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Review

A Review of Relevant Regulations, Requirements and Assessment Methods Concerning Physical Load in Workplaces in the Slovak Republic

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Abstract: This review brings an overview of the Slovak regulations concerning occupational safety and health at work (OSH) primarily considering the parameter of physical load. In addition to regulations, this article focuses on particular requirements at workplaces with an increased physical load and describes the permissible values of the physical load (see tables). Attention is given to assessing the working posture and handling of loads. The main purpose of the evaluation is to determine the parameters of physical load, which is the first important step in the process of health risk assessment. Based on the physical load assessment and the categorization of tasks for the physical load factor in the Slovak Republic, further steps and measures should be taken to improve working conditions, to reduce the workload, number of health problems, fatigue, and ultimately to prevent accidents at work and work-related musculoskeletal diseases.

Keywords: ergonomics for sustainable workplace; physical load; occupational safety and health (OSH)

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1. Introduction

The average person spends a great part of his/her life at work. A characteristic feature of the modern era is the increased emphasis on work, stressing the importance of productivity, performance efficiency, quality, and qualifications. To be able to achieve good results in the long-term run, occupational health and safety should be the main priority of each employer. Each business has its own procedures that require a certain degree of physical fitness. Employees carry out the tasks in a certain position or posture that is determined by both the nature of the task itself as well as the workplace parameters. They may have to work in such a position for many hours, potentially affecting their health negatively and resulting in pain or illness. The most frequent consequences are musculoskeletal disorders that can lead to reduced work performance. By including OSH into the system of work, employers can avoid the costs that arise from work injuries, as well as improve employees' productivity [1,2].

Every country has its own specific OSH legislation, and Slovakia is no exception. The OSH area is included in the Constitution of the SR as well as in the Labour Code—Act No. 311/2001 Coll. Every employee has the right to just and suitable working conditions that create a safe environment aimed at the protection of health at work for all employees [1].

The Slovak republic's main legal document is Act No. 355/2007 Coll. On the protection, promotion, and development of public health as amended. Conditions relating to safety and health at work are contained in Act No. 124/2006 Coll. on safety and health protection at work; in Government Decree No. 391/2006 Coll. on the minimum safety and health requirements for manual handling of loads, in the Regulation of the Government of the Slovak Republic No. 115/2006 Coll. on minimum health and safety requirements

for the protection of employees against risks related to noise exposure; and in the Decree of the Ministry of Health of the Slovak Republic No. 542/2007 Coll. on details of health protection against physical strain at work, mental workload, and sensory workload (Public Health Authority of the Slovak Republic, 2017). The Decree of the Ministry of Health of the Slovak Republic No. 448/2007 Coll. speaks in detail about the factors of work and the working environment in relation to the categorization of work in terms of health risks and the essentials of the proposal for the classification of work into categories, as amended. Other conditions concerning safety and health protection at work are also contained in the Regulation of the Government of the Slovak Republic No. 281/2006 on minimum safety and health requirements for manual handling of loads, Regulation of the Government of the Slovak Republic No. 272/2004 Coll., which establishes a list of jobs and workplaces that are prohibited for pregnant women, new mothers until the end of the ninth month after childbirth, and breastfeeding women, establishes a list of jobs and workplaces associated with a specific risk for pregnant women, mothers until the end of the ninth month after childbirth, and for breastfeeding women, and which lays down certain obligations for employers in the employment of these women, as amended; and in the Regulation of the Government of the Slovak Republic No. 286/2004 Coll., which establishes the list of works and workplaces that are prohibited for juvenile employees, and which establishes certain obligations of employers in the employment of juvenile employees, as amended [3,4].

For the purposes of this study, the terms used in the review are explained according to the valid Slovak legislation.

The working environment is the combination of the spatial, material, physical, chemical, micro-climatic, physiological, psychological, social, and other conditions in which the working process is carried out. These conditions affect work results, motivation, performance, psyche, safety, and health of the employees; a non-standard working environment is, e.g., a workplace without daylight, one situated underground, at great heights, underwater, etc. [3,4].

An operation with a fixed work pace is a type of work in which the employees cannot select the work pace themselves; the pace corresponds to the given technological process or to the work pace of other persons [5]. This excludes the operation of machines (e.g., machine tools) where the employees have to oversee the process and intervene if necessary—since they carry out several steps at once and they choose the work pace accordingly [4].

Monotonous work refers to permanently repetitive activities lasting more than a half of a shift, with a limited possibility of the employee's intervention to the activity [6].

Work under time pressure is an activity in a fast-paced working environment with a limited number of breaks and time for rest, or work with tight deadlines under time pressure with information overload that causes a rapid onset of fatigue [5,6].

