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ABSTRACT OF THE DISSERTATION

Psychophysiological Assessment of Health and Work Ability Risks in Small and Medium-Sized Businesses

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Scientific Specialty: Hygiene (including occupational, communal, school, radiation hygiene, etc.)

Varna, 2026

The dissertation comprises 186 pages and includes 68 tables and 23 figures. The reference list contains 134 sources.
The dissertation was discussed and approved for defence by the Departmental Council of the Department of Hygiene and Epidemiology at the Medical University of Varna.
The public defence of the dissertation will take place at an open session on …… before a scientific jury composed as follows:

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CONTENTS

LIST OF ABBREVIATIONS
INTRODUCTION
I. AIM, OBJECTIVES AND METHODOLOGY OF THE STUDY
1. Aim
2. Objectives
3. Working Hypothesis
4. Methodology
   4.1. Methods
   4.2. Procedure
II. RESULTS AND DISCUSSION
1. Sociodemographic and Occupational Characteristics of the Study Population
2. Working Conditions in the Study Groups
4. Assessment of Overall Work Ability
   4.1. Assessment of Work Ability According to the Nature of Work
   4.2. Daily and Weekly Dynamics of Work Ability
5. Psychological Assessment of Depression, Anxiety and Perceived Stress Using Standardised Methods
6. Assessment of Somatic Status
7. Factors Influencing Daily and Weekly Dynamics
8. Discussion
9. Study Limitations
III. CONCLUSIONS, RECOMMENDATIONS AND CONTRIBUTIONS
1. Conclusions
2. Recommendations
3. Contributions
FINAL CONCLUSION
Publications Related to the Dissertation Topic

LIST OF ABBREVIATIONS

ACTH – adrenocorticotropic hormone
AH – arterial hypertension
BP – blood pressure
BMI – body mass index
COVID-19 – coronavirus disease 2019
CRH – corticotropin-releasing hormone
CRP – C-reactive protein
EE – emotional exhaustion
ERI – effort–reward imbalance
ESENER – European Survey of Enterprises on New and Emerging Risks
FH – family history
GI – gastrointestinal
HADS – Hospital Anxiety and Depression Scale
HbA1c – glycated haemoglobin
HPA axis – hypothalamic–pituitary–adrenal axis
HDL – high-density lipoprotein
IT – information technology
IHD – ischaemic heart disease
PC – productivity coefficient
CS – corticosteroids
AC – accuracy coefficient
LDL – low-density lipoprotein
MBI – Maslach Burnout Inventory
MS – metabolic syndrome
P–E Fit – person–environment fit
PSS-10 – 10-item Perceived Stress Scale
RR – blood pressure
SAN – well-being, activity and mood
TC – total cholesterol
TG – triglycerides
WAI – Work Ability Index
WHO – World Health Organization
ANS – autonomic nervous system
GIT – gastrointestinal tract
DM – diabetes mellitus
SMEs / SMBs – small and medium-sized enterprises / small and medium-sized businesses

MSK – musculoskeletal system
Tr – tremometry
HD – hypertensive disease

INTRODUCTION

The dissertation addresses a topical issue of pronounced scientific and practical significance: the psychophysiological assessment of health and work ability risks among employees in small and medium-sized businesses during the post-COVID period. In the context of rapid technological development, digitalisation, an accelerated pace of work and increasing psychosocial demands, the assessment of mental health, functional status and work ability is becoming crucial not only for individual employees but also for organisations and public health systems.

The post-COVID period is characterised by marked changes in the working environment, social relationships and population lifestyles. The COVID-19 pandemic resulted in a sustained increase in perceived stress, anxiety, depressive symptoms, sleep disturbances and manifestations of occupational burnout. This created new requirements for occupational medicine and organisational practices aimed at preserving work ability and limiting psychophysiological risks.

Small and medium-sized enterprises are particularly vulnerable in this context. They constitute a major sector of the economy and make a substantial contribution to employment, innovation and economic resilience. At the same time, however, they often have limited resources, poorly formalised mental health policies and more restricted opportunities to implement structured interventions for stress management and burnout prevention. This highlights the need for evidence-based models for the comprehensive assessment of work ability that integrate mental, psychophysiological, cognitive and organisational indicators.

The dissertation was developed in accordance with contemporary scientific concepts of stress, mental health and occupational burnout. Its theoretical framework incorporates both classical and contemporary models of stress, including Selye's biological model, the transactional model of Lazarus and Folkman, the concept of allostasis, and current models of occupational stress such as Person-Environment Fit, Demand-Control-Support and Effort-Reward Imbalance. These models are examined in the context of the contemporary working environment and the specific characteristics of small and medium-sized enterprises in the post-COVID period.

I. AIM, OBJECTIVES AND METHODOLOGY OF THE STUDY

1. Aim of the Study

The aim of this dissertation is to conduct a psychophysiological assessment of health and work ability among employees in administrative and production units within small and medium-sized businesses and, on this basis, to propose effective work–rest schedules tailored to the lifestyle, working-environment and individual factors that influence employees' work ability.

2. Objectives of the Study

1. To investigate lifestyle factors (behavioural habits, physical activity, sleep and consumption of stimulating beverages) and working conditions that influence the work ability of employees in administrative and production units within small and medium-sized businesses.
2. To assess health status.
3. To investigate the dynamics of the work-ability curve over the working day and working week among employees in administrative and production units within small and medium-sized businesses.
4. To assess selected mental health parameters.
5. To develop effective work–rest schedules based on the findings and the nature of the work performed.

3. Working Hypothesis

The COVID-19 pandemic increased levels of occupational stress and symptoms of burnout among the working population.

In the period following the decline of the pandemic, employees in small and medium-sized businesses have an even greater need for specific measures to reduce stress levels and improve work ability.

4. Research Methodology

The study was conducted among employees of small and medium-sized enterprises, specifically those working in administrative and production units. The study population comprised a total of **314 participants** employed across various economic sectors, including administration, information technology, construction, garment manufacturing and agriculture. A range of sociodemographic characteristics were analysed, including sex, age, educational attainment, marital status, total length of employment, length of service in the current occupation and behavioural factors. Particular attention was also given to lifestyle characteristics such as smoking, alcohol consumption, insomnia, physical activity, coffee and tea intake, and the presence of

somatic diseases. The dynamics of work ability and selected mental health parameters were also analysed.

Because the study was conducted in stages across different enterprises, locations and time periods, and owing to organisational factors affecting empirical data collection, not all participants completed every instrument administered. Consequently, individual indicators were analysed using the corresponding subsamples of participants who had valid and fully completed questionnaires or tests.

Work ability was assessed using data from 224 participants with valid work-ability test results. A questionnaire on lifestyle, including harmful habits and dietary practices, was administered to all 314 participants. Mental health was assessed using standardised psychometric instruments, and the analyses included participants with fully completed questionnaires: the Hospital Anxiety and Depression Scale (HADS), 38 participants; the Zung Self-Rating Depression Scale (SDS), 79 participants; the 10-item Perceived Stress Scale (PSS-10), 73 participants; and the Maslach Burnout Inventory (MBI), 66 participants (Table 1).

Only valid and fully completed questionnaires for the respective instrument were included in the statistical analysis. Incomplete questionnaires were excluded from the analysis of the relevant indicator.

Table 1. Study Instruments

Instrument	**Total Number of Valid Questionnaires (n)**
Total sample	314
Work-ability tests	224
Questionnaire on lifestyle, harmful habits and dietary practices	314
HADS	38
Zung Self-Rating Depression Scale (SDS)	79
PSS-10	73
Maslach Burnout Inventory (MBI)	66

The study was conducted following approval granted on 10 November 2022 by the Research Ethics Committee of the Medical University "Prof. Dr. Paraskev Stoyanov" – Varna.

Inclusion criteria: current employment; provision of informed consent to participate; and availability for three measurements per day on each assessment day during the working week.

Exclusion criteria: absence of informed consent; incomplete repeated-measures data; or absence during scheduled assessments.

4.1. Methods

4.1.1. Documentary method – analysis of the scientific literature.

4.1.2. Sociological method – a structured survey comprising questions on anthropometric characteristics, occupational and working-environment factors, lifestyle, harmful habits and dietary practices, together with questionnaires assessing work ability and selected mental health parameters.

Instruments for the assessment of work ability

– **Work Ability Index (WAI) questionnaire** – provides a comprehensive self-assessment of an individual's capacity to perform occupational tasks in relation to health status and job demands.

– **Tremometry** – a method for assessing functional capacity through the graphical recording of tremor activity.

– **Proofreading test (a test of sustained attention)** – used to monitor changes in cognitive work ability at different stages of the working day and working week.

Instruments for the assessment of mental health

– **Hospital Anxiety and Depression Scale (HADS)** – a 14-item self-report psychological instrument comprising two seven-item subscales: anxiety (HADS-A) and depression (HADS-D).

– **Zung Self-Rating Depression Scale (SDS)** – a 20-item self-report questionnaire for the assessment of depressive symptoms.

– **10-item Perceived Stress Scale (PSS-10)** – a self-report measure of the level of subjectively perceived stress, i.e. how tense, overloaded or under pressure a person feels during a specified period.

– **SAN test** – a brief self-report instrument for the differentiated assessment of current functional status across three dimensions: well-being, activity and mood.

– **Maslach Burnout Inventory (MBI)** – assesses burnout across three core dimensions: emotional exhaustion, depersonalisation and reduced personal accomplishment/professional efficacy.

4.1.3. Physical examination and laboratory methods

– Preventive medical examination by an occupational medicine specialist, including occupational history, family history, clinical examination and electrocardiography.

– Laboratory assessment of haemoglobin, blood glucose and lipid profile, together with salivary cortisol and alpha-amylase.

4.1.4. Statistical methods

– **Statistical grouping of data:** variables were organised, according to their measurement characteristics, into variation, interval, categorical, ordinal and time-series distributions.

– **Descriptive statistics**

2.1. Point estimates were used to calculate arithmetic means and standard deviations for quantitative variables.

2.2. Interval estimates

a. Statistical significance was assessed at a confidence level of 0.95 (95%), corresponding to a Type I error probability of 0.05 (5%).

b. Confidence intervals (CIs) were calculated at the 95% level.

3. Graphical methods

Pie charts, exploded pie charts and bar charts were used to present the data.

4. Comparative analysis

– The independent-samples *t*-test was used to compare two independent groups; differences between proportions were assessed using the chi-square test.

– One-way analysis of variance (ANOVA) was used to identify differences between groups. Continuous variables are presented as mean ± standard deviation (SD).

– Chi-square tests were used to assess differences between groups.

5. Analysis of associations – Pearson correlation analysis was performed, with Pearson's correlation coefficient used as a measure of linear association.

Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated using logistic regression models.

4.2. Procedure

Participants were recruited through face-to-face contact during workplace meetings arranged in coordination with their employers, without disruption to the production process. Participation was entirely voluntary. The study was conducted in accordance with the ethical principles governing research involving human participants. Participants were informed about the study aims and procedures and provided written informed consent. Following the initial group assessment of work-ability levels, a preventive programme was proposed, comprising a physiologically appropriate work–rest schedule tailored to the work-ability curve and the nature of the work performed, together with group-based psychological interventions.

The study participants were allocated to two groups according to the predominant nature of their work: employees in administrative units and employees in production units. The participants were healthy volunteers - workers and employees engaged predominantly in either mental or physical work. The planned numerical ratio between the groups was 1:2. The groups were not matched for age or sex.

As part of the overall study, work ability was assessed at the following time points: at the beginning, midpoint and end of the working day on three days of the working week-Monday, Wednesday and Friday.
At each assessment time point, participants completed the proofreading test and tremometry, followed by the SAN test. The psychological scales (Zung SDS, HADS and PSS-10) and the WAI questionnaire were administered once during the study period.
All assessments were conducted in the workplace under routine working conditions.
Data were processed anonymously and reported in aggregate form.

II. RESULTS AND DISCUSSION

1. Sociodemographic and Occupational Characteristics of the Study Population

The study included a total of **314 employees** from small and medium-sized businesses, representing both administrative and production units. The group engaged predominantly in mental work comprised **216 participants**, whereas the group engaged predominantly in physical work comprised **98 participants** (Table 2). Employees from several economic sectors were represented. This broadens the analytical scope of the study by enabling not only comparisons between the two types of occupational activity but also an examination of sector-specific differences in the dynamics of work ability and mental health.

Table 2. Distribution by Type of Occupational Activity

	Number	Relative Proportion (%)	Valid Proportion (%)
Administration	74	23,6	24,6
Agriculture	18	5,7	6,7
Information Technology	123	39,2	40,2
Construction	40	12,7	13,7
Garment Manufacturing	59	18,8	19,8
TOTAL	314	100	101

The mean age of the participants was **41.9 ± 0.7 years**, indicating that the sample was representative of the active working-age population.
Additional sociodemographic indicators were analysed, including sex, age group, total length of employment, length of service in the current occupation, marital status and educational attainment. These characteristics are particularly important because substantial evidence in the literature and empirical research indicates that age,

occupational experience, sex and social context influence mental well-being, adaptive responses and work ability.

The mean total length of employment was 18.6 ± 0.7 years. The largest groups comprised participants with 5-15 years (32.0%) and 15-25 years (27.6%) of total employment. The corresponding mean values were 16.6 ± 0.9 years among participants engaged predominantly in mental work and 23.2 ± 1.4 years among those engaged predominantly in physical work.

Length of work experience in the current occupation showed the following distribution: the mean was 13.8 ± 0.7 years, with the largest group comprising participants with 5-15 years of service (25.4%). The corresponding mean values were 12.13 ± 0.9 years among participants engaged predominantly in mental work and 18.1 ± 1.4 years among those engaged predominantly in physical work.

Alongside the principal sociodemographic characteristics, a range of behavioural and health-related factors were examined, including smoking, alcohol consumption, insomnia, physical activity, consumption of caffeinated beverages and the presence of somatic diseases. The inclusion of these indicators is particularly relevant to the present study because it enables analysis of the relationships among lifestyle, somatic vulnerability, mental health and work ability. Self-reported alcohol consumption was prevalent (70.2%), although the pattern varied by beverage type: beer and wine were consumed more frequently (54.4%) than spirits (43.2%), for which abstinence predominated (56.8%). Coffee consumption was widespread (86.5% reporting “yes”), as were physical activity in the form of walking (90.1%) and organised sport (81.6%). Regarding sleep disturbances, 79.4% reported their presence, whereas 20.6% reported none. Overall, the health-behaviour profile was oriented towards higher activity and stimulant use (coffee, walking and sport), with moderate consumption of beer and wine and less frequent consumption of spirits.

2. Working Conditions in the Study Groups

With regard to overtime work, 82.2% of respondents reported that they did not work overtime, whereas 17.8% reported that they did. Perceived occupational risk was reported even less frequently: 91.5% responded “no” and 8.5% “yes”. Regarding the occurrence of errors, 70.3% denied making errors, whereas 29.7% reported that they did. Conflicts were absent according to 82.6% of respondents and present according to 17.4%. Time pressure was the most frequently reported adverse factor: 32.4% reported its presence, compared with 67.6% who reported its absence. In the “other” category, 78.7% responded “no” and 21.3% “yes”. This distribution indicates that, although most respondents did not report overtime work, occupational risk, conflicts or other difficulties, relatively substantial proportions reported errors and, in particular, time pressure. In both occupational-load groups, most participants did not report overtime

work, risk, conflicts or other difficulties. The most pronounced difference between employees engaged predominantly in mental and physical work concerned time pressure, which was reported significantly more often among those engaged in mental work, whereas the remaining indicators varied within narrower ranges (Table 3).

