

ISSUES OF OCCUPATIONAL FATIGUE

Anna GEMBALSKA-KWIECIEN

Silesian University of Technology, Organization and Management, Economics and Informatics Institute;
Anna.Gembalska-Kwiecen@polsl.pl, ORCID: 0000-0001-9275-0447

Purpose: The paper deals with the issues of occupational fatigue. One of the features of the work model adopted in recent years is that employees work more than forty hours a week. This results in greater fatigue, which over time may turn into severe fatigue. Then we cannot cope with our work tasks and we are also mentally less resistant to various types of stressful situations, which deepens the feeling of fatigue and exhaustion. Chronically tired people usually suffer from insomnia, which deepens problems with the already disturbed circadian rhythm and does not allow us to have a sufficient rest. Strong and constant fatigue, described as exhaustion, is a signal that your body needs some rest. Chronic fatigue may also indicate the presence of a disease. The purpose of this paper is to highlight this very important problem.

Design/methodology/approach: Literature research of the subject was carried out.

Findings: They fatigue also increase the risk of accidents, defects or mistakes at work. Fatigue itself is not a disease, but only a symptom. According to general practitioners, chronic fatigue, which persists for no apparent reason, is currently one of the most common health problems reported by their patients. Unfortunately, diagnosing and treating this condition is not easy due to the large number of possible causes and risk factors.

Practical implications: The issues discussed in this paper significantly affect the improvement of methods related to work environment management and the desired shaping of employees' attitudes and behavior regarding the approach to the problem of being tired at work, a problem related to work environment that has been downplayed so far.

Originality/value: A holistic approach to the issues of occupational fatigue. Defining it as an interdisciplinary problem. It should be dealt with by doctors of various specialties, especially in occupational medicine, of course, but also general practitioners, neurologists, gastroenterologists, and cardiologists. It also requires the attention of non-medical specialists, including psychologists and physiologists.

Keywords: company management, occupational fatigue, human factor.

Category of the paper: review paper.

1. Introduction

One of the typical features of the work model adopted in recent years is taking on more and more responsibilities that require working far more than forty hours a week. In addition, the era of remote working is here with us – which, apart from bringing undoubtedly positive impacts, has also some negative features. For example, we can work “as much as we wish” and “with no time limits”, because for many employees the professional sphere has entered the private one and they cannot separate them. Unfortunately, as a result, we feel more and more tired, which over time may turn into severe fatigue – and at the same time we do not have time to regenerate.

When we are overworked, we cannot cope with everyday responsibilities and challenges. We are also mentally far less resistant to various types of stressful situations, which in turn further deepens the feeling of fatigue and exhaustion. We also often have chronic headaches, sometimes irritating migraines, tension and pain in muscles, including neck and even spine pains. A very common and troublesome symptom of fatigue comprises problems with the digestive system, which manifests itself in the form of chronic stomachache and diarrhea. Chronically tired people usually suffer from insomnia, which deepens problems with the already disturbed circadian rhythm and does not allow us to have a sufficient rest. For this reason, we are sleepy, apathetic and unable to work during the day. Chronic fatigue quite often causes skin problems, hair loss and even weight gain. For many women, the state of being overworked may result in irregular periods and problems with getting pregnant.

Strong and constant fatigue, described as exhaustion, is a signal that your body needs some rest. Chronic fatigue may also indicate the presence of a disease (Stoner, Wankel, 1997; Gembalska-Kwiecień, 2017; Reiman et al., 2019).

2. Literature review

It's definitely not an easy skill to acquire, that's why many of us learn and improve it throughout their lives (Knight et al., 2010; Sęk, 1991). Of course, there are many definitions of fatigue in the reference publications, so below I will present those that explain the problem concisely and factually:

- Fatigue can be defined as a disturbance in the balance of basic life processes, leading to reduced capacity to work.
- Fatigue is a specific work-related “physiological cost”. This cost should be as low as possible, which is achieved, among others, by introducing proper work organization, including the system of breaks and rest periods.

- Fatigue – forcing us to stop performing activities – is a defensive and protective body reaction protecting it against the effects of excessive strain on the muscles or nervous system. Therefore, this is one of the autoregulatory signals that act similarly to the feeling of hunger or thirst.
- Fatigue is a reversible reduction in the body's or organ's ability to work resulting from performing it.

In general, there are two dominant types of fatigue. This is muscle fatigue, also referred to as physical or local – because it can often be located in a specific place, e.g. in the upper or lower limb. Another type of fatigue is central nervous system fatigue, also referred to as central fatigue, because it is difficult to locate any specific place where it occurs, and it usually covers the entire body.