Influences disrupting concentration are those influences that disrupt the necessary concentration at work, requiring the individual to make an extra effort to concentrate or pause his or her work, e.g., noise at the workplace, various distractions, phones ringing, etc. [7,8].

Life- and health-threatening risks to an employee or others at work mean a higher probability of occurrence of a negative final effect on life or health due to the combination of risk factors, and can be expressed by the ratio of all possible cases (events) and unsuccessful (unfavorable) events. In the working process, it represents a load factor requiring a great deal of professional knowledge, discipline, concentration, and the need to fulfill the principles of safety and protection of health at work [7–9].

The response of the body may include both physiological and psychological reactions. The organism's response to a load is represented by quantification of the measured parameters of physiological functions; the assessment of psychological parameters is expressed by performance of a corresponding psychological task [7–9].

Psychological overload is a psychological state in which an employee realizes the conflict between the requirements (for them or for the working position), and their performance or true abilities [7–9].

Monotony is a gradually developing condition of reduced activation that appears during long-term, monotonous, and repeated activities or tasks which usually results in drowsiness, fatigue, reduced and fluctuating performance, deterioration of adaptability and reactivity, and is frequently accompanied by an increasing variability of the heart rate [10].

2. Physical Load in the Context of Slovak Legislation

In the Slovak Republic, all legal regulations in the field of occupational health and safety related to the physical load of a person at work have undergone a process of approximation, i.e., bringing Slovak legislation in line with the EU legislation [11].This consists of thew process of preparing and adopting a legal regulation or amending it with a goal of achieving either the same legal effect as that of the European Union in the law of the European Communities and European Union law (transposition), achieving the same conditions for the functioning of the legal system within the European Union (coordination), or ensuring that the administrative procedures applied in the national law conform with those applied in the Member States of the European Union (adaptation). Approximation consists of taking effective measures to ensure that the legal acts of the European Union are implemented in practice (implementation) [12].

Within the framework of approximation of EU legislation, and based on the "List of European Community directives which have been incorporated into Slovak legislation relating to safety and health at work", it is clear that the "Council Directive 90/269/EEC of 29 May 1990 on the minimum safety and health requirements for the manual handling of loads where there is a risk particularly of back injury to workers (fourth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC)" is directly related to the issue treated in our common article. The Council Directive in question was approximated to Slovak legislation, namely No. 281/2006 Coll. on minimum safety and health requirements for manual handling of loads [11,12].

According to Council Directive 90/269/EEC, "manual handling of loads" means any transport or carrying of a load by one or more employees, including lifting, handling, pushing, pulling, carrying, or moving a load, which, by reason of its characteristics or adverse ergonomic conditions, presents a risk to workers, in particular, that of back injury [11,12].

Pursuant to the Decree of the Ministry of Health of the Slovak Republic No. 542/2007 on details of health protection against physical stress at work, mental workload and sensory stress at work, individual requirements for the place of work, total physical load, local muscle load, and working positions are defined.

2.1. Requirements for the Workplace in Which Employees Are under Increased Physical Load

The place of work must be arranged in such a way that the handling planes, the space, and the workload correspond to the body dimensions and natural movements of the workers' limbs in order to avoid physiologically unacceptable working positions. For a place of work where the basic working position is one of permanently standing, and the work does not require constant monitoring of the operation of the machine, the workplace must be fitted with a seat of simple construction for short-term rest [12]. The seat should be stable, and both the height of the seat and the incline of the backrest should adjust easily. The surface of the seat and backrest should correspond to the working conditions in terms of porosity, washability and the like. A workplace in which the working plane is raised must be equipped with work seats, where the seat height corresponds to the height of the working plane and the visual requirements at work, and must also be fitted with lower limb support. In the case of assembly line production with permanent or intermittent seating, and when operations require torso rotation or operations outside the arm's reach, the place of work should be equipped with swivel or mobile seats [9–11].

The individual adjustment of the chair's seat height and lower limb support above the floor, with respect to the height of the working surface of the table, is adjusted according to Figures 1 and 2. The work surface of the table must not be less than 65 cm, provided that

its thickness does not exceed 5 cm. The height of the table for both sitting and standing work positions must not be more than 95 cm above the floor [13–20].