Table 3. Frequency of Reported Work-Related Factors by Type of Occupational Activity (chi-square: **p < 0.005, *p < 0.05)

Type of Work		Statistic	Overtime Work	Risk	Errors	Conflicts	Time Pressure	Other
Mental Work	No	N	145	161	120	138	103**	137
		%	83,8	93,1	69,4	79,8	59,5	79,2
	Yes	N	28	12	53	35	70**	36
		%	16,2	6,9	30,6	20,2	40,5	20,8
Physical Work	No	N	68	76	62	76	72**	66
		%	79,1	88,4	72,1	88,4	83,7	77,6
	Yes	N	18	10	24	10	14**	19
		%	20,9	11,6	27,9	11,6	16,3	22,4

With regard to health status (somatic diseases), the findings were as follows. In the overall study population, the highest proportions were observed for a family history of hypertension (27.4%) and a family history of diabetes mellitus (19.5%), whereas a family history of ischaemic heart disease and cerebrovascular disease was reported by approximately 11–12%. The prevalence of diagnosed conditions was lower: hypertension, 15.5%; dyslipidaemia, 9.0%; and diabetes mellitus, 6.9%.

Sex-specific analysis showed that, women reported higher proportions of a family history of hypertension and diabetes mellitus than men (32.3% vs 20.0% and 21.8% vs 16.7%, respectively), whereas the pattern was reversed for diagnosed hypertension and diabetes mellitus: men had higher proportions of hypertension (18.6% vs 12.9%) and diabetes (9.3% vs 4.8%).

Significant differences according to predominat type of occupational load were observed for and diabetes mellitus. The proportions were higher among participants engaged predominantly in physical work (hypertension, 25.0%; diabetes , 13.6%) than among those engaged predominantly in mental work (hypertension, 11.1%; diabetes, 3.7%). A family history of hypertension was likewise more prevalent among participants engaged in physical work (36.8% vs 22.3%), whereas differences in family history of ischaemic heart desease and cerebrovascular disease were more moderate.

As expected, haemoglobin (Hgb) and body mass index (BMI) values were higher among men, whereas women had lower Hgb and BMI values. Lipid profiles were comparable between the sexes, with only minor differences in total cholesterol.

3. Lifestyle Characteristics of the Study Groups

The proportion of participants who reported never engaging in sport was compared between the two principal groups defined by type of occupational activity. The percentages and the statistical significance of the difference are presented. Among participants engaged predominantly in physical work, 28.9% reported never participating in sport, compared with only 13.4% of those working at a computer screen (Pearson's chi-square = 23.371, $p < 0.001$). Thus, participants engaged in physical work were significantly more likely to report never engaging in sport. Together with the higher BMI observed in this group, this finding contributes to its adverse risk profile.

Smoking status was assessed in 257 participants and insomnia in 253 participants. The distributions were as follows: 113 participants (44.0%) reported smoking, whereas 144 (56.0%) were non-smokers. Insomnia was reported by 52 participants (20.6%), whereas 201 (79.4%) reported no insomnia. Regarding alcohol consumption, the following pattern was observed: daily use was reported by 32 participants (12.4%); consumption once or twice weekly by 77 (29.7%); occasional consumption by 73 (28.2%); and complete abstinence ("never") by 77 (29.7%). The frequencies of organised sport and walking as forms of daily activity revealed distinct physical-activity profiles within the study population. Organised sport was predominantly characterised by low or occasional participation: 43.9% reported engaging in sport rarely and 18.4% never. Moderate participation (two to three times per week) was reported by 27.8%, whereas daily participation was relatively uncommon (7.9%). Walking showed a more active pattern, with a greater concentration at higher frequencies. Daily walking was the most frequently reported category (35.3%), followed by walking two to three times per week (24.7%). Infrequent walking was reported by 30.2%, whereas the complete absence of this activity ("never") was relatively uncommon (9.8%). The prevalence of chronic diseases, risk factors for work-related psycho-emotional strain and lifestyle characteristics, together with their distribution across different levels of work ability, is presented in Figure 1.

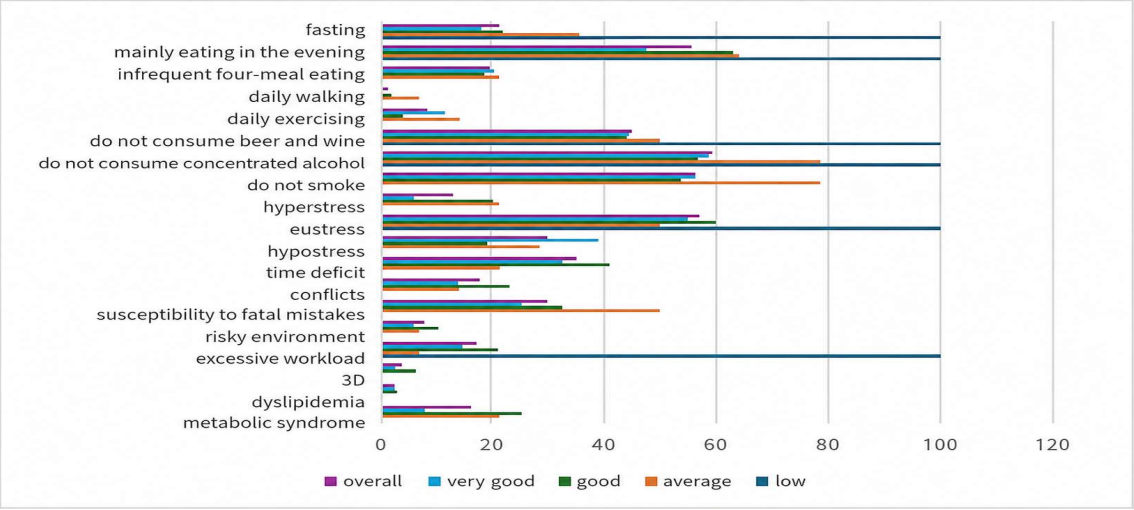

Figure 1. Chronic Diseases, Risk Factors for Psycho-Emotional Strain and Levels of Work Ability

4. Assessment of Overall Work Ability

Overall work ability was assessed using the **Work Ability Index (WAI)**. The analysis was based on valid completed questionnaires (n = 224). The distribution across categories demonstrated a clear predominance of favourable scores. Excellent work ability was observed in 50.9% of participants (n = 114), good work ability in 42.4% (n = 95), moderate work ability in 6.3% (n = 14), and poor work ability in 0.4% (n = 1). These findings indicate that overall work ability was largely preserved in the study population.

4.1. Assessment of Work Ability According to the Nature of Work

Comparative analysis by type of work revealed differences in the distribution profiles of participants engaged predominantly in mental and physical work. Poor and moderate work ability were uncommon in both groups; however, the higher categories were distributed differently. Good work ability was more frequently observed among participants engaged predominantly in physical work, whereas excellent work ability predominated among those engaged predominantly in mental work (Figure 2).

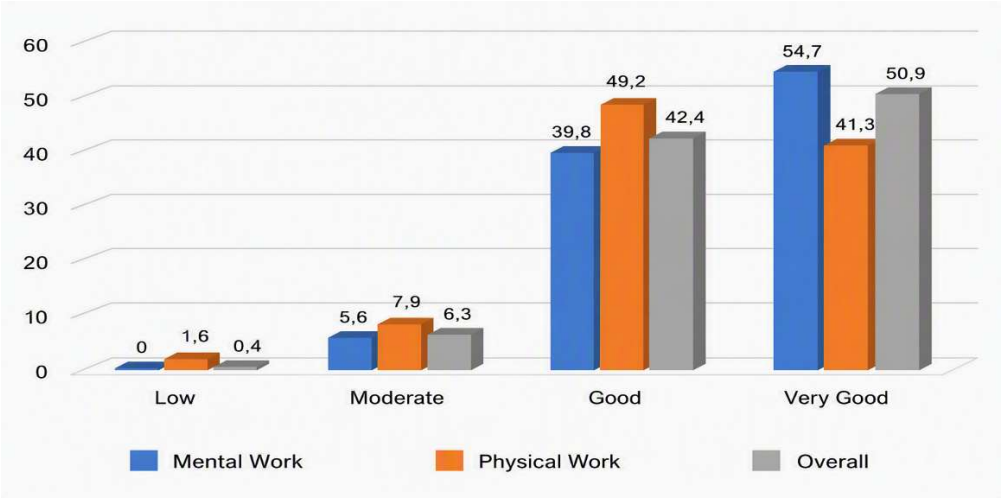

Figure 2. Levels of Work Ability among Participants Engaged in Mental and Physical Work

4.2. Daily and Weekly Dynamics of Work Ability

One of the principal emphases of the study was the assessment of work ability over the course of the working day. The main indicators derived from the proofreading test were as follows:

Accuracy coefficient (AC): the highest mean value, 0.732 ± 0.045, was recorded at the midpoint of the working day on Wednesday, i.e. in the middle of the working week.

Productivity coefficient (PC): the highest value was observed at the beginning of the working day in the middle of the working week - Wednesday morning (284.8).

The mean values of the objective AC and PC indicators over the course of the working week are presented in Table 4.

Table 4. Mean Values of Proofreading Test Indicators at the Beginning, Middle and End of the Working Week

		Proofreading test			
		Accuracy Coefficient		Productivity Coefficient	
		Mean	Standard Deviation	Mean	Standard Deviation
Beginning of the Working Week	Beginning	0,625	0,048	198,8	28,25
	Middle	0,606	0,055	226,64	33,9
	End	0,612	0,55	209,18	32,07
Middle of the Working Week	Beginning	0,728	0,043	284,82	27,65
	Middle	0,732	0,045	267,57	26,6
	End	0,709	0,045	262,86	31,2

End of the Working Week	Beginning	0,643	0,046	214,83	27,46
	Middle	0,644	0,055	258,9	34,394
	End	0,521	0,056	139,76	34,93

Comparative analysis of the results obtained at the beginning, middle and end of the working week was based on the mean values of the indicators examined and on individual variation in each participant. Only measurements for which participant-level correspondence across time points was available were included in the statistical analysis, thereby allowing paired observations to be formed.

On the basis of individual variation in the indicators, two groups were defined: participants with increased work ability and participants with reduced work ability.

The day-specific results demonstrated the following patterns:

Monday (beginning of the working week):

AC: 0.625 → 0.606 → 0.612. Accuracy remained relatively stable, with a slight decrease at midday and partial recovery by the end of the day. This suggests that the initial adaptation to work did not appreciably improve accuracy and may reflect a shift in the balance between focus and speed.

PC: 198.8 → 226.64 → 209.18. A classical speed-related adaptation pattern was observed from the beginning to the middle of the day (approximately +28 characters/min), followed by a moderate decline by the end of the day (approximately 17 characters/min relative to midday), reflecting initial activation followed by the onset of fatigue.

Wednesday (middle of the working week):

AC: 0.728 → 0.732 → 0.709. Accuracy was highest on Wednesday and remained high throughout the day, with only minimal fluctuation, indicating a plateau of optimal attention and control.

PC: 284.82 → 267.57 → 262.86. Speed was highest at the beginning of the day and subsequently declined slightly, although it remained substantially higher than on Monday and Friday. This represents the weekly peak in cognitive productivity, accompanied by mild within-day fatigue.

Friday (end of the working week):

AC: 0.643 → 0.644 → 0.521. Accuracy began at a moderate level in the morning and remained almost unchanged until midday, but declined sharply at the end of the day, indicating substantial accumulated fatigue and impaired attentional control.

PC: 214.83 → 258.90 → 139.76. Speed improved by midday, reflecting adaptation to work, but then declined markedly by the end of the day (approximately 119 characters/min relative to midday), representing the largest decrease observed during the week and a characteristic end-of-week decline.

Weekly changes in fine hand motor control are presented in Table 5.

Table 5. Weekly Tremometry Results

		Tremometry						
		Time		Errors		Coefficient		
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
Beginning of the Working Week	Beginning	51.95	20.24	13.88	10.625	0,679	0,27	
	Middle	46.53	17.49	16.38	14.04	0,617	0,26	
	End	45.25	17.27	17.65	14.72	0,808	0,41	
Middle of the Working Week	Beginning	43.83	22.08	16.33	14.2	1,584	0,587	
	Middle	42.44	21.22	18.25	13.87	0,949	0,428	
	End	41.07	19.69	18.78	14.81	1,193	0,491	
End of the Working Week	Beginning	43.48	18.45	17.2	13.55	0,726	0,414	
	Middle	41.58	18.51	19.66	14.67	0,617	0,249	
	End	40.87	17.3	18.66	14.23	1,085	0,54	

This indicator reflects the stability of fine motor control and fatigue: lower values indicate better control and less fatigue, whereas higher values indicate impaired control and greater fatigue.

The pattern followed the weekly work-ability curve: fine motor control was most stable in the middle of the week (Wednesday), with the most pronounced deterioration occurring by Friday afternoon.

Day-by-day comparison:

The lowest mean values, indicating better control, were recorded around midday on Monday and Friday (approximately 0.617); however, Wednesday showed the greatest improvement from the beginning to the middle of the day.

The least favourable values were observed at vulnerable time points, particularly at the end of Friday (1.085) and the beginning of Wednesday (1.584), indicating increased susceptibility to fine-motor errors.

In summary, the daily dynamics of cognitive-function indicators on the first day of the working week showed a tendency towards adaptation to work and increases in the accuracy and productivity coefficients from the beginning to the middle of the working day and from the beginning to the end of the working day; however, these differences were not statistically significant. AC improved by 0.02 from the beginning to the

middle of the day and by 0.016 from the beginning to the end of the first working day of the week. The corresponding improvements in PC were 46.85 and 25.75, respectively ($p > 0.05$).

For fine motor control, a comparable adaptation pattern emerged only after the middle of the working day. The group mean improved by 0.107 from the middle to the end of the working day on Monday, although this change was again not statistically significant.

The SAN test revealed a typical daily curve, characterised by adaptation to work until midday and fatigue towards the end of the day, with the most pronounced decline on Friday afternoon. Across the working week, Wednesday showed the most balanced profile, whereas Friday exhibited the greatest end-of-day decreases. Adaptation to work was most evident in well-being and mood on all three assessment days, with improvement by midday. Activity showed a less pronounced adaptation effect and a stronger end-of-day decline, particularly on Friday (4.533 → 3.855). The interval from midday to the end of Friday represented the critical period, with the largest decrease observed in activity, an indicator of energy level and work pace. Overall, Wednesday represented a plateau of stability, with a more predictable profile and higher intermediate values; Monday was characterised by initial work-related strain, reflected in a decrease in well-being by midday; and Friday reflected accumulated fatigue, particularly through the marked decline in activity. These subjective patterns were consistent with the objective findings: the largest declines on the proofreading test (PC and AC) and tremometry were likewise observed on Friday afternoon. The SAN test results are presented in Table 6.

