and access to health services" (p=0.001) and transportation" (p=0.006) firefighters were more satisfied than teachers were.

I. item- quality of life

Evaluation of "quality of life" was significantly better in firefighters - 31% rated as very good and 60% as good. Teachers rated this item worse - 11% as very good and 53% as good (p=0.001).

II. item- satisfaction with health

Teachers were less satisfied with their health - 10% were dissatisfied, 32% were moderately satisfied and 3% were very satisfied.

Firefighters had better results - 61% were satisfied and 25% very satisfied (p=0.001).

5. Discussion

This dissertation was interested in the assessment of teachers at the 2nd level of elementary schools. In accordance with the studies performed by many researchers (also by our department), this profession is classified in category of occupations with increased occupational psychic load perception.

The first part of study was about subjective perception of psychic overload. It was assessed by the Meister Questionnaire, which is main screening legislative tool of public health in our conditions. As we found out, the whole set of 142 participated teachers reported exceeded critical medians in items of time pressure, burdening responsibility, signs of fatigue, exhaustion and decrease of long-term work performance. Women teachers and respondents older than 40 years had worse balance in negative subjective perception of responsibility and decreasing efficiency. In men teachers, we recorded higher nervousness. Their final classification was on grade two, which means temporary influence of their subjective status.

The study of Žídková et al. (2003) about psychic load in teachers at elementary schools showed the results very similar to results of ours [21]. The comprehensive study provided by Hodačová et al. (2007) with 123 elementary school teachers states that they complained mainly about fatigue and feeling that it is impossible do this profession for a long time (elementary and secondary schools). Also, women teachers had worse results compared to men teachers in items of overload and non-specific stress reactions [22]. In another study focused on exposure to health risk factors and its perception by teachers, occupational stress was the second most negatively perceived factor [23]. In firefighters, the results of this assessment were better than in teachers. This phenomenon could be explained by very strict selection of individuals for work performance, after check-up by deep screening of health ability, including very detailed evaluation of their mental health. These requirements are defined in detail by the Regulation No. 487/ 2004 of the Low Digest, where there is description of personal capabilities for providing of these services.

In salivary cortisol concentrations, teachers and firefighters reached morning and evening values within normal range. However, individual range between these two professions was quite large. Among teachers, the morning salivary cortisol levels were on similar line between both genders. Overall, men teachers showed higher levels and had higher levels during the whole working day than women teachers.

It indicated flattening on their diurnal cortisol slope and smaller relative slope. These findings corresponded with the results of Steptoe et al. (2000).
His observations of total daytime output of cortisol tended to be higher in men teachers in comparison with women teachers [24]. From physiological side, slightly increased levels might reflect of heightened responsibility of hypothalamus - pituitary axis to acute challenge in men teachers. It is possible that they explicate confrontations with some situations in a different way than women teachers. This fact was observed by Kirschbaum et al. (1999), where elevated adrenocorticotropic hormone together with a stronger response to more stressful stimuli was suggested compared to women [25]. According to salivary cortisol levels, men teachers seemed to be more affected by stress than firefighters. Some inconsistencies due to inability to depict real occupational stress at a group level in teachers could be explained by very low concentrations of salivary cortisol, while the individual variations may show higher values [26].

Simple morning value of cortisol is described as a good predictor of unbalanced or pathologies [27]. In the presented study, teachers had morning concentrations of cortisol c= 8, 0 nmol/ l. In the comparison with other studies, the measured concentrations are different. For instance, Masilamani et al. (2012) reported a concentration c=2.24 nmol/l in Malaysian women teachers compared to men teachers' concentration, which was estimated around 2, 64 nmol/ l [28]. In contrast, in the study of Moya- Albiol (2010), the morning cortisol values in teachers were scored to high level of burnout (c=18.92nmol/l) compared to teachers with lower level of burnout (c=3.25nmol/l) [26]. The study of Pruessner et al. (1999) observed very similar results reported in the previous study. Teachers suffering on burnout had elevated cortisol concentrations (c=15.3nmol/l) [29]. The study performed by Brandstädter et al. (1999), which was interested in socioeconomic status in teaching profession. They proved that low early morning cortisol and less marked slope to the daytime rhythm can associated with lower socioeconomic status and worse well-being. [30].
The significantly higher evening cortisol level was found in men teachers and in their age subgroups. This indication can mean that aging might be potential confounder of increased salivary cortisol levels. This argument was supported by the study of Ferrari et al. (2001) [31]. Another statement is built on assertion that these impaired levels could be a sign of reduced activity of central cholinergic and serotoninergic pathways.

Cohen et al. (2006) reported potential associations between lower socioeconomic status and potentially higher evening salivary cortisol [32].

Firefighting belongs to occupations with many variableness and character of their work performance is unpredictable [33]. In this study, these respondents had lower daytime cortisol, which is not sign of good health. The study of Perroni et al. (2009) concluded that the firefighters daily work stressors were different intensity and we could consider an adaption to stress [34].