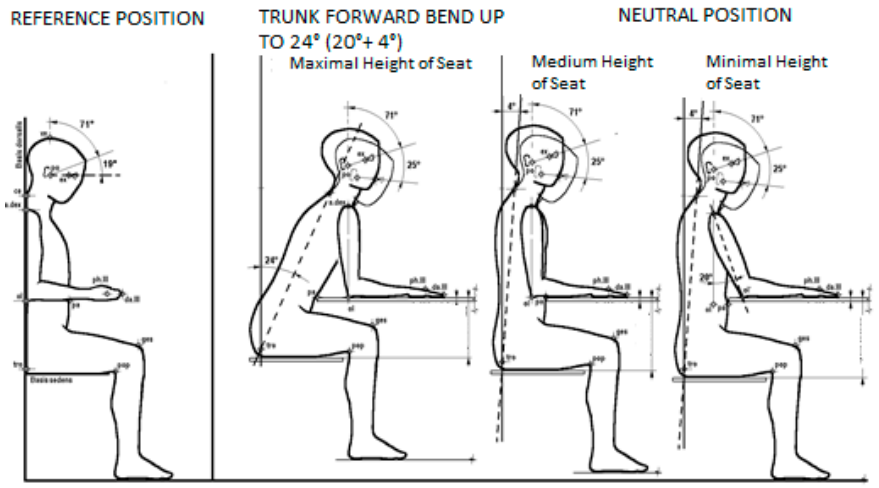

Figure 1. Individual adjustment of the set height of the chair and the lower limbs support to the height of the desk working surface [9].

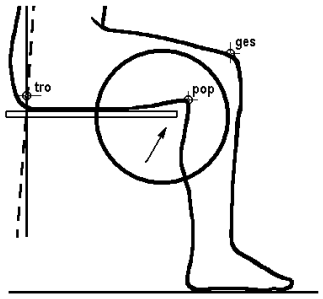

Figure 2. Individual adjustment of the chair's seat height above the floor and the lower limb support to the height of the desk surface (Decree 542/2007 of the Ministry of Health of the Slovak Republic) [9].

A free space for the lower limbs with a minimal width and depth of 50 cm and a minimal height of 60 cm above the floor, or lower limb support (in which the optimal width and depth of the space for lower limbs is 70 cm or more) is required for a sitting work position. The mean height of the individual adjustment of the upper surface of the seat in the neutral position of the employee to the table (forward inclination of the torso axis 4°) is equal to the difference in height of the upper surface of the table from the floor and the olecranon point above the seat [21]. The minimum height of individual upper seat adjustment in the neutral position to the given table (inclination of the torso axis 4°) is equal to the difference in height of the upper surface of the table and the olecranon point in abduction 20° above the seat. The maximum height of the individual adjustment of the upper surface of the seat is equal to the difference between the height of the upper surface of the table and the olecranon point perpendicular to the floor with a torso forward tilt of 24°, which is the value of the angle after correction for the neutral position of the torso (20° + 4°) of the employee to the table [21–25].

The free space between the upper seat surface of the chair and the bottom table surface should be at least 11 cm and optimally more than 21 cm. For work that requires increased visual concentration, for example, with small objects, spare parts, and the like, the height of the working plane increases by approximately 10 cm to 20 cm, while providing support for the forearms. When working with objects heavier than 2 kg in a standing position, the handling plane is reduced by approximately 10 cm to 20 cm. The adjustment of the chair height above the floor, or lower limb supports when using higher tables, must allow the

position of the lower limbs to be changed during work. The correct adjustment of the seat height should be so that in the front part of the seat there is a free space corresponding to the thickness of the palm below the lower thigh (behind the fossa popliteal)—see Figure 2 [9].

The maximum depth of the chair seat shall be 35 cm, so as not to press the popliteal area. When working in the sitting position, one should sit on the entire surface of the chair with the lumbar spine supported. Space for movements and reaching of the upper limbs when working while sitting and standing is adjusted according to Figure 3 [9], in which: the handling plane is the plane in which the most work operations are performed; the reference plane is the base plane for deriving other dimensions and spatial relationships; reference plane A is a plane which is perpendicular to the floor and imaginarily divides the employee into symmetrical halves at the workplace; reference plane B is the floor; reference plane C is the plane perpendicular to the floor and passes through either the front edge of the table or the point of the machine nearest to the worker. The workplace reference point is where reference planes A and C intersect one another with the manipulation plane for men and women [21–25].