Table 6. SAN Test Results

		SAN Test					
		Well-Being		Activity		Mood	
		Mean	SE	Mean	SE	Mean	SE
Beginning of the Working Week	Beginning	5.353	0.13	4.858	0.15	4.736	0.23
	Middle	4.992	0.19	4.896	0.21	5.233	0.16
	End	5.22	0.22	4.792	0.19	4.724	0.2
Middle of the Working Week	Beginning	4.51	0.15	4.858	0.15	4.736	0.226
	Middle	4.992	0.19	4.896	0.21	5.233	0.158
	End	5.222	0.22	4.792	0.19	4.724	0.203

End of the Working Week	Beginning	4.736	0.226	4.083	0.29	4.75	0.246
	Middle	5.233	0.15	4.533	0.22	5.22	0.207
	End	4.724	0.2	3,855	0,28	4,779	0,25

The results identified Wednesday as the most stable day, reflecting a balance among accuracy (AC), productivity (PC), fine motor control (Tr) and subjective resources (SAN). Wednesday is therefore suitable for tasks requiring both high speed and accuracy. Monday exhibited an adaptation-to-work profile, with lower work ability during the first half of the day, particularly in PC and AC, followed by partial recovery by the end of the day; this pattern supports the scheduling of planning, preparation and gradual progression to more complex tasks. The highest-risk period occurred from midday to the end of Friday, when marked declines in PC and AC, deterioration in fine motor control and reductions in subjective resources (well-being, activity and mood) were observed. Accordingly, critical operations after 15:00 should be limited, peer review and double-checking should be implemented, tasks should be divided into smaller steps, and active breaks should be mandatory.

5. Psychological Assessment of Depression, Anxiety and Perceived Stress Using Standardised Methods

5.1. Hospital Anxiety and Depression Scale (HADS)

The analysis was based on valid completed questionnaires (n = 38).

The anxiety profile (HADS-A) yielded the following results: 81.6% of participants were within the normal range (category 0), 10.5% were in the borderline range (category 1), and 7.9% were in the clinical range (category 2). A small subgroup with elevated anxiety was identified, which may influence daily stability and the end-of-week “final surge”.

The depression profile was as follows: 76.3% of participants were within the normal range (category 0), 18.4% were in the borderline range (category 1), and 5.3% were in the clinical range (category 2).

5.2. Zung Self-Rating Depression Scale

The analysis was based on valid completed questionnaires (n = 79).

The results showed that 63.3% of participants had no depressive manifestations according to the scale (level 0). Approximately one third of those assessed (30.4%) fell within the category of mild/borderline depressive symptoms (level 1), whereas a small proportion (6.3%) exhibited more pronounced symptoms (level 2). Depression severity, as determined using the Zung scale, influenced the distribution of participants demonstrating a final surge in well-being at the end of the working day on Friday. An improvement in well-being was observed in 36.4% of participants with moderate

depression and in none of those with either absent or high depression levels (chi-square = 6.446, $p < 0.05$). The same association was observed for the subjective assessment of activity at work. Activity at the end of the final working day was likewise significantly influenced by depression level. A final surge in subjectively assessed activity shortly before the end of the working day on Friday was demonstrated by 45.5% of participants with moderate depression and by none of those with low or high depression levels (chi-square = 8.442, $p < 0.05$).

Data on well-being at the end of the working week in relation to depression levels are presented in Figure 3.

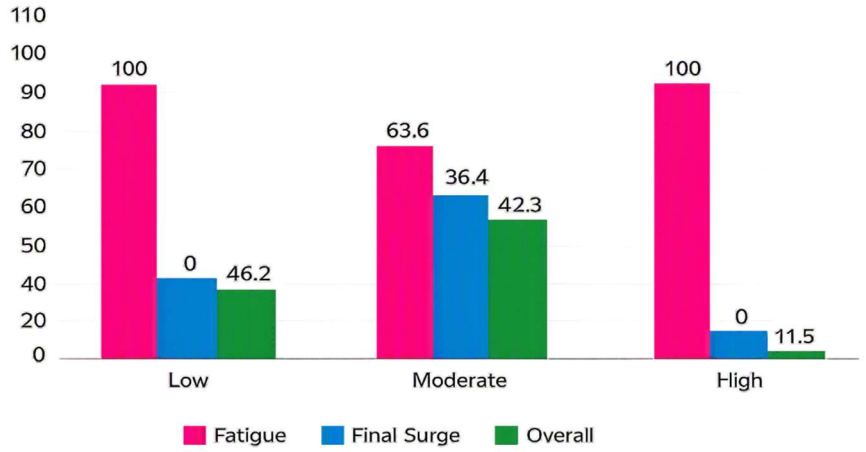

Figure 3. Distribution of Participants by Depression Level and Final Surge in Work Ability Shortly Before the End of the Working Day on Friday, Based on Workplace Well-Being

The statistically significant differences in the distribution of depression-level groups demonstrating a final surge at the end of the working day on Friday were also observed for the subjective Activity score of the SAN work-ability test and are presented in Figure 4. A final surge was observed only in 45.5% of participants with moderate-to-severe depression (chi-square = 6.446, $p < 0.05$).

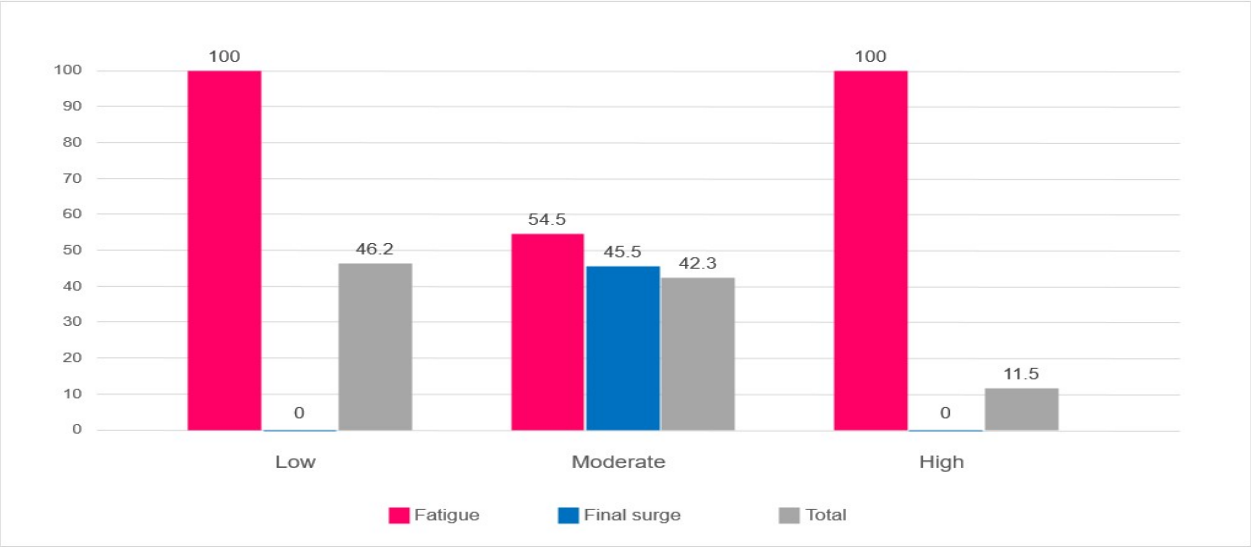

Figure 4. Distribution of Participants by Depression Level and Final Surge in Work Ability Shortly Before the End of the Working Day on Friday, Based on Workplace Activity

A more detailed analysis of Zung depression levels among participants engaged predominantly in mental work revealed the following characteristics. According to the accuracy coefficient, fatigue at the end of Monday was observed in 76.2% of participants with low depression levels, compared with 46.2% of those with moderate depression and none of those with high depression levels (chi-square = 7.793, $p < 0.05$). Preservation of work ability during the second half of the working day in the middle of the working week (Wednesday), as assessed by subjective well-being, was achieved by 33.3% of participants with no depression, compared with 77.8% of those with moderate depression and none of those with high depression levels (chi-square = 6.745, $p < 0.05$). A final surge in work ability at the end of Friday, based on the well-being score, was observed only among participants with moderate depression (36.4%). No such pattern was found among participants engaged in mental work who had either no depression or high depression levels (chi-square = 6.446, $p < 0.05$). Comparable findings were obtained for the subjective Activity scale: a final surge was observed exclusively in 66.7% of participants with moderately pronounced depression, with no such cases among those with absent or pronounced depressive symptoms (chi-square = 11.917, $p < 0.05$).

With regard to the accuracy coefficient, achievement of a final surge on Friday was significantly influenced by Zung depression-level group. Cognitive work ability at the end of both the working week and the working day, relative to the beginning of the day, was higher in 16.7% of employees without depression, compared with 80.0% of those with moderate depression and none of those with pronounced depression (chi-square = 7.584, $p < 0.05$).

In summary, depressive manifestations influenced the distribution of participants showing improved well-being on Wednesday and Friday. In the middle of the week, improvement was observed in 33.3% of participants without depression, compared with 77.8% of those with mildly pronounced depression and none of those with pronounced depression (chi-square = 6.745, $p < 0.05$). A final surge in well-being was achieved by 10.0% of employees without depression, compared with 55.6% of those with mildly pronounced depression and none of those with pronounced depressive tendencies (chi-square = 6.259, $p < 0.05$). From the middle to the end of Friday, improvement was observed only in 36.4% of employees with moderate depression and in none of those without depression or with pronounced depression (chi-square = 6.446, $p < 0.05$). Similar statistically significant effects of depressive symptoms were identified for the subjective Activity scale on Friday.

5.3. Perceived Stress Scale (PSS-10)

The analysis was based on valid completed questionnaires (n = 73).

Table 7 presents the data according to the type of work performed by the study participants.

Table 7. Distribution of Stress Levels Assessed Using the PSS-10

	Administration		Information Technology		Total	
	Number	Proportion (%)	Number	Proportion (%)	Number	Proportion (%)
Low	8	47,1	24	42,9	32	43,8
Moderate	9	52,9	31	55,4	40	54,8
High	0	0	1	1,8	1	1,4
Total	17		56		73	

The following results were obtained:

In the overall profile, 32 participants (43.8%) had low stress, 40 (54.8%) had moderate stress, and one (1.4%) had high stress. Moderate stress predominated, almost half of the participants had low stress, and high stress was uncommon. This represents a typical intermediate workload profile, with a vulnerable subgroup characterised by moderate stress that, according to the present analyses, was associated with poorer adaptation to work on Monday and more pronounced declines on Friday. These employees experienced sufficient job demands and time pressure to sustain moderate stress, but not extreme strain.

Sector-specific results were as follows. In administration (n = 17), eight participants (47.1%) had low stress and nine (52.9%) had moderate stress; no participants had high stress. Thus, low and moderate stress were distributed relatively evenly, with no cases

of high stress. This suggests a more stable environment, although more than half of the participants remained within a range that may influence adaptation to work and the Friday decline. In the information technology sector (n = 56), 24 participants (42.9%) had low stress, 31 (55.4%) had moderate stress, and only one employee (1.8%) reported high stress. The profile was similar to that observed in administration, but with a slightly larger proportion of moderate stress and isolated cases of high stress. This pattern is consistent with greater time pressure, perceived lack of time and cognitive workload in information technology.

According to stress profile (hypostress, eustress and hyperstress), the following findings were obtained in relation to work-ability levels among the study participants: Eustress showed the most favourable distribution, with high proportions of good (60.2%) and excellent (54.9%) work ability and no cases of poor work ability. Under hypostress, scores were concentrated in the excellent (38.9%) and good (19.4%) categories, with a comparatively small proportion of moderate work ability (28.6%) and no poor scores. Under hyperstress, the pattern was less favourable: excellent work ability was least frequent (6.2%), good work ability was moderate (approximately 20%), and moderate work ability accounted for a substantial proportion (approximately 21.4%); poor work ability was virtually absent. Overall, eustress accounted for the largest proportion (57.0%), followed by hypostress (29.9%) and hyperstress (13.1%). The data are presented in Figure 5.

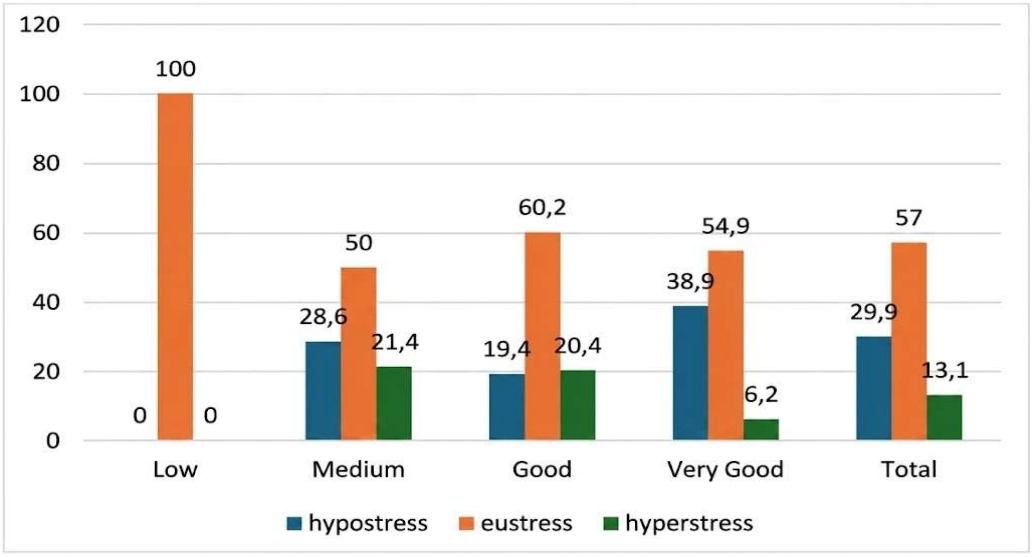

Figure 5. Relationship between Stress Levels and Work-Ability Levels

The distribution of participants by perceived stress level influenced their subjective assessment of workplace well-being. On Monday, adaptation to work and an increase in subjective well-being from the beginning to the middle of the working day were observed in 62.5% of participants with low stress, compared with 37.5% of employees with moderate stress and none of those with high perceived stress (chi-square = 7.471, $p < 0.05$). The data are presented in Figure 6.