- Muscle or local fatigue:
 - is a type of fatigue leading to a temporary decrease in the performance of a specific muscle group,
 - causes disorders in the so-called synaptic conduction (in neuromuscular junctions), as a result of the toxic effects of muscle metabolism products (elevated concentration of lactic acid and pyruvic acid in the muscle tissue),
 - occurs during high-intensity work,
 - the effects of muscle fatigue can be removed by providing more oxygen, for example, by massage.
- Central nervous system fatigue or central fatigue:
 - is a type of fatigue including general physical fatigue of the body,
 - mental work fatigue,
 - fixation of the organ of vision on one point or repeatable psychomotor activities,
 - occurs when performing monotonous work,
 - finally, chronic fatigue resulting from the accumulation of various forms of fatigue,
 - occurs with low-intensity work that strains the body for a long time,
 - removing the effects of nervous fatigue typically requires longer periods of rest.

It is generally assumed that a person working physically under normal conditions does not use more than 30-35% of their maximum capacity. Working within 35-50% of one's capacity requires additional motivation from the employee and such effort leads to both mental and physical fatigue. However, working at the capacity level of 65% or higher results in exceeding the so-called “mobilization threshold” and it requires releasing energy reserves (Grandjean, 1971; Mansberg, Thompson, 2008).

Fatigue triggers related phenomena that affect the tasks performed by the employee, in many cases. They include:

- slowing down the transfer of stimuli,
- decreasing the level of attention,

- difficulty thinking (brain fog),
- reducing the acuity of perceiving phenomena through the organs of senses,
- decreased functional (psychomotor) capacity,
- changing the excitability threshold for reflex reactions,
- impairment of the coordination role of nervous centers,
- functional disorders of the cortical part of the adrenal glands.

In general, the symptoms of fatigue can be divided into two types: objective and subjective.

- The objective symptoms include work efficiency fluctuations. These symptoms include, among others: an increase in production defects, more and more frequent mistakes, various types of omissions, damage to tools, accidents at work, etc.
- Subjective symptoms include: pains in intensely working muscles, a feeling of general weakness and irritability or depression, and states of fatigue occurring especially during monotonous work.

Objective symptoms of fatigue can and often are noticeable to those around you, especially to your co-workers. However, subjective symptoms are only felt by a tired person and may not always be noticed by those around them.

Outstanding researcher of the subject H. Kirschner distinguishes the following forms of fatigue:

- Acute fatigue – resulting from very intense muscular or neural and mental effort, which in turn leads to the state of (although transient) exhaustion. It appears if effort is irrationally distributed as well as in emergency situations. Acute mental (nervous) fatigue may occur in traffic controllers, dispatchers, etc.
- Moderate fatigue – occurs while working with medium intensity, but for a long time. This is a completely normal and reversible phenomenon.
- Severe fatigue – occurs when the states of fatigue overlap, when the rest insufficiency is serious. This is a disease-like situation. It results in bad mood, depression, poor appearance, sleep disturbance or many other symptoms.
- Weariness – this is the exhaustion of human working potential. To regain the potential, we have to rest. However, we often experience fatigue without exhaustion of working potential – it occurs especially when we are bored with work or, for example, in the states of alienation.
- Mental fatigue – manifests in the inhibition of activity of cortical centers, which results in relaxation of attention, slowing down and inhibiting the ability to observe, reducing the body dynamism as well as physical and intellectual fitness. The mental fatigue is due to many different reasons. It is different from physical fatigue, which is rather easy to combat and remove. The effects of mental fatigue are quite severe and make our everyday life difficult. Knowing how to recognize the symptoms of this type of fatigue helps keep your body's cognitive functions at the appropriate level. The lack of

motivation to act and the feeling of an excessive workload are the first signals of mental exhaustion. Special cases that require intensive work include mental fatigue in the professional sphere and toxic relationships (Aaron et al., 2001; Chojnacka-Szawłowska, 2009; Sęk, 1991; Gembalska-Kwiecień, 2017; Gros, 1994).

3. Methods of measuring fatigue

Moving on to the next issue, which is the measurement of fatigue, I will quote renowned physiologist G. Lehmann who maintained – “measuring fatigue is practically impossible. There are no methods that could measure both the phenomena of fatigue in individual muscle groups and the processes of fatigue manifesting themselves in the central nervous system or in the autonomic nervous system”.

The above opinion could end the considerations related to the topic of fatigue measurement, but for the sake of accuracy, below we will present a brief description of currently used methods.

At first, you have to determine what type of fatigue you deal with.

Muscle fatigue:

- one can try to determine the blood level of lactic acid generated as a result of physical effort. The greater the concentration, the higher the level of fatigue. However, the load of muscular system may be uneven, and in extreme cases, the load on one muscle may lead to the interruption of work, while the amount of lactic acid will be relatively low,
- determining the level of muscle fatigue based on the pulse rate – you can also try to measure, for example, the pulse rate or the amount of air flowing through the lungs. However, by measuring the pulse rate, we are not able to eliminate other causes of elevated pulse rate.