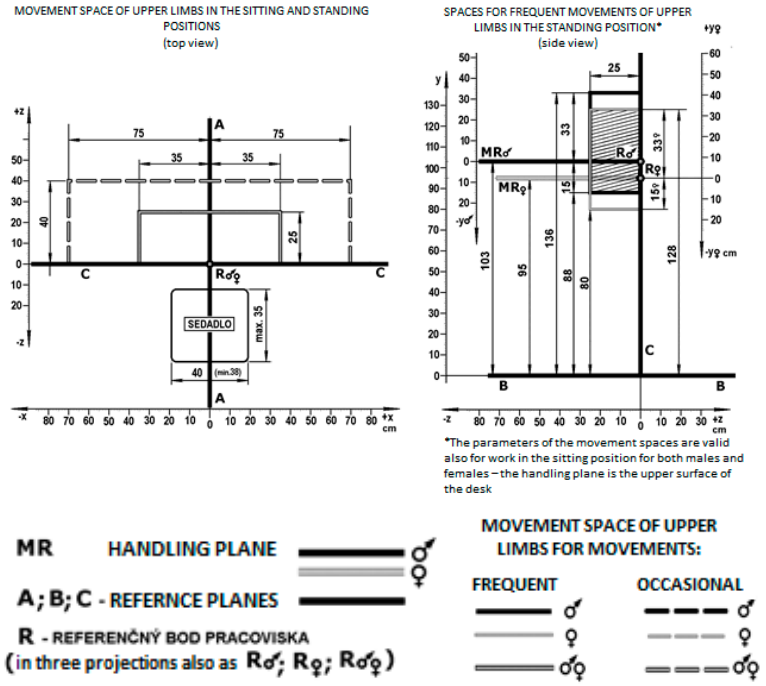

Figure 3. Space for movements of the upper limbs at [9].

The pressures allowed when using the controllers are given in Table 1, in which: permanently used controllers are used more than 40 times during a work shift; frequently used controllers are used more than 20 to 40 times during a work shift; rarely used drivers are the ones used less than 20 times during a work shift [21–25].

For a standing working position, it is not recommended to use foot switches or pedals. It is forbidden to use controllers operated by means other than the hands and feet, e.g., by the elbow or knee.

Table 1. Controllers [9].

Controller	Shape, Position, Frequency	Actuation	Pressure (N) Min–Max
Button	Circle, square, rectangle, mushroom	One finger Palm	2.5–8 2.5–50
Toggle switch	Cylinder, taper, prism Two- and three-position	Fingers	2.5–10
Rotary switch	Basis—circle Grip—taper, rectangle 8–24 positions	Fingers	2.5–15
Turn knob	Cylinder, taper Diameter to 2.5 cm Diameter more than 2.5 cm	Fingers	2.5–4 2.5–15
Manual wheel	The higher the rotation speed, the smaller the wheel diameter	One hand Both hands	10–100 10–200
Steering wheel	Stationary tech. device Mobile tech. device Emergency control	Both hands One or both hands Both hands	max 115 max 80 max 350
Hand lever	Holder—cylinder, taper, ball Used permanently Used frequently Used rarely (emergency)	Hand Forward and backward To the sides Forward and backward To the sides Up and down	 10–60 10–40 10–120 10–80 max 300
Foot lever	Rectangle, circle, square Used permanently Used frequently	Movement of whole leg Pedal of emergency brake Pedal controlled by ankle movement	10–90 40–400 20–60

2.2. Permissible Values of the Total Physical Load

The following Table 2 gives permissible values of energy output and heart rate as the physiological indicators of the workload.

Table 2. Permissible values of energy output and heart rate as the physiological indicators of the workload [9].

Energy Output	Unit	Age Group (Years)									
		18–29		30–39		40–49		50–59		60–65	
		Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
Average/shift	MJ	8.3	5.1	7.5	4.8	6.8	4.5	6.0	4.0	5.2	3.7
Permissible/shift	MJ	9.9	6.1	9.0	5.8	8.0	5.4	7.2	4.8	6.2	4.4
Annual	MJ	1.940	1.200	1.760	1.130	1.600	1.060	1.400	940	1.220	858
Permissible/minute	W	685	445	635	425	575	395	515	360	478	334

The following conditions are considered when assessing the energy expenditure indicator:

When using the muscles of the upper limbs in a standing position, all values given in Table 2 will be reduced by 20%; when using both upper limbs in a sitting position or one upper limb in a standing position, the values given in Table 2 are reduced by 50%; when using one upper limb in a sitting position, the values listed in Table 2 will be reduced by 75%; if both lower limbs are being used, it is evaluated as work with the whole body [21–25].

The average energy output expresses the value of the energy output that must not be exceeded during a shift when the work during a shift is scheduled uniformly. The permissible energy output determines the upper permissible limit if the work load is unequally divided during a week, month or year. The average energy output for a given interval must not exceed the average energy output per shift [26,27]. The annual energy output determines the highest permissible energy output during a year and equals the amount of energy spent during 235 working days at the average energy output per shift [26–33].

The permissible energy output per minute determines the energy output that must not be exceeded during a shift, even during short-term operations. The value can be exceeded only in special situations in the case of some selected, extremely physically fit groups of employees (e.g., firemen, policemen, etc.) who have undergone preventive medical check-ups and are physically fit for this demanding work [26–33].

Where: A is value used to assess medical findings during the examination of a group of individuals if the normal heart rate is not determined. B is the value that can be tolerable for the person examined for a longer period of time if the C value is not exceeded, i.e., an increase in the working heart rate above the normal (resting) value. C is the highest acceptable value for the heart rate increase above the normal value that is tolerable in healthy individuals over a long period of time. D is the maximum allowable heart rate increase above the normal value that must not be exceeded [34].