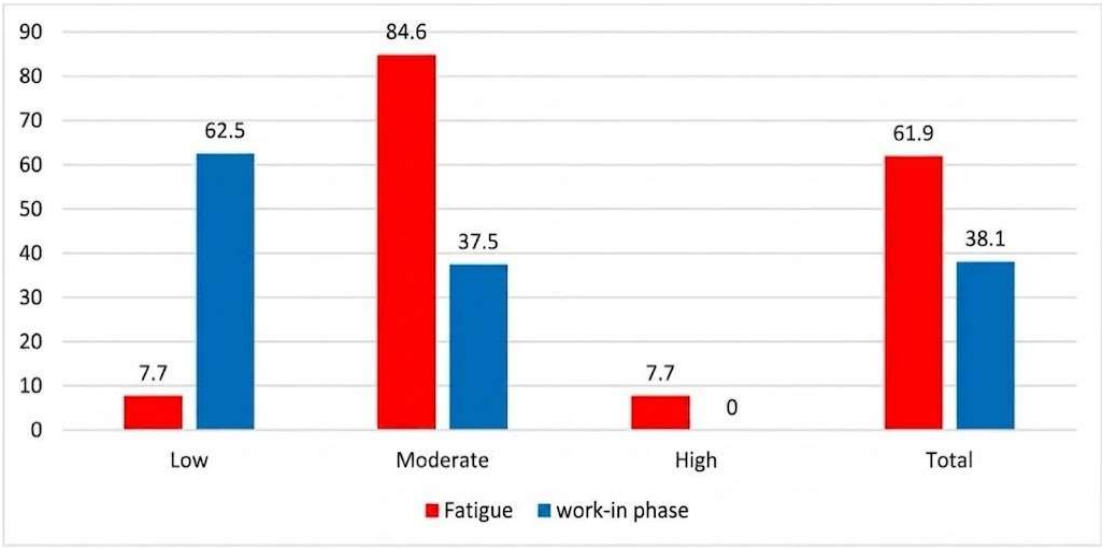

Figure 6. Distribution of Participants by Perceived Stress Level and Adaptation to Work, Based on Workplace Well-Being

5.4. Maslach Burnout Inventory (MBI): Assessment of Occupational Burnout

The analysis was based on valid completed questionnaires (n = 66).

Depersonalisation

In the sample of 66 participants, the distribution of depersonalisation scores was skewed towards low levels. Most respondents (77.3%) were classified as having low depersonalisation, indicating that this component of burnout was limited in the majority of the sample. Moderate levels were identified in 10.6% of participants, whereas high depersonalisation was observed in 12.1%. Although the distribution was predominantly concentrated in the low range, approximately one fifth of the participants, combining those with moderate and high scores, exhibited signs of depersonalisation that may be relevant to occupational functioning and well-being.

Reduced Personal Accomplishment

The distribution of reduced personal accomplishment was more even and shifted towards higher levels than that observed for depersonalisation. A low level was identified in 39.4% of participants, a moderate level in 28.8%, and a high level in 31.8%. Thus, nearly two thirds of respondents fell within the moderate-to-high range, indicating a marked presence of this component of occupational burnout. Moderate and high levels together accounted for 60.6% of the sample, with high levels alone observed in 31.8%. This profile suggests that a substantial proportion of participants experienced reduced professional efficacy and job satisfaction, representing a core dimension that increases the overall risk of burnout.

Among participants engaged in physical work, the results for reduced personal accomplishment assessed on Friday, from the beginning to the end of the working day, demonstrated a statistically significant difference between the subgroups (chi-square =

7.584, $p = 0.023$) with respect to the cancellation test. In the sample of 19 participants, low reduced personal accomplishment predominated: 63.2% were classified in the low category, 26.3% in the moderate category, and 10.5% in the high category.

Emotional Exhaustion

The emotional exhaustion dimension was also assessed. Its distribution was relatively even, with a slight predominance of low scores. Low emotional exhaustion was observed in 43.9% of participants, moderate emotional exhaustion in 30.3%, and high emotional exhaustion in 25.8%. Thus, more than half of the respondents fell within the low-to-moderate range, whereas approximately one quarter were classified in the high category, indicating a substantial subgroup at increased risk in relation to this component of burnout. From an interpretative perspective, the considerable proportion of participants with high emotional exhaustion, together with the depersonalisation and reduced personal accomplishment profiles described above, underscores the need for targeted organisational measures aimed at prevention and support.

Among participants engaged predominantly in mental work, the Mood score, assessed from the beginning to the end of the working day on Monday, differed significantly across subgroups (chi-square = 6.147, $p = 0.046$), suggesting an association between the level of emotional exhaustion and the likelihood of increased fatigue at the beginning of the working week. Of the 20 participants, 20% had low emotional exhaustion, 35% had moderate emotional exhaustion, and 45% had high emotional exhaustion. With regard to fatigue, 55% reported increased fatigue, whereas 45% reported no increase.

6. Assessment of Somatic Status

Preventive medical examinations, including electrocardiography, anthropometric assessment and laboratory investigations, were conducted in 277 participants.

The prevalence of chronic conditions, including hypertension (25.0% vs 11.1%), dyslipidaemia and type 2 diabetes mellitus, was significantly higher among participants engaged predominantly in physical work ($p < 0.05$). In contrast, perceived time pressure was substantially more common among participants engaged predominantly in mental work (40.5% vs 16.3%; $p < 0.001$). Participants engaged in physical work also reported less frequent participation in sport. The Work Ability Index was lower among individuals with chronic diseases and elevated stress levels, irrespective of the nature of their work.

Mean body mass index (BMI) was significantly higher among participants engaged in physical work than among those engaged in mental work, suggesting a greater risk of obesity in the former group. The prevalences of hypertension, dyslipidaemia and diabetes mellitus were likewise significantly higher among participants engaged in physical work ($p < 0.05$). These findings are consistent with published evidence

indicating a greater somatic risk associated with higher physical workload and less favourable health behaviours.

No statistically significant differences were observed in mean haemoglobin, blood glucose or total cholesterol levels. Triglyceride levels were significantly higher among participants engaged predominantly in physical work than among those engaged predominantly in mental work (1.36 ± 1.05 vs 0.95 ± 0.66, respectively; $p < 0.001$). Statistically significant associations were identified between work ability and the presence of arterial hypertension (Pearson's chi-square = 11.759, $p < 0.01$), as well as between work ability and subjective stress ratings on a 1-to-10 scale (Pearson's chi-square = 16.36, $p < 0.05$).

The observed levels of work ability and their association with arterial hypertension, dyslipidemia and diabetes mellitus are presented in Figure 7.

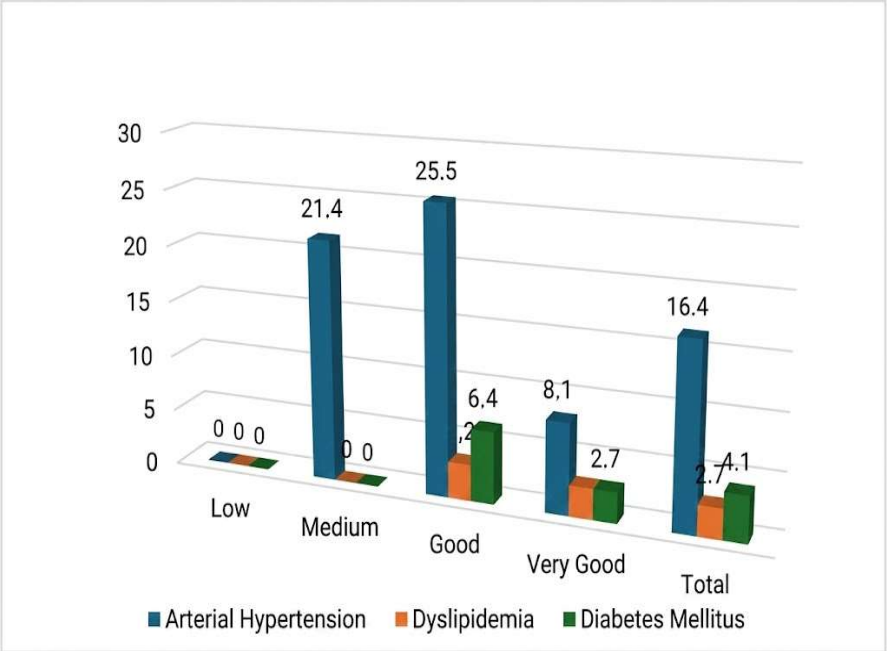

Figure 7. Association between Work-Ability Levels and Arterial Hypertension, Dyslipidemia and Diabetes mellitus

7. To identify the factors influencing the adaptation and end-spurt phases, each test was divided into short consecutive intervals comprising 5-10-minute blocks. The following measures were calculated from the proofreading test: speed, accuracy, omissions, incorrect responses, coefficient of variation, and curve slope. The following measures were derived from tremometry: mean amplitude, RMS/power, frequency spectrum, variability, and post-load change. The main dependent variables were:

Δ adaptation phase = result at the end of the first stage - result at the beginning of the first stage

Δ end spurt = result at the end of the task - result at the intermediate stage of the task

7.1. Factors Influencing "Adaptation phase" on Monday

The adaptation phase, corresponding to the "work-in phase" refers to the initial period during which the worker adapts to the demands of the task.

The analysis of factors influencing "adaptation phase" on Monday (productivity coefficient (PC), revealed a statistically significant difference between groups according to type of work (value = 5.449; p = 0.020). Of the 73 participants, 64.4% demonstrated increased work ability from the beginning to the middle of the day, whereas 35.6% demonstrated fatigue. Stratification by type of work identified distinct profiles:

Mental work: the distribution was nearly even -47.5% demonstrated fatigue and 52.5% (n = 21) demonstrated successful work adjustment.

Physical work: successful adaptation phase predominated: 78.8% demonstrated increased work ability, whereas 21.2% failed to adjust and demonstrated fatigue.

According to the productivity coefficient derived from the proofreading test test on the first day of the working week, the odds of successful work adjustment among participants engaged predominantly in physical work were 3.361 times those among participants engaged predominantly in mental work (95% CI 1.188–9.508) (Figure 8).

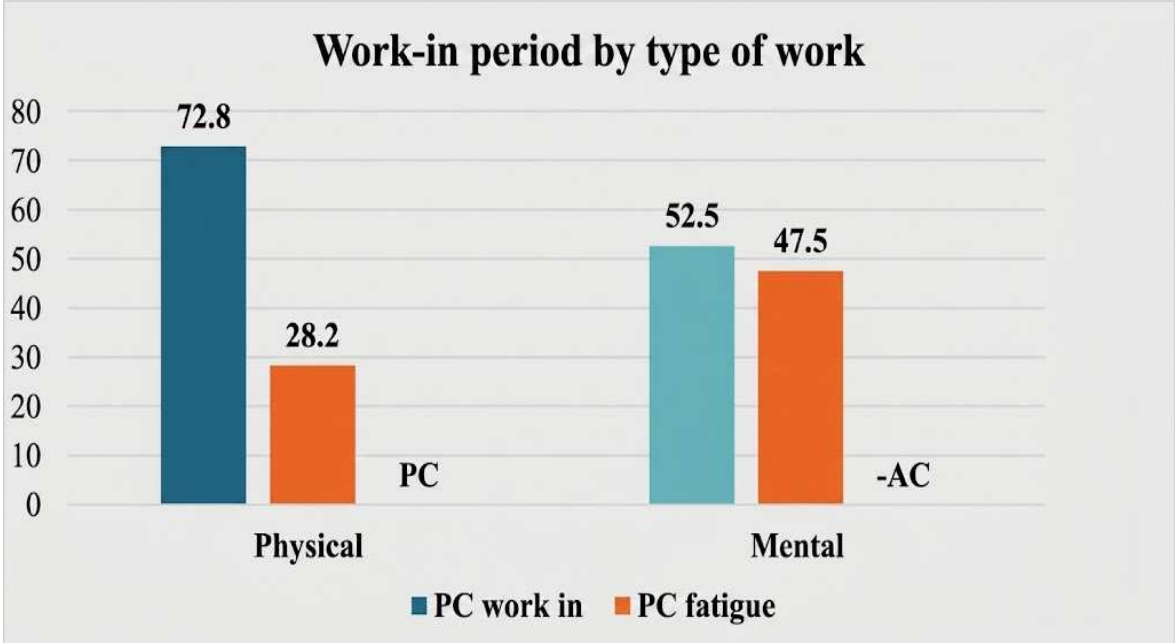

Figure 8. Adaptation phase according to PC by type of work

When analysed by **industry sector**, the distribution of fatigue according to the investigated **accuracy coefficient (AC)** on Monday (from the beginning to the middle of the day) showed different profiles in the IT sector and the garment industry (χ^2 = −4.073; p = 0.044). In the IT sector, most participants demonstrated fatigue (64.3%), whereas 35.7% demonstrated increased work ability. Among garment workers, the pattern was reversed: 60.0% demonstrated work adjustment, whereas 40.0% demonstrated fatigue. For the total sample, the proportions were nearly equal: 49.3% demonstrated fatigue and 50.7% demonstrated work adjustment. In summary, during the early part of Monday, the garment industry was characterised by a higher proportion of participants with increased work ability, whereas among IT specialists, participants demonstrating cognitive fatigue according to the accuracy coefficient predominated. (Figure 9)

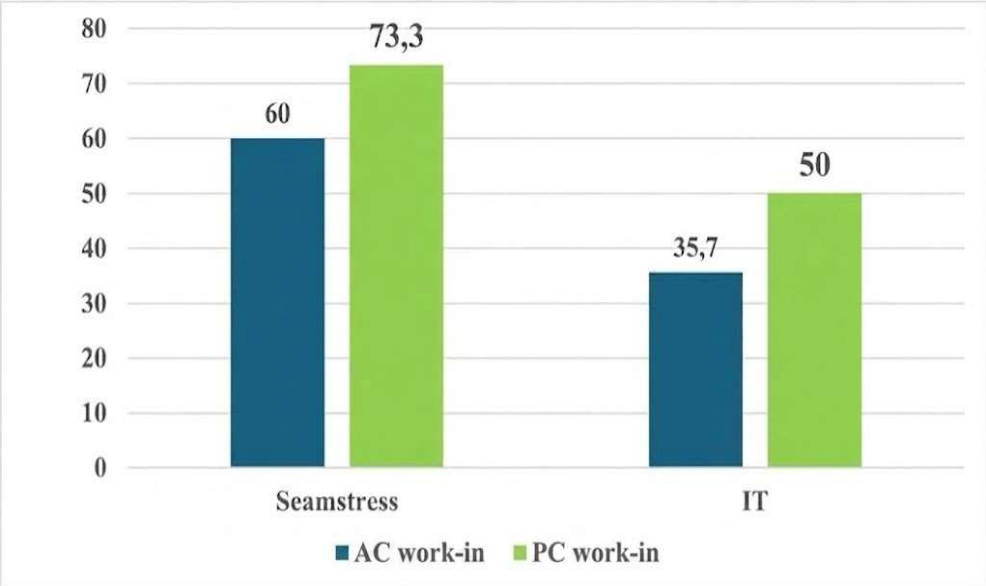

Figure 9. Work-in phase according to AC and PC by industry sector

On Monday, from the beginning to the middle of the working day, fatigue according to the **AC** showed a statistically significant association with **total work experience** (χ^2 = 11.608; p = 0.041). In the overall profile, increased work ability predominated (54.2%) over fatigue (45.8%), although the distribution varied markedly across length-of-service categories. During the early part of Monday, failure to achieve adequate work adjustment was most characteristic of participants with the shortest work experience (up to 5 years), whereas medium-to-long swork experience intervals (25-45 years) were associated with the highest proportions of increased work ability. This stepwise distribution supports the statistically established association between length of work experience and fatigue dynamics at the beginning of the working week.

On Monday, from the beginning to the middle of the working day, fatigue according to the **PC** for attention and concentration also differed by **total work experience**, with statistically significant differences (χ^2 = 16.446; p = 0.006). Employees with the

shortest work experience again began the week with the smallest group of individuals who successfully adjusted to work, whereas among employees with medium-to-long service, the likelihood of increased work ability early on Monday rose substantially (Figure 10).