For a better comparison with other occupations, using salivary cortisol levels, we found similar results in the study of Yang, et al. (2001). Two groups of nurses were taken into account (emergency department nurses vs. general ward nurses). They found out that emergency (ED) nurses showed higher levels of salivary cortisol than general ward (GW) nurses did. The morning salivary cortisol concentration in ED nurses was attenuated (c= 9.10 nmol) when compared to GW nurses (c=15.45 nmol/l) [35]. We can see much closer results to our reached values. Also, we can conclude the possibility of single morning salivary cortisol using the assessment of subjectively perceived occupational stress.

Another important marker is the shape of final diurnal curve. Many authors claim big difference between single morning and single evening values. Typically, normal diurnal curve is associated with large decrease and in contrast, a weakened (or flattened) curve is an indicator of lower morning values or high evening values or both. Adam and Kumari (2009) in their study state that “steeper decline of the diurnal slope expresses better health (psychosocial and physical together)” [36]. In our case, men teachers showed impaired diurnal slope in the comparison with women teachers. This conclusion can point out worse physical and psychological health in subgroup of men teachers. Flatter decline has also been shown in lower socioeconomic status groups relative to higher socioeconomic status groups. It has been suggested that chronic stress may explain this state in these individuals [38].

In firefighters, their diurnal curve seemed more attenuate. In the study of Kudielka (2006), this phenomenon could be explained by a biological view such as adaption to stress together with reduction of cortisol response. The values usually return to normal range through a homeostasis process [37].

A substantial part of this evaluation is description of hormonal output by Pruessner et al [20]. As mentioned before, greater value of area under the curve is considered a sign of worse health status [39]. Based on reached results, women teachers had smaller hormonal output and higher reactivity of daily stressors.

On the opposite side, men teachers had greater hormonal output and smaller reactivity to daily stressors.

We were wondering how performed profession might influence quality of life and whether these studied groups have differed in quality of life.
From the overall perspective, teachers definitely had significantly lower results in all domains than firefighters. The domain about "satisfaction with your health" was comparable to results mentioned before. This fact may be explained from different points of view. One of them is strictly selected group of people who want to work in the Fire and Rescue System. Simply, firefighters are selected respondents who have to be checked up physically, emotionally and mentally. In teachers, check-up of their health status for work performance is not required.
Worse perception of stress may be another factor which could decrease quality of life. Recent studies have given positive information about self- perceived stress at work in teachers. For example, Paulík (2012) obtains relative satisfaction among these workers in spite of higher level of work-related stress [40].
Age and gender have been described as important indicators of quality of life in teachers. From our results, these variables are main confounders. In one study of Yang et al. (2009) about relationship between quality of life and occupational stress among Chinese teachers, gender was found to be the most crucial factor for physical health [41].

This study has some limitations. The single measurements were taken just on one working day, which can mean limited examination and capture of real work- related stress. In the future, this collection should be enriched with one resting day in more professional groups. We selected a cross-sectional epidemiological study design, which cannot catch real causality relations and associations. One possible reason is the use of self-reported measures (questionnaires), answers of which can be influenced by subjectivity of respondents in all items and domains. All recommendations are supported by the need for performance of a large longitudinal study for investigations and understanding of individual relations.

6. Conclusions

Within the described limitations of study, conclusions were drawn:

- teachers show worse perception of mental load (proved by the Meister Questionnaire);
- the average salivary cortisol concentration are higher in teachers and it outlines higher exposition to chronic stress (even if measured concentrations are in range of normal values);
- growing tendency to flattened diurnal slope in teachers;
- higher probability of fatigue and decrease of long work performance in teachers;
- proof of the Meister Questionnaire validity by deep regression analysis;
- greater indecision in teachers (domination of answers "undecided);in all four domains: quality of life statistically lower in teachers than in firefighters (but not statistically significant difference within Czech population norms);
- negatively perceived occupational stress of teachers can decrease their quality of life (especially in the assessment of their own health);
- type of profession doesn't have a major impact on overall quality of life. Age and gender seem to be stronger determinants of QoL.

Regarding the conclusions, we recommend for consideration:

- regular monitoring of occupational stress;
- not working only with subjective feelings of workers;
- taking into account a possibility of influence of work performance by non-occupational factors;
- inclusion of salivary cortisol use within public health practise as a possible objective marker indicating mental overload;
- improvement of existing methodology for purposes of future health risk assessment;
- development of the standard curve of common population for better evaluation.

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The active conference participations

Domestic:

University of Ostrava in Ostrava, Faculty of Medicine, Department of Epidemiology and Public Health

The conference name: The Global Problems of Public Health 2011

The presented poster: Olga Šušoliaková, Markéta Papršteinová, Jindra Šmejkalová, Lenka Hodačová, Eva Čermaková: Exposure to health risk factors and its perception by teachers of various school levels.

International:

Mayo Clinic, Rochester (Minnesota, the United States)

The conference name: Summer Research Stay Conference

The presented poster: Ian Legget, Jorge Vergen, Olga Susoliakova, Xianoning Li, Michael Thompson, Y.S. Prakash: Effects of Positively- charged Gold Nanoparticles on Pseudomonas aeruginosa Biofilms