The average values of the heart rate per shift for males and females during physical work performed by large muscle groups (see Table 3) must not exceed, even for a short time, 150 beats per minute. This value can be exceeded only in exceptional situations for selected groups of employees (firemen, policemen, etc.) who have undergone medical preventive check-ups and are physically fit for this work [35].

Table 3. Criteria for assessing the heart rate per shift for operations performed predominantly by big muscle groups [9].

Age Group	Values of the Heart Rate per Minute/per Shift			
	Absolute Values		Increase over the Basic Value	
	A	B	C	D
	Average Values	Limit Values	Average Values	Limit Values
18–29	108	117	30	33
30–39	106	115	29	32
40–49	101	110	26	28
50–59	97	105	23	25
60–65	93	100	20	22

2.3. Permissible Values of the Local Muscle Load

The time-related average of the muscle tone must not exceed the values expressed by the percentage of maximum muscle strength (% Fmax) of the exposed muscle group in the Table 4. The number of movements when small muscle groups of the forearm and hand are loaded must not exceed the given values of the energy output per shift (not even for a short time/per minute). The number of the movements of the small muscles of the fingers and hand must not exceed the value of 110 per minute at 3% Fmax, or the value of 90 per minute at 6% Fmax. Work operations with the used muscle strength over 70% Fmax for the mainly dynamic performance as part of the main working operation are not permissible. Work operations with muscle strain over 60% Fmax for mainly dynamic operations are permissible maximally 600 times per shift. Working operations of mainly static performance with muscle strain higher than 45% Fmax are not permissible [36–40].

In recent years, bone, joint, tendon, and nerve diseases account for the highest proportion of occupational diseases, both in the long-term, excessive, and repetitive load, including small muscle groups. These diseases can affect every employee [41]. However, they can be prevented by evaluating occupational tasks from the point of view of energy output, the number of tasks carried out or frequency of work movements; by observing the positions of extremities while carrying out the tasks depending on the static and dynamic component of the task; and by introducing preventive measures and by checking their effectiveness [42–45]. Local muscle tension representing the load of small muscle groups to carry out a task using the extremities at work must not exceed the permissible values of the local muscle load relative to the muscular strength and the frequency of the working movements, as shown in Table 4.

Table 4. Permissible values of the local muscle load [9].

Permissible Average Values in % $F_{max/per\ shift}$					
Dominance of the dynamic component of work			Dominance of the static component of work		
30			10		
Average muscle forces of the forearm and hand per shift in the area of 7–51% F_{max} (shift = 480 min)					
% F_{max}	Number of movements	% F_{max}	Number of movements	% F_{max}	Number of movements
7	27,600	22	9600	37	5400
8	24,300	23	9300	38	5200
9	21,800	24	9000	39	5000
10	19,800	25	8700	40	4800
11	18,100	26	8400	41	4600
12	16,700	27	8100	42	4400
13	15,500	28	7800	43	4200
14	14,000	29	7500	44	4000
15	13,500	30	7200	45	3800
16	12,700	31	6900	46	3600
17	12,000	32	6600	47	3400
18	11,400	33	6300	48	3200
19	10,900	34	6000	49	3000
20	10,400	35	5800	50	2700
21	10,000	36	5600	51	2400

2.4. Assessment of Work Positions

The assessment of work from the point of view of the work position is most important for stationary workplaces, e.g., stationary and mobile machines, assembly lines, etc., when the employee is at the same workplace and carrying out the same tasks for more than half of an 8-h shift. In this case, the employees cannot choose their work position; rather, it is directly dependent on the machine, the workplace arrangement, workplace parameters, etc. Other types of working activities can also be assessed on the aforementioned criteria [46]. However, the individual characteristics of the tasks must be always taken into account. The work position is always evaluated only in connection with the given activity, i.e., if it is a structural, repeated part of the work activity and not a rare task. A two-step system of the work task assessment is used: The first step includes the assessment of the working posture of the individual body parts using angles. The second step includes the conditions which in the first step were labelled as conditionally acceptable or as acceptable [45–50].

Work in a sitting or standing position, or a combination, is considered an acceptable working position (see Table 5). The definition of a conditionally acceptable position of the trunk, head and neck, and upper and lower limbs is shown in Steps 1 and 2. The total time during an 8-h shift in each conditionally acceptable working position must not exceed 160 min, and the duration of the individual tasks must not be longer than 1 to 8 min depending on the type of the position and movement frequency [45–50].