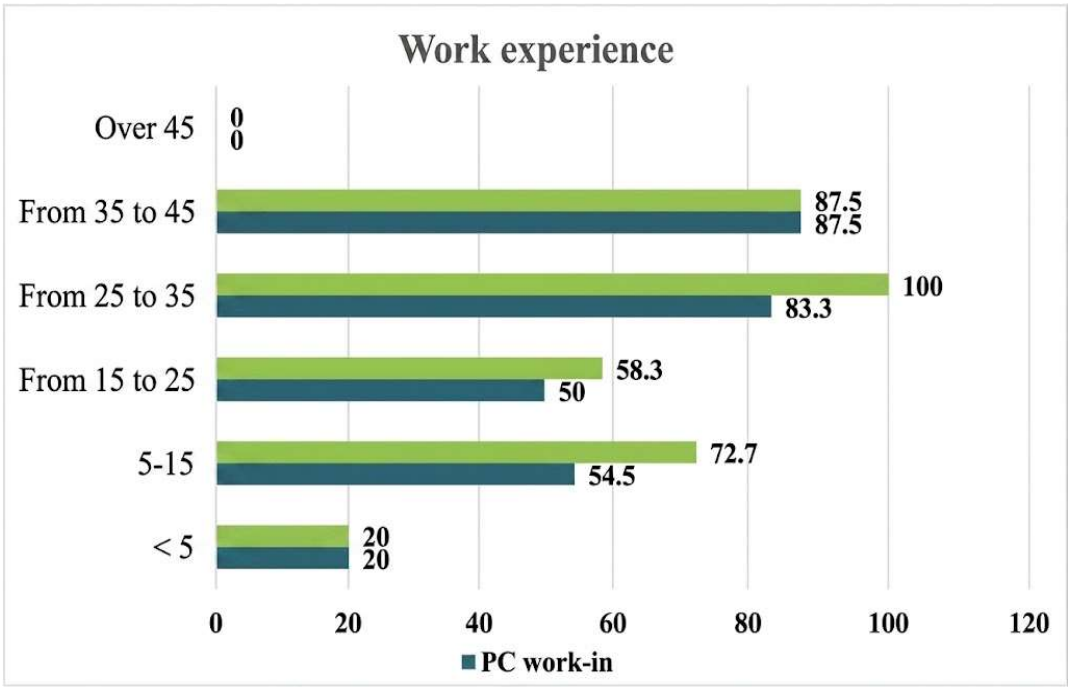

Figure 10. Distribution of participants with fatigue and increased work ability according to changes in AC on Monday from the beginning to the middle of the day, by total work experience ($\chi^2 = 16.446$; $p = 0.006$)

When mental work ability was assessed using the proofreading test on Monday (beginning-to-middle interval), fatigue was also significantly associated with **job-specific work experience** ($\chi^2 = 7.177$; $p = 0.028$). According to the **AC**, the least favourable profile was observed among specialists with up to 5 years of service: failure to adjust and fatigue evident from the beginning of the first working day of the week predominated (66.7%). In groups with longer specialised experience, the trend reversed: increased work ability predominated among those with 5-15 years of service (66.7%), and the proportion with increased work ability and adequate work-in phase further among those with more than 15 years of service (70.6%). Overall, cases of increased work ability slightly outnumbered those without it (54.2% vs 45.8%), with a clearly expressed gradient by length of work experience. On Monday, from the beginning to the middle of the day, the **PC** was also significantly associated with **job-specific work experience** ($\chi^2 = 6.48$; $p = 0.039$). Among specialists with up to 5 years of service, fatigue predominated (54.2%). In the 5-15-year group, increased work ability predominated (72.2%), and among those with more than 15 years of work experience the proportion with increased work ability was even higher (82.4%). The data are presented in Figure 11.

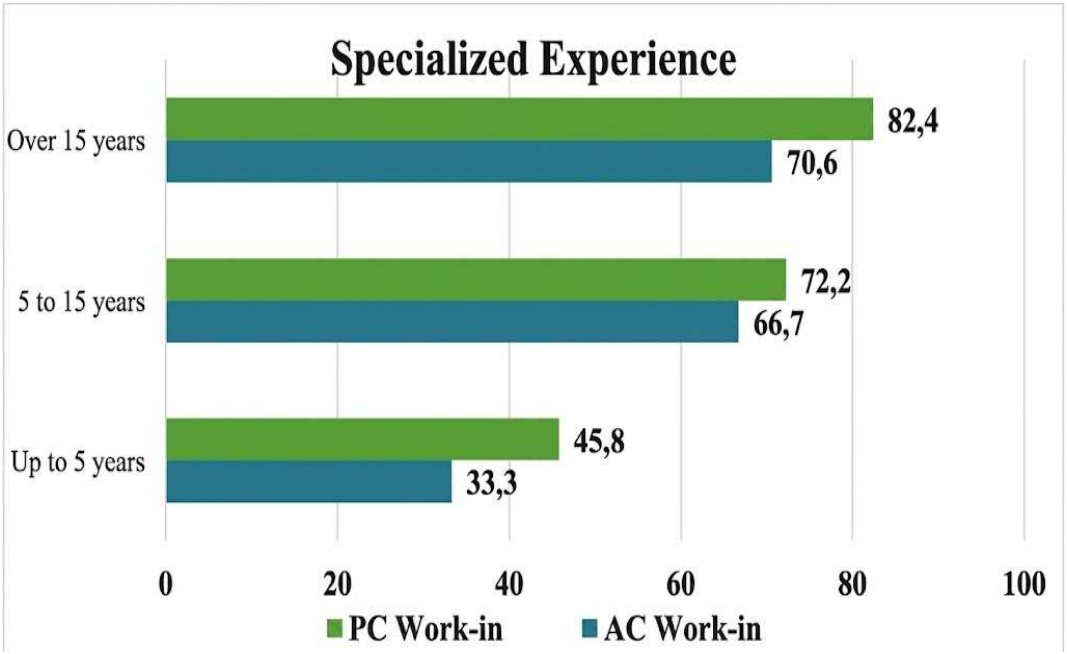

Figure 11. Distribution of participants with fatigue and increased work ability according to changes in AC and PC on Monday from the beginning to the middle of the day, by duration of specialised work experience ($\chi^2 = 7.177$; $p = 0.028$)

Regarding **physical activity and fatigue**, analysis of the AC produced the following results: daily brisk walking was associated with a lower proportion of work adjustment (28.6%) and a predominance of fatigue (71.4%). Among those walking briskly two to three times per week, the proportion with increased work ability rose to 61.5%. Among those who rarely engaged in brisk walking, fatigue was most frequent (72.2%). In the "never" group, the two outcomes were equally distributed (50% vs 50%). In summary, more regular brisk walking-especially daily walking - was associated with a lower probability of increased work ability early on Monday, whereas occasional practice coincided with the highest frequency of good work-in phase (Figure 12).

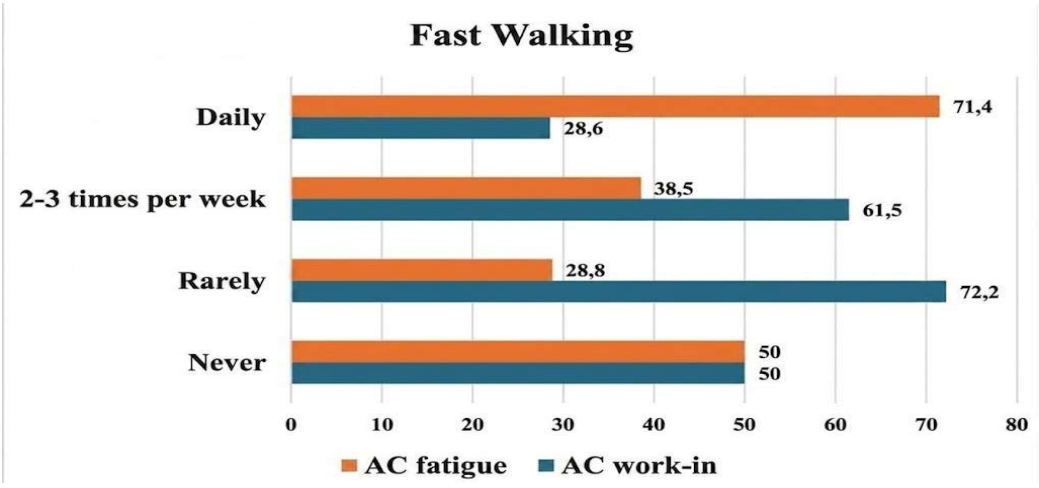

Figure 12. Distribution of participants with fatigue and increased work ability according to changes in AC on Monday from the beginning to the middle of the day, by leisure-time physical activity (brisk walking) ($\chi^2 = 9.377$; $p < 0.05$)

Data on fatigue and **insomnia** are presented in Figure 13. The subgroup profiles differed: among participants without sleep disturbances, increased work ability predominated (71.4%), whereas among participants reporting insomnia, the proportion with fatigue was higher (57.1%) than the proportion with increased work ability (42.9%).

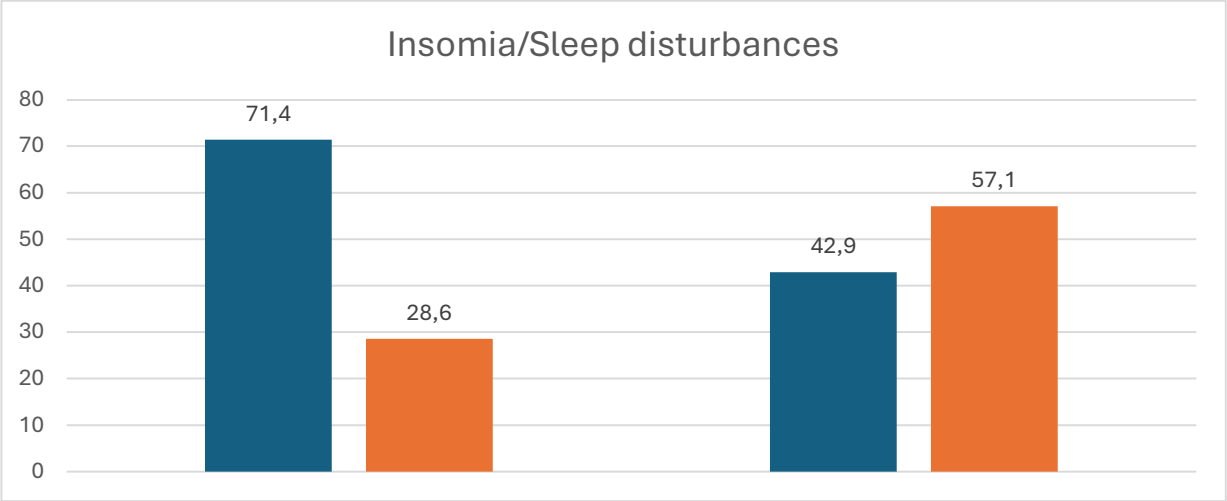

Figure 13. Distribution of participants with fatigue and increased work ability according to changes in PC on Monday from the beginning to the middle of the day, by presence or absence of insomnia ($\chi^2 = 3.911$; $p = 0.048$)

In the context of mental work, the tremometry measure recorded on Monday from the beginning to the middle of the day (Figure 14) showed a statistically significant association with **alcohol consumption** habits ($\chi^2 = 6.981$; $p = 0.03$). The proportion of participants with increased work ability was 47.9%, whereas 52.1% demonstrated fatigue.

Stratification by **alcohol consumption** revealed different fatigue profiles. Among participants who did not consume alcohol, increased work ability predominated: 41.7% demonstrated fatigue and 58.3% demonstrated work adjustment. Among those who drank occasionally, the pattern was reversed - 76.2% demonstrated fatigue, whereas 23.8% demonstrated increased work ability. In the daily-consumption group, the distribution was symmetrical: one case each of increased and reduced work ability.

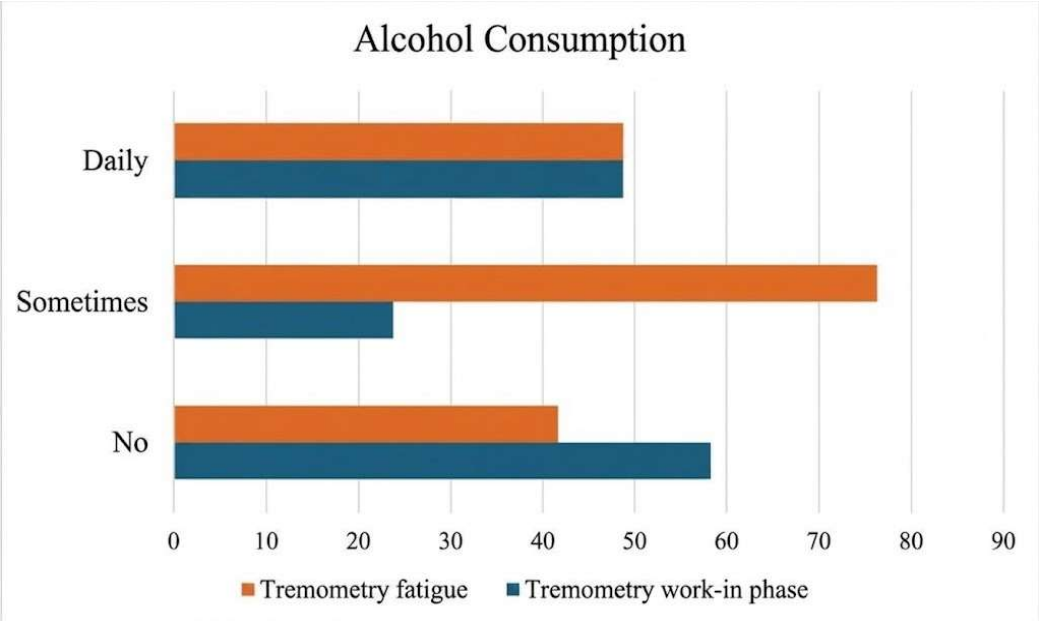

Figure 14. Distribution of participants with fatigue and increased work ability according to changes in tremometry on Monday from the beginning to the middle of the day, by alcohol consumption

Fatigue analysed by **sex** showed the following distribution: on Monday, from the beginning to the middle of the working day, fatigue according to the AC differed significantly by sex ($\chi^2 = 5.426$; $p = 0.020$). The overall pattern was slightly weighted toward increased work ability, although the profiles of men and women diverged. Among men, participants demonstrating fatigue predominated: approximately three quarters had reduced accuracy values (72.2%), whereas nearly one quarter maintained or increased their work ability (27.8%). Among women, the trend was reversed: increased work ability was more frequent (59.6%) than reduced work ability (40.4%). The data are presented in Figure 15.