The definition of an unacceptable working position of the trunk, head and neck, or upper and lower limbs is shown in Steps 1 and 2. The total time during an 8-h shift in each unacceptable working position must not exceed 30 min. The total time of work in a conditionally acceptable and unacceptable work position must not be longer than half of the 8-h shift [45–50].

The assessment of the trunk position is based on the position of the protuberance of the seventh cervical vertebra and the upper edge of the greater trochanter that define the neutral position. The angles for assessing the trunk position relate to the vertical plane. The angle between the plane passing through the trunk in a neutral position and the vertical plane is 4° [45–50].

The assessment of the position of the neck and head (see Table 6) is based either on the angle of view of the torso position in the neutral position, i.e., from the value of the angle below the horizontal plane of the eye, or from the value of the angle of inclination of the head and neck to the vertical plane [46].

Table 5. Trunk positions [9].

STEP 1	
Unacceptable positions	
Static positions	Trunk—forward bend > 60°
	Back-bend without support of the whole body
	Significant side bend or slight rotation of the trunk >20°
Dynamic positions	Trunk—forward bend >60° at the movement frequency of $\geq$2 min^{-1}
	Significant side bend of the trunk or slight rotation >20° at the movement frequency of $\geq$2 min^{-1}
Conditionally acceptable positions	
Static positions	Trunk—forward bend of 40°–60° without support of the trunk (STEP 2A)
	Back-bend of the trunk with support of the body (STEP 2B)
	Significant side bend or rotation >10° and >20°
Dynamic positions	Trunk—forward bend of >60° at the movement frequency of <2 min^{-1} (STEP 2C)
	Significant side bend of the trunk to the sides >20° at the movement frequency of <2 min^{-1} (STEP 2A)
	Back bend of the trunk at the movement frequency of <2 min^{-1} (STEP 2C)
STEP 2	
A	Acceptable if the duration of this posture is < than the longest acceptable duration of the posture (in min)
B	Acceptable if there is a support of the trunk (spine support)
C	Unacceptable if the machine is used for longer than one half of the shift

Table 6. Positions of head and neck [9].

STEP 1	
Unacceptable positions	
Static positions	Head bend forward >25° without support of the trunk
	Head back-bend without support of the whole head
	Side bend and rotation of the head >15°
Dynamic positions	Side bend and rotation of the head >15° at the movement frequency of $\geq$2 min^{-1}
	Head bend forward >25° at the movement frequency of $\geq$2 min^{-1}
Conditionally acceptable positions	
Static position	Head bend forward 25°–40° with the support of the whole trunk (STEP 2A)
Dynamic positions	Head bend forward 25°–40° at the movement frequency of <2 min^{-1} (STEP 2B)
	Head back-bend up to 15° at the movement frequency of <2 min^{-1} (STEP 2B)
	Side bend and rotation of the head up to 15° at the movement frequency of <2 min^{-1} (STEP 2B)
STEP 2	
A	The longest acceptable time of the posture has to be kept
B	Unacceptable if the machine is used for longer than one half of the working shift

The evaluation of the upper limbs (see Table 7, below) is based on two points on the upper limb: the outer edge of the collarbone and the elbow joint. The upper limb raised upward is defined as the angle the limb forms relative to the neutral position of the limb, in the working position. The neutral position is the position in which the limb hangs freely along the body [46].

Assessment of positions of the lower limbs can be found in Table 8, and positions of other body parts in Table 9.

Table 7. Positions of the upper limbs [9].

STEP 1	
Unacceptable positions	
Static positions	Unfit position of the limb (backbend of the limb, extreme external rotation, raised arm)
	Raising the limb >60°
Dynamic positions	Raising the limb >60° at the movement frequency of <2 min^{-1}
	Stretching arm backward at the movement frequency of <2 min^{-1}
Conditionally acceptable positions	
Static position	Raising the limb 40°–60°, if the limb is not supported (STEP 2A)
Dynamic position	Raising the limb 40°–60° at the movement frequency of <2 min^{-1} (STEP 2B, C)
	Stretching arm backward at the movement frequency of <2 min^{-1} (STEP 2B)
STEP 2	
A	The longest acceptable time of the posture has to be kept
B	Unacceptable if the movement frequency is 10/min^{-1}
C	Unacceptable if the machine is used for longer than one half of the working shift

Table 8. Positions of the lower limbs [9].

STEP 1	
Unacceptable positions	
Static positions	Extreme flexion of the knee, extreme dorsal/plantar flexion in the ankle
Dynamic positions	Positions of the joints in the range close to the largest spans with the movement frequency of ≥2 min^{-1}
Conditionally acceptable positions	
Dynamic positions	Positions of the joints in the range close to the largest spans with the movement frequency of ≥2 min^{-1} (STEP 2B)
STEP 2	
B	Unacceptable if the machine is used for longer than one half of the working shift

Table 9. Positions of other body parts [9].

STEP 1	
Unacceptable positions	
Static positions	Extreme flexion or extension in the elbow, extreme supination and pronation of the wrist, extreme flexion and extension of the wrist
Dynamic positions	Positions of the joints in the range close to the largest spans with the movement frequency of ≥2 min^{-1}
Conditionally acceptable positions	
STEP 2	
B	Unacceptable if the machine is used for longer than one half of the working shift
Step 1	
Unacceptable positions	
Static positions	Extreme flexion or extension in the elbow, extreme supination and pronation of the wrist, extreme flexion and extension of the wrist
Dynamic positions	Joint positions in the range that is close to the largest spans with a frequency of movements ≥2 min^{-1}
Conditionally acceptable positions	
Static positions	lying position, kneeling, with the knees bent (STEP 2B)
Dynamic positions	Joint position in the range close to the largest spans with a frequency of movements >2 min^{-1} (STEP 2B)
Step 2	
B	Unacceptable if the machine is used for longer than one half of the working shift

2.5. Handling of Loads

The Decree of the Ministry of Health of the Slovak Republic No. 448/2007 Coll. on the details of the factors of work and the working environment in relation to the categorization of work in terms of health risks and the classification of works into categories, as amended, determines the criteria for classification of work activities into categories—physical load factor—handling of loads, heart rate, energy expenditure (Decree of the Ministry of Health of the Slovak Republic No. 448/2007) [10].

Category 1—works for which it is assumed that the criteria set out in [10] Category 2 are not met; Category 2: (a) Work predominantly dynamic, performed by large muscle groups in which the variable net energy expenditure per shift does not exceed the average and permissible values for the age groups of men and women, but exceeds 0.85 multiple of the average and permissible values for the age groups of men and women; per minute, net energy expenditure does not exceed the permissible values for the age groups of men and women, but exceeds 0.85 multiple of the permissible values for the age groups of men and women, or; the heart rate does not exceed the mean heart rate values per shift for the male and female age groups, but exceeds 0.85 multiple the mean heart rate values per shift for the male and female age groups. (b) Work associated with the transfer of loads where the weight of the hand-moved loads does not exceed: the maximum weight per shift but exceeds 0.5 multiple the maximum weight per shift; maximum weight of the load but exceeds 0.2 multiple the maximum weight of the load laid down for males and 0.5 multiple the maximum weight laid down for females. (c) Work carried out mainly in a basic working position while sitting, standing, or changing positions, with regularly occurring conditionally acceptable working positions and unacceptable working positions, but the permissible limits are not exceeded [10].

Category 3: (a) Works in which some of the criteria listed in Category 2 are exceeded; (b) Work associated with the movement of loads, in which the weight of manually moved loads does not exceed the reference mass values, but other indicators of physical load, e.g., energy expenditure or heart rate exceeds the criteria in Category 2; (c) Work performed mainly in the basic working position while standing with limited movement of the lower limbs and a forced pace of work with changes of torso and limb position; (d) Work in which the criterion in Category 2 is not exceeded and for which an occupational disease has occurred repeatedly or the risk of occupational disease in workers in relation to physical activity, in particular, due to damage to the musculoskeletal system and peripheral nerves as a result of long-term, excessive and unilateral loading of the limbs [10].

Category 4: (a) Work in which some of the criteria listed in Category 3 are exceeded; (b) Work in which the criteria set out in Category 3 (a) to (c) are not exceeded and in which there was a recurrence of an occupational disease or a threat of occupational disease in workers in relation to physical activity, in particular, due to damage to the musculoskeletal system and peripheral nerves due to long-term, excessive and unilateral loading of the limbs. (c) Work in which the criteria listed in category 3 are not exceeded, but in which there are additional factors, in particular cold, vibration, humidity, which demonstrably worsen the health changes of employees caused by physical strain [10].

Factors related to the risk of damage to health during manual handling of loads—the main causes of damage to health (Annex No. 1 and Annex No. 3 of the National Council of the Slovak Republic No. 281/2006 Coll.):

Properties of the load: Manual handling of loads can present a risk of damage to health, especially the spine, if the load is too heavy or too big; cumbersome; unstable, or its content can move; placed in such a position that it has to be held or handled in a certain distance from the body, or its handling requires bending or rotating of the trunk; because of its shape, content or consistency it can cause the employees' injury, especially in the case of a collision [10].

Physical strain: Physical strain can present a risk of damaging to health, especially the spine, if it is oversized; the task is achieved only by rotating the trunk; there is a probability

that the load will move unexpectedly; or the load must be handled in an unstable or non-physiological position of the body [10].