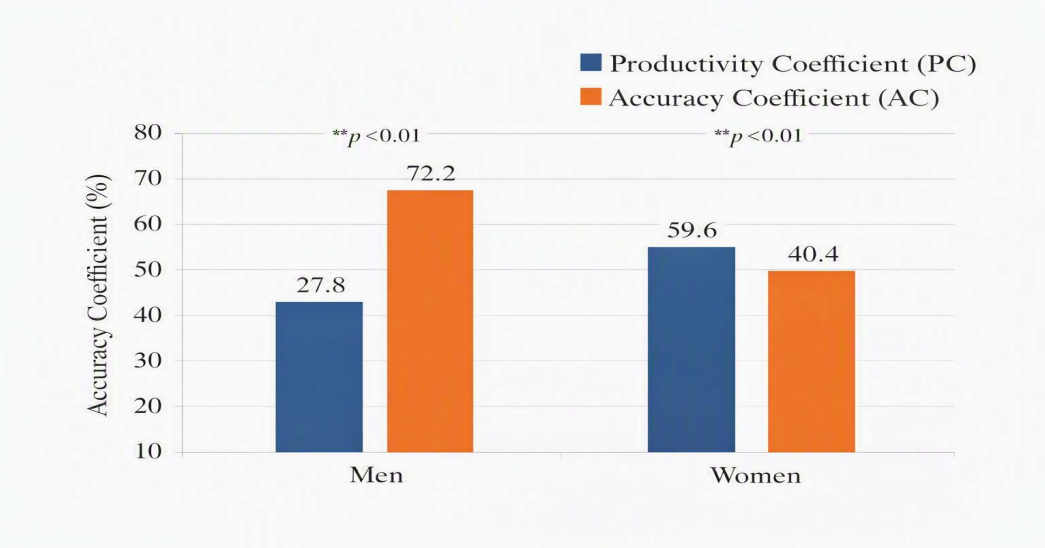

Figure 15. Distribution of participants with fatigue and increased work ability according to changes in AC on Monday from the beginning to the middle of the day, by sex ($\chi^2 = 5.426$; $p < 0.05$)

Assessment of "adaptation phase" on Monday from the beginning to the middle of the day (PC) also identified a significant association with **time pressure** ($\chi^2 = 5.853$; $p = 0.016$). Of the 63 study participants, nearly two thirds demonstrated increased work ability (65.1%), whereas one third failed to adjust (34.9%). The profile differed markedly according to perceived time pressure. Among participants who did not report time pressure, increased work ability predominated during the early part of the day: 73.9%, compared with 26.1% demonstrating fatigue. The reverse was observed among those experiencing time pressure: most demonstrated fatigue (58.8%), whereas 41.2% showed increased work ability on the tests. Working under perceived time pressure reduced the odds of successful adjustment at the beginning of the working week in terms of the productivity coefficient from attention tests (OR = 0.247; 95% CI 0.077-0.795). The data are presented in Figure 16.

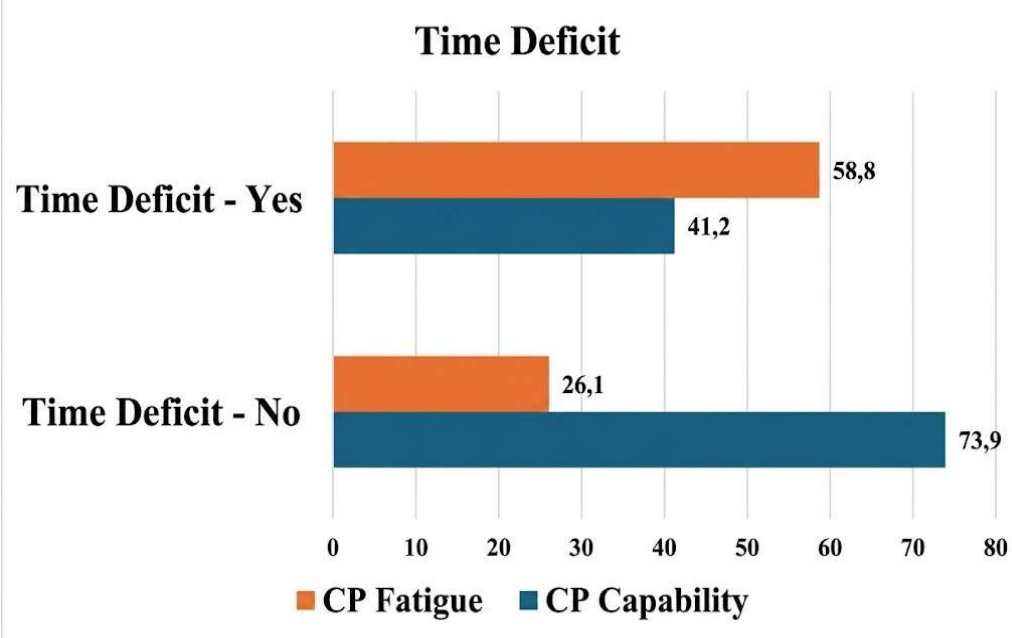

Figure 16. Distribution of participants with fatigue and increased work ability according to changes in PC on Monday from the beginning to the middle of the day, by reported time pressure during task performance

On Monday, from the beginning to the middle of the day, subjective self-assessment of well-being showed a statistically significant association with **stress level** ($\chi^2 = 7.471$; $p = 0.024$). For the **well-being** indicator, almost all respondents with low stress demonstrated increased work ability (83.3%), and fatigue occurred infrequently (16.7%). At moderate stress, the pattern reversed: participants with fatigue predominated (78.6%), whereas only 21.4% maintained or increased their work ability.

At high stress, all cases demonstrated fatigue (100%). Overall, fatigue was more common than its absence (61.9% vs 38.1%), with a clear gradient across stress levels: the higher the stress, the greater the likelihood of increased fatigue at the beginning of the week (Figure 17).

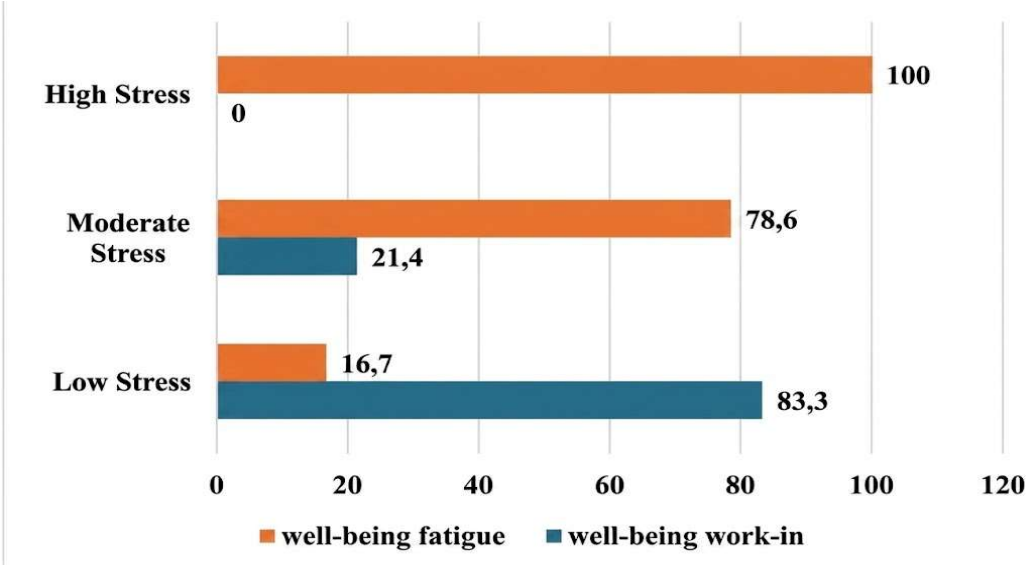

Figure 17. Distribution of participants with fatigue and increased work ability according to changes in well-being on Monday from the beginning to the middle of the day, by Work Ability Index (WAI) ($\chi^2 = 7.873$; $p = 0.020$)

On Monday, from the beginning to the middle of the day, the **activity** indicator was significantly associated with the level of work ability (WAI) ($\chi^2 = 7.873$; $p = 0.020$). At a moderate Work Ability Index (WAI), all cases demonstrated fatigue (100%). At a good WAI, failure to achieve successful work adjustment predominated (66.7%), whereas one third reported increased work ability (33.3%). The reverse pattern was observed at a very good WAI, where the proportion with increased work ability reached 100%. Overall, participants with increased fatigue predominated (56.3%) over those without increased fatigue (43.8%), and the distribution clearly differed across WAI categories (Figure 18).

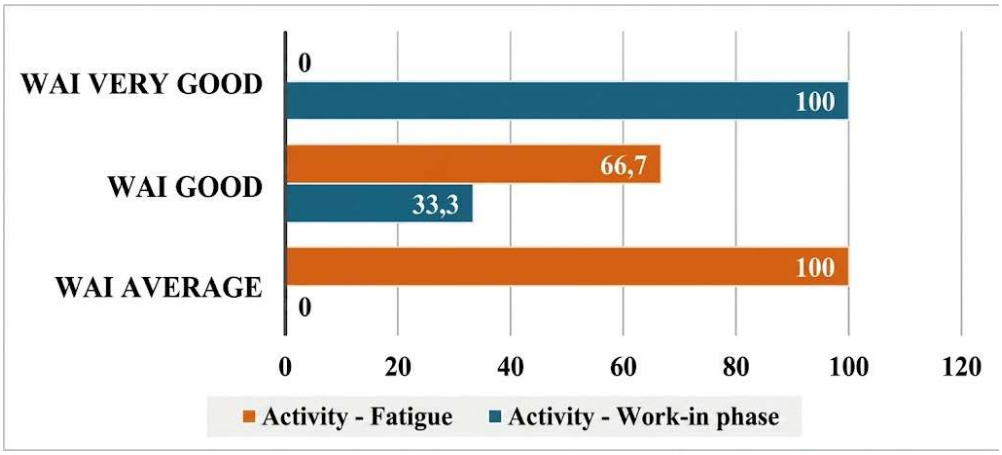

Figure 18. Distribution of participants with fatigue and increased work ability according to changes in activity on Monday from the beginning to the middle of the day, by stress level ($\chi^2 = 7.471$; $p = 0.024$)

7.2. Factors Influencing the Presence or Absence of an End Spurt on Friday

The analysis of factors influencing the occurrence of an "end spurt" on Friday, based on changes in the objective productivity coefficient (PC) derived from the cancellation test of attention concentration and presented in Figure 19, revealed a statistically significant difference between groups according to type of work (value = 5.184; p = 0.023). Of the 70 participants assessed using these indicators, 30% demonstrated increased work ability from the middle to the end of Friday, whereas 70% demonstrated fatigue. Stratification by type of work revealed distinct profiles:

Mental work: fatigue predominated - 80.5% (n = 33), whereas 19.5% (n = 8) demonstrated an end spurt.

Physical work: the distribution was almost even between the two groups: 16 participants (55.2%) demonstrated fatigue, whereas 13 workers (44.8%) achieved an end spurt and increased their work ability before the end of the final working day.

According to the productivity coefficient derived from the cancellation test on the final working day of the week, the odds of an end spurt among participants engaged predominantly in physical work were 3.352 times those among participants engaged predominantly in mental work (95% CI 1.156-9.713) (Figure 19).

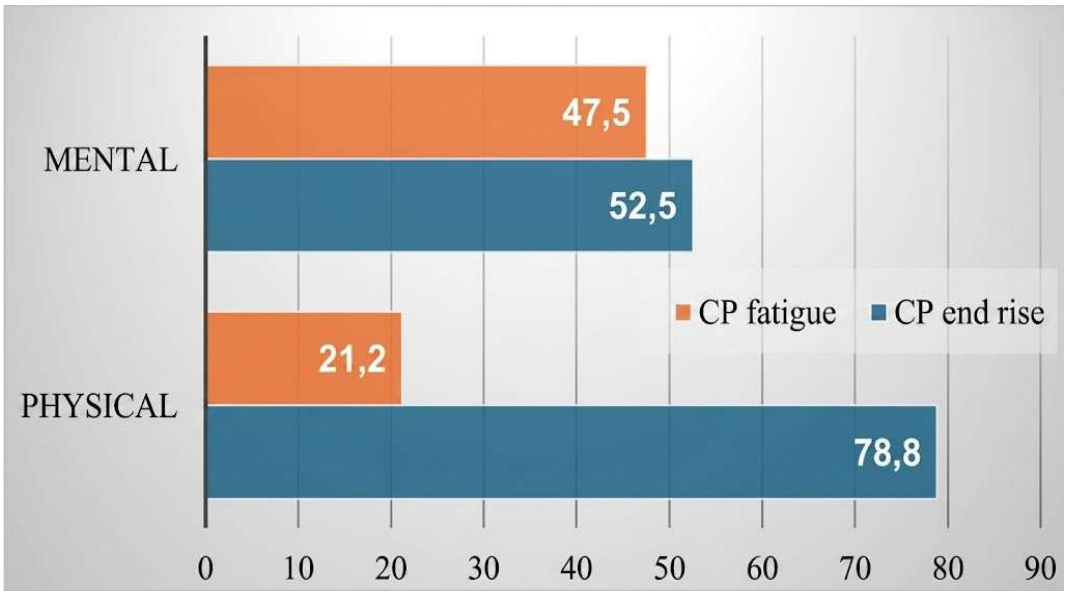

Figure 19. Distribution of participants with fatigue and increased work ability according to changes in PC on Friday from the middle to the end of the day, by type of work

On Friday, from the middle to the end of the working day, fatigue according to the **accuracy coefficient (AC)** differed significantly by **industry sector** ($\chi^2 = 8.265$; $p = 0.004$) in a subsample of N = 70. In the IT sector, fatigue predominated: 89.3% demonstrated fatigue, whereas 10.7% demonstrated increased work ability. In the garment industry, the proportion with increased work ability before the end of the working day and working week was substantially higher at 42.9%, whereas 57.1% demonstrated fatigue. The data are presented in Figure 20.

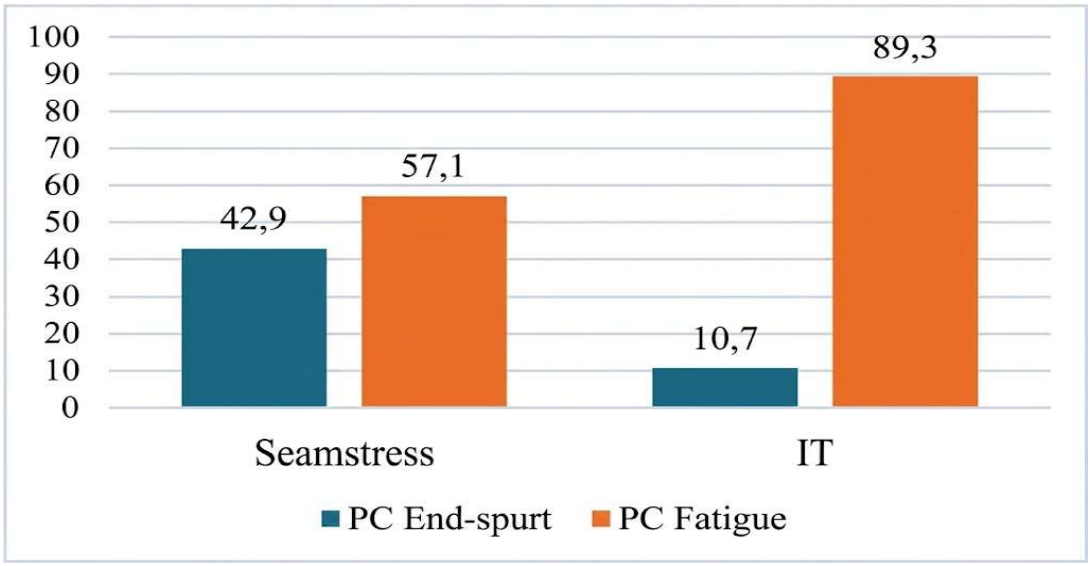

Figure 20. Distribution of participants with fatigue and increased work ability according to changes in AC on Friday from the middle to the end of the day, by industry sector ($\chi^2 = 8.265$; $p = 0.004$)

Figure 21 presents the statistically significant association between **age** and increased fatigue ($\chi^2 = 13.066$; $p = 0.023$). Overall, 29.2% demonstrated increased work ability. The distribution across age groups suggests that increased work ability peaked among participants aged 46–55 years (69.2%). The smallest group demonstrating an end spurt comprised the youngest workers, aged up to 25 years.