Working environment: The working environment can increase the risk of damage to health, especially the spine, if there is not enough space for carrying out the activity, especially in the vertical direction; the floor is uneven such that there is a risk of tripping, or a risk of slipping due to the employees´ footwear; if the workspace does not allow the employees to handle the load in a safe height or a correct position; if the floor level or working surface change (e.g., stairs) and the load must be handled at various level; or if the floor or leg support is unstable; lighting, temperature, humidity, or airing are inappropriate [10].

Requirements for activity: A working activity can increase the risk of damage to health, especially the spine, if it includes one or more of the following conditions: the physical activity is straining, to the spine in particular, too long or too frequently; there is insufficient time for rest or recovery; there are too long of distances during lifting, lowering or transferring the load; a fixed work pace during the working process that the employee cannot change [10].

Individual risk factors: Individual risk factors include age, body fitness, chronic diseases, etc. Operations with loads can damage employees' health, the spine in particular, if the employee is not capable of carrying out the corresponding work activity due to individual physical or health conditions; the employee does not have clothing, footwear, or other personal equipment; or the employee does not have appropriate qualifications and training [10].

3. Discussion

It follows from the above that technical, organizational, and other measures can be proposed in two basic areas: measures to reduce the level of excessive physical strain at work, and measures to reduce the level of excessive mental workload. The basic technical measures that eliminate or reduce the increased physical load at work to the lowest possible level can generally include: (according to Decree 542/2007 of the Ministry of Health of the Slovak Republic): ergonomic adjustment of the workplace; restriction or complete ban on the use of products, tools, and equipment, which cause increased physical strain at work, i.e., technological processes; requirements for adequate microclimatic conditions [50–53].

Regarding organizational measures, particular attention should be given to the organization of work and the work and rest regime.

Other measures to prevent increased physical strain at work may include ongoing assessment of health risks for employees who work at risk of excessive physical activity; assessment of the employees' medical fitness of to work, including preventive medical examinations in relation to work. [54].

Any transport or handling of a load by one or more employees, including lifting, pushing, pulling, carrying, or moving a load which, by reason of its characteristics or adverse ergonomic conditions, poses a risk to workers, in particular that of back injury The employer must take appropriate organizational measures or use appropriate means, mainly mechanical devices, to avoid manual handling of loads by workers. Where manual handling of loads is necessary, the employer must take appropriate organizational measures, use appropriate means, or provide workers with such means to limit the risk of manual handling of these loads [55,56].

Where the need for manual handling of loads by workers is necessary, the employer shall organize the workplace in such a way that the handling is as safe as possible and does not endanger health, and

(a) Assesses, in advance if possible, the health and safety conditions of the type of the task in question and, in particular, assesses the characteristics of the loads.
(b) Tries to eliminate or reduce the risk, in particular, of back injury to workers, by taking appropriate measures while taking into consideration the characteristics of the working environment and the requirements for the said activity.

Employers must ensure that employees or their representatives are informed, as accurately as possible, of the weight of the load and of the center of gravity of the heaviest side of the burden, if the weight of the burden is distributed unevenly.

Employers must also ensure that employees are properly trained and informed about how to handle loads properly and about the risks they may face if these tasks are not carried out correctly.

4. Conclusions

Along with supporting the health and prosperity of employees, a supportive company's policy should address both the question of what must not be done (preventing unhealthy conditions), as well as the question of what must be done (creating resources). Healthy and motivated employees perform better, work longer, and remain more loyal to their companies. In this way, they become an essential economic factor for the company.

Work must not cause illness. Improperly organized and insufficiently creative work has a negative effect not only on the performance of the employee, but in the long run can lead to permanent damage to his or her health.

Signals that an employee is not able to deal with the workload and requirements may include, e.g., employee complaints about overload and excessive physical strain in the workplace, low work motivation, bad work atmosphere, irritability, internal competence disputes, insufficient flexibility, an increasing number of sick leaves, fluctuations, failures, complaints, the need for overtime, non-compliance with the interdepartmental and general deadlines, high overhead costs, etc.

Work-related musculoskeletal disorders of upper extremities are among the most frequent occupational diseases and constitute a serious problem with significant social and economic impact for both individuals and employers. Diseases often return and lead to long-term sick leave and to a reduction in the workers' quality of life.

Timely and effective prevention is the most effective solution. However, in order to be able to implement it, a thorough assessment of the work activities and working environment in terms of health risks is crucial.

In the context of Slovak legislation regarding physical load at workplaces, the employer is obliged to ensure the assessment of physical load at work and subsequently take appropriate corrective measures (organizational, ergonomic, and technical). The article/review provides readers with detailed information on the requirements for the place of work under increased physical load, permissible values of total physical and local muscle load, evaluation of work positions, and of handling of loads in the Slovak Republic.

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