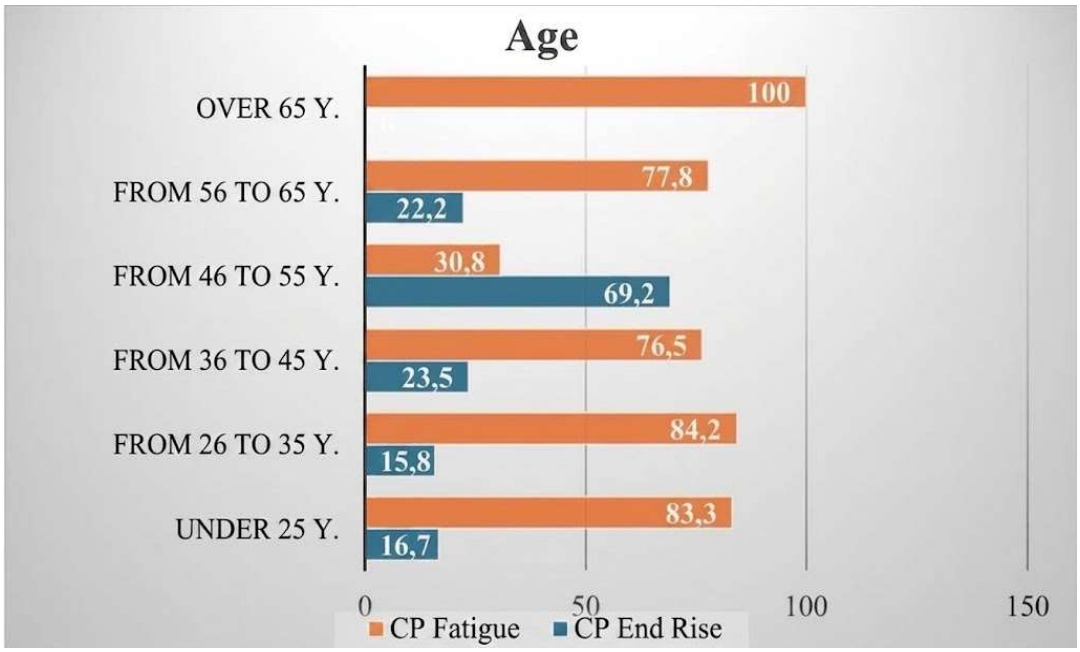

Figure 21. Distribution of participants with fatigue and increased work ability according to changes in PC on Friday from the middle to the end of the day, by age group ($\chi^2 = 13.066$; $p < 0.05$)

Figure 22 shows fatigue levels on Friday from the middle to the end of the working day according to the duration of **job-specific work experience** among 55 participants and demonstrates a statistically significant association ($\chi^2 = 7.432$; $p = 0.024$). Overall, 25.5% demonstrated increased work ability, whereas 74.5% demonstrated fatigue. A clear gradient was observed across length-of-service groups. Among employees with up to 5 years of specialised service, the proportion with increased work ability was lowest: 2 of 23 (8.7%), whereas 91.3% demonstrated fatigue. In the 5–15-year group, the proportion with increased work ability rose to 30% (6 of 20), indicating a moderate increase relative to the least experienced group. Among employees with more than 15 years of service, half of the respondents demonstrated increased work ability (6 of 12; 50%), the highest proportion across the groups. The statistical result ($p = 0.024$) supports differences among the three length-of-service categories. In practical terms, this pattern may reflect successful adaptation: prolonged exposure to stressors or age-related factors among more experienced employees may contribute to more effective coping and workload management, whereas newly appointed employees (≤5 years) may demonstrate weaker adaptation to stress, less efficient expenditure of energy, or insufficient motivation (Figure 22).

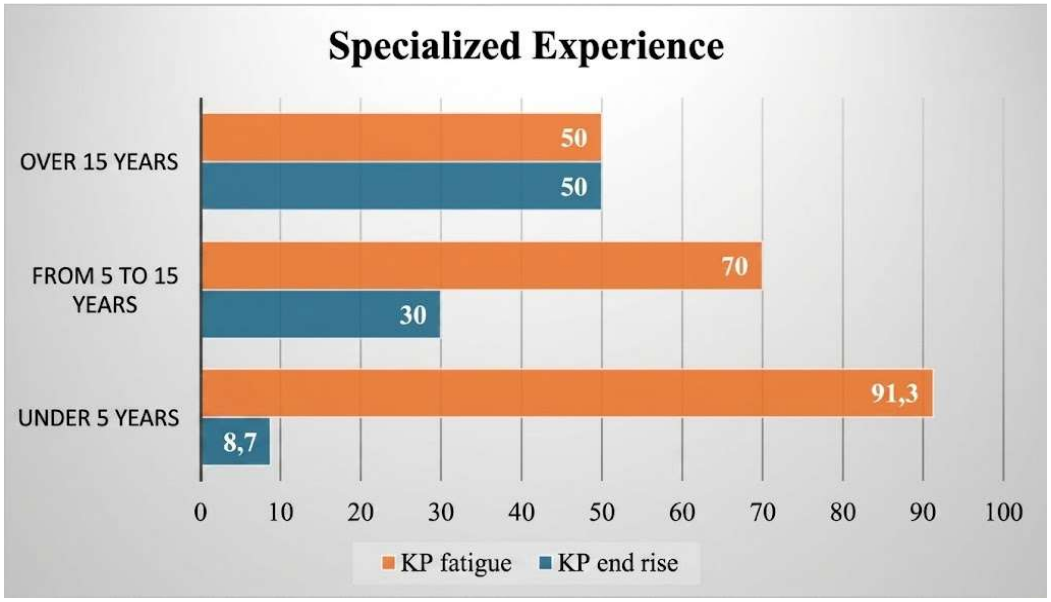

Figure 22. Distribution of participants with fatigue and increased work ability according to changes in PC on Friday from the middle to the end of the day, by duration of specialised experience

Of the predictors examined, only **time pressure** emerged as a statistically significant independent factor. For the presence of time pressure, $B = 1.453$, $p = 0.048$, $OR = 4.277$, with a 95% CI of 1.013–18.068 (Table 8). Thus, in the presence of time pressure, the odds of belonging to the category characterised by failure to adjust to work by the middle of the work shift were approximately 4.3 times higher after controlling for type of work, age, and length of service. Despite the statistical significance, the wide

confidence interval indicates limited precision of the estimate, probably also related to the relatively small sample size.

Table 8. Factors associated with impaired work adaptation phase: results of binary logistic regression analysis

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	Type of work	-1.409	.897	2.468	1	.116	.244	.042	1.418
	Age	.004	.057	.006	1	.940	1.004	.898	1.123
	Work experience	.013	.058	.053	1	.818	1.014	.904	1.137
	Time pressure	1.453	.735	3.908	1	.048	4.277	1.013	18.068
	Constant	.201	2.110	.009	1	.924	1.223		

The analysis of the end spurt at the end of the working day revealed a substantially different pattern. It may therefore be concluded that **the factor structure of workiin phase and that of the end spurt are not identical**.

8. Discussion

The results delineate clearly distinguishable risk profiles by age, specialised length of service, and type of work, with marked peaks in fatigue and reductions in subjective resources during specific time windows. The statistically significant differences and correlations identified between psychosocial demands, symptoms of anxiety/depression, and work ability confirm that the pandemic environment acted as an amplifier of pre-existing risks.

Overall Work Ability

Across the objective and subjective indicators of current work ability, the results of the proofreading test, tremometry, and the SAN test outline a consistent weekly and intraday profile. In the proofreading test - accuracy coefficient (AC) and productivity coefficient (PC) - performance was most stable on Wednesday, with minimal variation between the beginning, middle, and end of the shift. On Monday, a work-in phase decline was observed during the first half of the day, followed by partial recovery by the end. The greatest instability occurred on Friday, with a sharp reduction in accuracy and pace at mid-shift and a pronounced decline toward the end of the working day,

increasing the risk of errors in tasks requiring both speed and precision. Tremometry, reflecting fine motor stability, confirmed this pattern: micromotor control was most consistent on Wednesday, whereas deterioration was recorded on Friday afternoon, with greater tremor and fatigability limiting the reliability of precision operations. The subjective SAN indicators - well-being, activity, and mood - also converged with the objective measures: activity and mood declined most markedly at mid-shift and remained reduced through the end of Friday, while well-being decreased precisely during the time windows in which AC/PC and tremometric performance worsened. The literature supports this pattern. Chronobiological and ergonomic studies describe more stable cognitive performance in the middle of the week, a work-adjustment effect at its beginning, and convergent declines at its end. Contemporary occupational stress models - the Demand-Control-Support and Effort-Reward Imbalance models and reviews of the WAI similarly predict greater vulnerability under high work pace and time pressure during late time windows, with tasks requiring accuracy best scheduled for morning periods in the middle of the week.

Combining objective and subjective indicators to examine changes in work ability - PC/AC (speed/accuracy), tremometry (fine motor function), and SAN (subjective functional state) makes it possible to validate subjective complaints against functional measures and to identify critical time windows, such as afternoon declines and Friday afternoon.

The results concerning the use of these indicators to construct daily and weekly work-ability curves for different types of work indicate that the methodology should be refined according to the characteristics of working conditions, lifestyle, and the physical and mental health of employees.

The proofreading test is less sensitive at the beginning of the working day and working week in predominantly physical work. Objective attention indicators among garment workers, and among employees performing other types of work that mainly engage large muscle groups, deteriorate and reflect reduced work ability when general fatigue or pain is present, or when work tasks combine physical demands with requirements for sustained attention. Productivity and accuracy indicators are highly sensitive to work-in phase, sustained attention, time pressure, and depression-related slowing in predominantly mental work.

In our results, dynamic tremometry measures proved to be key indicators of local fatigue, static exertion, and loss of fine motor control in predominantly physical work. In occupations involving predominantly mental work, however, under psychosensory demands and sensorimotor tasks these measures appear to function more as indicators of stress, anxious activation, and psychomotor instability, consistent with our findings and those of other researchers. Despite being an objective method, the test was less

specific, most likely because writing and computer work involve limited fine motor activity.

The typical dynamics of work ability in predominantly physical work described in the results have also been reported by other authors. These include an early or gradual increase in tremor, with the final decline depending on muscular load. By contrast, mentally demanding work is characterised by a slower start, increasing variability, and more errors. The coefficients show only a small end spurt or none at all - when exhaustion is present at the end of the working week and working day.

Current evidence outlines opportunities to compensate for fatigue and increase the likelihood of an end spurt in predominantly physical work by reducing pace, changing posture, and engaging muscle groups that have not previously been active. In predominantly mental work, by contrast, any demonstrated increase in productivity tends to occur at the cost of more errors and omissions, narrowed attention, or greater effort.

The most important control factors for effective adaptation phase and sustained work ability at the end of the work cycle under predominantly physical demands are muscular strength, working posture, repetition of work movements, the presence of musculoskeletal disorders and local pain, and cardiorespiratory load with or without metabolic disorders. Among employees performing mentally demanding work, task characteristics such as complexity, monotony, time pressure, noise and visual strain, emotional exhaustion, and sleep disturbances are confirmed as the leading factors directly affecting rapid work-in phase and sustained work ability.

The most important methodological conclusion is that the same final outcome does not necessarily reflect the same level of work ability. A physical worker may preserve speed in the cancellation test while showing a sharp deterioration in tremor; an operator performing a mental or psychosensory task may maintain average productivity but achieve it through greater effort, more errors, and increasing variability. These findings again support a comprehensive approach when comparing different types of work, using a battery of objective indicators that describe effects on the relevant organs and systems through standardised short blocks and careful analysis of each stage: onset, work-in phase, plateau, decline, and end spurt.

For individualised approaches to the timing, duration, and type of rest breaks during working hours, the work-adjustment stages and the possibilities for maintaining optimal work ability at the end of the work cycle are of particular interest. According to the prevailing conclusions in the literature, management of the **risk factors affecting work-in phase and the end spurt** determines the effectiveness of physiological work-rest schedules. In proofreading testing and tremometry, these factors do not appear merely as “lower work ability,” but as a different curve shape: initial level, rate of work adjustment, sustainability during prolonged work, and end spurt. Direct studies that

simultaneously include a proofreading test, tremometry, and measurements at the beginning and end of the work period remain limited.

Time pressure increases work pace and the probability of impulsive errors. In the proofreading test, the expected profile is a shorter work-in phase but lower accuracy, more omissions or false markings, and greater variability between intervals. Under sustained time pressure, early depletion may occur: productivity declines toward the end, while the end spurt is weak or absent. The literature on performance under time pressure describes time pressure, overload, and fatigue as factors that moderate both cognitive and physical capacity. In tremometry, an increased amplitude or power of tremor and greater instability of fine motor control would be expected; however, this effect should be verified under actual workload conditions because time pressure may simultaneously increase activation and impair motor control. In the context of published research, the present results support the general concept of the **multifactorial determination of functional work ability**, while demonstrating the importance of both the physical characteristics of work and organisational and psychosocial factors.

In this regard, the most compelling result of the present analysis is the independent association between **time pressure and work-in phase**, whereas no independent statistically significant predictor of the end spurt was identified among the factors included in the reduced model.

Depressive Symptoms and Work Ability

Analysis of the relationship between depressive symptoms, assessed using the Zung scale, and changes in psychophysiological status among employees performing predominantly mental work identified statistically significant associations between the level of depression and changes in individual SAN indicators - well-being, activity, and mood - as well as in certain measures of work ability. The findings indicate that the effect of depressive symptoms on occupational functioning is not a simple linear relationship in which increasing symptoms uniformly worsen all indicators. The nonlinear relationship observed between the severity of depressive symptoms and individual work-ability indicators may be explained by differences in individual adaptive resources and coping strategies. Contemporary models of occupational distress view psychological strain as a process in which early manifestations of distress may be compensated for, whereas progressive symptoms lead to restriction of functional capacity (Schonfeld & Bianchi, 2021). Individuals with mild-to-moderate depressive symptoms were more likely to demonstrate positive changes in subjectively assessed indicators at certain points in the working week. In the middle of the week and at the end of the Friday working day, these individuals more often showed improved well-being and activity than those without depressive symptoms and those

with pronounced symptoms. These results should not be interpreted as evidence of a beneficial effect of depression on work ability, but rather as reflecting different adaptation mechanisms and compensatory behaviours among employees.
At the same time, no comparable positive dynamics in well-being, activity, or work-ability indicators were observed among individuals with pronounced depressive symptoms. This may be associated with more limited adaptive capacity, greater psycho-emotional exhaustion, and more difficult recovery within the work cycle. Epidemiological and occupational health studies show that depressive symptoms are associated with reduced work ability, a higher risk of absence, and impaired occupational functioning (Bonde, 2008; van den Berg et al., 2009).

Role of Perceived Stress in the Occupational Environment

Assessment of perceived stress using the PSS-10 showed a predominance of individuals with moderate stress (54.8%), followed by those with low perceived stress (43.8%), while only isolated participants had high stress levels (1.4%). This profile is characteristic of a working population in which occupational demands and the need to adapt to the work environment are present but do not reach levels associated with pronounced psycho-emotional maladaptation.
The predominance of moderate stress may be viewed as an indicator of persistent perceived strain related to occupational tasks, time constraints, and the need to maintain high performance. At the same time, the low relative proportion of individuals with high stress suggests that most employees retained effective mechanisms for adapting to the demands of the work environment.
The association between perceived stress and changes in subjective well-being at the beginning of the working week indicates that the degree of psycho-emotional strain may influence the process of initial work adaptation phase. Similar associations between psychosocial work factors, perceived stress, and work ability have been described by van den Berg et al., who showed that individual and occupational factors make a substantial contribution to Work Ability Index values (van den Berg et al., 2009).

Relationship Between Burnout Dimensions and Work Ability

The results demonstrate a statistically significant relationship between reduced personal accomplishment and indicators of psychophysiological fatigue under different types of occupational load. These associations support the view that the subjective perception of reduced professional effectiveness is related not only to psychological factors but also to measurable changes in employees' functional state. Reduced personal accomplishment is one of the core components of occupational burnout in the model of Maslach et al. and reflects a negative self-evaluation of professional competence and effectiveness. In this context, the association between reduced

personal accomplishment and fatigue indicators may be interpreted as reflecting an interaction between subjective occupational experience and objective functional state. The findings are consistent with other studies demonstrating a significant relationship between burnout, depressive symptoms, and reduced work ability (Ahola et al., 2005). This supports the need to view occupational burnout not only as a psychological phenomenon but also as a factor capable of affecting overall occupational functioning. According to our findings and those of other authors, perceived stress exerts its strongest effect on result variability. Two workers may process the same average number of symbols, but the more stressed individual may show greater fluctuation, more errors, and greater tremor. In a controlled study of emotional stress, physiological tremor increased and its spectral characteristics changed. Tremometry therefore provides an objective correlate of strain that may not be visible in the overall cancellation-test result. High stress is likely to delay stabilisation of performance and reduce the end spurt, particularly when recovery between tasks is insufficient.

Depression should be considered separately from general stress. The principal expected mechanism is psychomotor slowing, reduced sustained attention, and slower information processing. Untreated patients with unipolar depression have shown impairments in psychomotor performance and sustained attention compared with healthy controls. In the proofreading test, this manifests as lower speed, a longer work-in phase, more omissions, and a smaller or absent end spurt. Tremometry may demonstrate slower motor responses and poorer stability, but tremor is not a specific marker of depression and should be interpreted together with psychomotor speed, sleep, medication use, and anxiety.

Emotional exhaustion and burnout are more apparent in performance dynamics than in a single or baseline measurement. In a study involving mental workload, the burnout group did not differ from controls at baseline; however, as the working day progressed, controls improved their performance to a greater extent, whereas the burnout group expended more effort and was more fatigued by the end. This is particularly important when defining work-ability dynamics: in emotional exhaustion, initial performance may be normal, but initial work adaptation phase may be slower, sustainability lower, and the end spurt reduced. Tremor or its variability may increase after prolonged load; however, this hypothesis should be distinguished from the effect of muscular fatigue.

The practical profiles identified are as follows:

Low time pressure/low stress: gradual improvement in speed and accuracy, few errors, a stable or moderate end spurt, and low tremor.

High time pressure: high initial speed but more errors; during a prolonged task, performance declines and the end spurt is weak.

High perceived stress: greater interval-to-interval variability, more errors, and increased tremor; the average result may remain normal, but the performance curve is unstable.
Depressive symptoms: low initial speed, prolonged work adjustment, psychomotor slowing, and a small end spurt.
Emotional exhaustion: a relatively preserved start, but a weaker positive trend, faster depletion, and poorer performance at the end.
The difference between predominantly mental and predominantly physical work concerns not only the degree of fatigue but also its mechanism and temporal profile. In predominantly physical work, the leading factors are peripheral muscular fatigue, static load, posture, and local pain; in mental and psychosensory work, they are sustained attention, processing speed, monotony, visual strain, time pressure, and emotional self-control. High physical demands, unfavourable postures, and poor working environments are associated with lower work ability (Tuomi), but this does not mean that mental work is less demanding: its decline is often first evident in accuracy, variability, and effort rather than in overall speed.

Influence of Sex, Age, Work-Task Characteristics, and Lifestyle Factors on the Potential for Improving Work-Ability Indicators at the Beginning and End of the Working Day and Working Week
The study findings regarding the likelihood of improved work-ability indicators from the beginning toward the end of the week under lower physical and psychosocial task demands, sufficient leisure-time physical activity, and good sleep quality are supported by other authors. Work-in phase and the end spurt are impaired by insomnia, high workload, and unfavourable work organisation.

Average work ability generally declines **with age**, but this does not mean that older workers cannot demonstrate work adjustment and an end spurt. Among older employees exposed to social stress, initial sleep quality is lower, but improvement over the working week is stronger. Age therefore probably moderates the effects of workload and recovery rather than determining them independently.

Total work experience Length of service alone does not appear sufficient as a causal factor. Rather, it reflects accumulated exposure to physical, psychosocial, and organisational demands, as well as adaptation to the task.

Work-task characteristics emerge, both from the reported findings and from the available literature, as the most likely moderators of weekly dynamics. High physical demands, an unfavourable work environment, non-ergonomic working postures, and

limited autonomy are associated with lower work ability. Lower demands, less physical load, and greater task resources are associated with a better WAI (Airila). The most frequently described pattern is a lower level at the beginning of the week and a lower likelihood of recovery by Friday in repetitive, heavy, or low-autonomy work.

Regarding **leisure-time physical activity**, the evidence most consistently indicates a positive association in predominantly physical work. Low-intensity activity showed no association. This supports the hypothesis that physical activity increases the likelihood of better recovery, particularly when the work task is physically demanding, although cross-sectional data do not establish causality.

9. Study Limitations

The present study has several methodological limitations. First, owing to the phased implementation of the study and organisational aspects of data collection, not all participants completed the full set of psychometric instruments administered. Consequently, the individual indicators of mental health and work ability were analysed using different analytical subsamples comprising participants with validly completed questionnaires and tests.

Second, two internationally validated instruments - the HADS and the Zung scale - were used to assess depressive symptoms at different stages of the study. Although both questionnaires assess depressive symptomatology and have good psychometric properties, differences in their structure and scoring systems preclude direct comparison of the raw scores. Therefore, the results were interpreted within the framework of the respective instrument.

These considerations should be taken into account when interpreting and generalising the findings, without calling into question the validity of the analyses conducted within the respective analytical subsamples.

III. CONCLUSIONS, RECOMMENDATIONS, AND CONTRIBUTIONS

1. Conclusions

The findings support the conclusion that the mental health and work ability of employees in small and medium-sized enterprises are closely interrelated and are influenced both by the nature of work and by the broader organisational and social context. The study data confirm that the contemporary work environment, further complicated by the consequences of the COVID-19 pandemic, creates conditions for increased psycho-emotional strain, which may manifest through higher levels of perceived stress, anxiety, depressive symptoms, emotional exhaustion, and fluctuations in subjective well-being. The observed changes in attention, psychomotor stability, and

work-ability dynamics over the working day and working week indicate that workload does not act as a one-time exposure but has a cumulative effect on employees' functional state. At the same time, the differences between employees engaged predominantly in mental work and those engaged predominantly in physical work highlight the need for a differentiated interpretation of the results, because different occupational groups are affected by different combinations of risk factors, adaptive mechanisms, and coping resources. It is also important that some of the adverse outcomes observed were associated with behavioural and health characteristics such as insomnia, smoking, insufficient physical activity, and features of the daily routine, supporting the multifactorial nature of psychophysiological risk. The findings therefore support the need for comprehensive measures, including optimisation of work-rest schedules, early prevention, and psychological support.

2. Recommendations

The study findings indicate that maintaining work ability in small and medium-sized enterprises requires a differentiated approach tailored to the nature of work, the age and length-of-service profile, the level of psycho-emotional workload, and the sex differences identified. For employees engaged predominantly in mental work, organisational measures aimed at sustaining cognitive effectiveness are particularly appropriate, including greater autonomy, clear structuring and prioritisation of tasks, rotation between activities with different cognitive demands, and the introduction of active breaks and short recovery intervals. In this context, complex tasks requiring high accuracy should preferably be scheduled for the middle of the week and the early hours of the working day. Toward the end of the week, particularly on Friday afternoon, new critical tasks should be limited, with routine, monitoring, or completion activities assigned instead.

For physically demanding activities, ergonomic improvements, the use of assistive devices, alternation between "heavy" and "light" tasks, limitation of prolonged shifts, and the introduction of more frequent microbreaks are of greater importance, particularly in the afternoon and at the end of the working week, when the risk of fatigue, errors, and occupational accidents increases.

The established association between perceived stress, depressive symptoms, and work ability supports the need for a comprehensive approach combining organisational and individual interventions aimed at stress management.

This provides a rationale for comprehensive recommendations aimed at both early detection and prompt mitigation of adverse effects. As an initial measure, we consider it appropriate for SMEs to introduce periodic screening using instruments such as the PSS-10, Zung scale, and WAI, not only for assessment but also as the basis of a threshold-based early-warning system. When elevated levels of perceived stress or

depressive symptoms, or a decline in the Work Ability Index, are identified, pre-planned measures should be activated, including temporary workload reduction, limitation of concurrent deadlines, redistribution of complex tasks, and increased opportunities for recovery during the working day. In this regard, stress reduction should be viewed as a primary intervention target, because it may subsequently reduce depressive symptoms and improve work ability. From a practical perspective, organisations are advised to develop a two-component intervention model comprising organisational measures on the one hand and individual support approaches on the other. Organisational measures may include clearer priorities, realistic time planning, time buffers, greater autonomy, active breaks, task rotation, and improvements in working conditions, in line with the published evidence. Individual measures should include sleep-hygiene training, breathing and relaxation techniques, brief self-regulation strategies, psychoeducation on early symptoms of stress and depression, and facilitated access to psychological counselling or employee assistance programmes. For individuals with elevated stress and depressive symptoms, tasks should be structured into smaller, achievable stages with clearly defined short-term goals to reduce feelings of overload and loss of control. Regular feedback should be provided, particularly for high-risk groups, because clarity, predictability, and a sense of support may substantially mitigate adverse effects on mental health and work performance.

The identified sex differences in the experience of occupational stress and burnout are also important. For women, among whom higher levels of emotional exhaustion, anxiety, and depressive symptoms were observed more frequently, emphasis should be placed on stress-management programmes, emotional regulation, group support, systematic feedback, and early identification of psychological distress. It is particularly important to avoid the accumulation of multiple deadlines and to provide sufficient time buffers and more predictable task organisation. For men, among whom manifestations of depersonalisation and distancing were more prominent, appropriate measures include rotation between different types of tasks, more active participation in decision-making, involvement in activities with a social component, and promotion of a healthy lifestyle, physical activity, and cardiometabolic risk prevention.

3. Contributions

3.1. Scientific Contributions

1. An integrated methodological model for comprehensive psychophysiological assessment of work ability was applied, combining objective cognitive measures, psychomotor indicators, subjective assessments of functional state, and standardised psychometric instruments for assessing stress, anxiety, depressive symptoms, occupational burnout, and work ability.

2. Patterns in work-ability dynamics over the working day and working week were identified, characterising the processes of work adjustment, fatigue accumulation, and recovery, and periods associated with an increased risk of reduced effectiveness were established.
3. The influence of psychosocial factors - perceived stress, depressive symptoms, anxiety, and emotional exhaustion - on the level of work ability was demonstrated, together with their associations with cognitive and psychomotor indicators.
4. Statistically significant differences in work-ability and mental-health indicators were identified according to the nature of work, industry sector, sex, age, and job-specialised work experience, thereby extending knowledge of how individual and organisational factors influence occupational functioning.
5. For the first time, multivariable analysis (binary logistic regression) demonstrated that the phases of "work-in phase" at the beginning of the week and the "end spurt" at the end of the week are governed by different independent mechanisms.
6. Methodological guidelines were formulated for multivariable assessment of occupational risk through an integrated approach combining objective cognitive and motor tests (PC, AC, tremometry), biomarkers (cortisol, sAA), and psychometric scales (PSS-10, WAI, Zung/HADS) to predict work ability accurately under real-world conditions. An important methodological caution for occupational-health practice was also derived: relying solely on bivariate associations may lead to misleading risk estimates; therefore, controlled multivariable models are essential for identifying genuine organisational predictors.

3.2. Practical Contributions

1. Practical guidelines were proposed for organisational management of work processes in small and medium-sized enterprises by optimising task allocation according to the identified periods of maximum and reduced work ability.
2. Measures were proposed to limit psychophysiological workload, including active breaks, job rotation, ergonomic improvements, and organisational interventions for activities requiring high concentration and precision.
3. Recommendations were developed for reducing occupational stress and burnout by optimising the balance between demands and control, the effort-reward balance, and by promoting supportive leadership and social support within organisations.
4. A basis was developed for algorithmic allocation of workload according to the objectively established phases of circadian and weekly work ability:
Monday: schedule adaptive activities and limit severe time pressure.
Wednesday (optimal plateau): assign the most complex, analytical, and safety-critical tasks, when AC is highest and stress is low.

Friday: introduce controls to manage the "Friday decline," including discontinuing critical cognitive tasks after midday to prevent errors.

5. Targeted prevention profiles for occupational health were developed, clearly defining two fundamentally different risk packages for medical and biological monitoring in small and medium-sized enterprises (SMEs):

For predominantly mental work: programmes focused on managing time pressure, preventing insomnia, limiting excessive caffeine consumption (>3 coffees per day), and addressing emotional exhaustion and burnout.

For predominantly physical work: metabolic screening programmes covering BMI, glucose, lipids, and blood pressure; training modules on leisure-time physical activity; and prevention of presenteeism and absenteeism.

6. An integrated model for periodic monitoring of mental health and work ability was recommended, enabling early identification of adverse changes and timely implementation of preventive measures. This model may also be used as a tool for assessing and managing psychophysiological risks in small and medium-sized enterprises, with the aim of maintaining high work ability, productivity, and occupational safety.

CONCLUSION

In conclusion, maintaining work ability in the post-COVID period requires a comprehensive, context-sensitive, and evidence-based approach. In small and medium-sized enterprises, this entails not only assessing individual resources and deficits but also actively managing organisational psychosocial and psychophysiological risks. Such an integrated approach can simultaneously protect employees' health, sustain high work ability, and improve occupational effectiveness and safety.

Publications Related to the Dissertation

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