Central (nervous) fatigue: measuring central fatigue is very difficult and complicated and can only be performed in an indirect way:

- critical flicker frequency (CFF) – uses a phenomenon related to the observation of a flickering source of light stimuli. For example, a person who notices flickering at the beginning of a film show, no longer notices it at the end of screening. More detailed research has shown that the above phenomenon occurs in three phases: initially, the frequency increases (in the phase corresponding to the introduction to work), then it decreases, and finally, at the end of the shift, it increases again under the influence of significant stimulation. This three-phase nature can be observed during both physical and mental work;

- electrical activity of the cerebral cortex – the above activity is recorded by EEG machines showing the frequency and amplitude of the waves emitted by the cerebral cortex. The so-called alpha index decreases significantly in the initial phase of work and then gradually increases. This may refer to the gradual development of inhibition processes under the influence of increasing fatigue. This phenomenon is very similar during mental and physical work;
- reaction time – it was found that one of the criteria for determining fatigue may be the extended response time to incoming stimuli, and above all, the delay in conscious movements controlled by the cerebral cortex motor centers. The research performed shows that immediately after starting a shift, the response time is slightly longer than the accepted reference, but after two hours of work it becomes slightly shorter. However, a significant time reduction occurs after the 15-minute break (after the 4th hour of work), in subsequent working hours the response time gradually increases, reaching its maximum at the end of the shift;
- the value of sensitivity and difference thresholds – this is a mental work specific criterion for analyzers. The test involves examining the sensitivity threshold to determine the lowest stimulus level that triggers the analyzer's response, or difference (sensitivity) threshold to determine the smallest noticeable difference between the intensity levels of two stimuli. These thresholds increase along with the increase of fatigue. However, it should be noted that the value of thresholds is also affected by other factors, e.g. environmental conditions, motivation, etc.;
- precision of sensorimotor activities – the test involves measuring the precision of eye-hand coordination or other sensorimotor activities. The decrease in precision reflects the state of mental fatigue (Zaborowski, 1985; Zimmerman et al., 2015; Zużewicz, 2022; Urbańska, 2010; Stoffregen et al., 2019).

4. Fatigue and its symptoms

Many factors can cause the severe fatigue of the body. Apart from strictly health-related aspects that are not a consequence of any disease, severe fatigue is usually temporary. However, under no circumstances should we ignore it. The severe fatigue can be simply defined as various overlapped states of fatigue that occur under conditions of insufficient rest. The phenomenon itself is similar to some disease conditions. It can manifest itself as poor well-being, depression, sleep disturbances, constant fatigue, and sometimes even poor physical appearance.

Body fatigue is largely caused by depleting energy reserves. If we feel tired, it means that our body is rebelling, it wants to tell us that we should slow down or just have a rest – this is a simple way of trying to get us back in order. This is a physiological reaction that protects our body against working too much.

It is believed that the most frequent cause of severe fatigue results from taking on too many responsibilities in professional and private life, for which we simply do not have time during the day. As a result, our brain works constantly at the highest speed, and the body does not have time to regenerate, because we do outstanding things at the expense of sleep, and the brain has practically no time to rest. The brain does not slow down even during sleep, because we lie down with our heads filled with thoughts and unfinished tasks. As a result, we do not enter the deep sleep phase, which in turn takes our life energy away the next day. If this situation persists, it may lead to serious consequences and cause many diseases. Therefore, it is so important to find a balance.

Our country is one of the countries where people work the most. Despite the statutory eight hours a day, Poles often work overtime. Some people additionally work at home. This is the way plain body fatigue turns into severe fatigue. It should be noted that long-term mental and physical severe fatigue can lead to serious health problems (De Drue, Gelfand, 2008).

The most common symptoms of body severe fatigue are:

- Sleep problems, both insomnia and excessive sleepiness, sleep is unable to regenerate the body:

long-term stress and focus on professional duties can make it difficult to fall asleep, resulting in waking up during the night and leading to problems with getting up. Sleep deficit increases the symptoms of severe fatigue, which is why your well-being and health deteriorate week by week. Disturbing thoughts make it difficult to enter the deep sleep phase, it does not allow reducing the level of stress hormone cortisol, which induces frequent waking up during the so-called restless sleep. Excessive daytime sleepiness and sleep disorders are the first alarm signals sent by our body.

- Apathy and frequent mood swings:
indifference to external factors and reluctance to start any activity – these are other symptoms of fatigue that should prompt you to take care of your health. Apathy, manifested by severe depression and a decrease in involvement in everyday duties that previously did not cause any problems, may cause tension in the workplace. Sometimes it may also manifest itself as an excessive, unjustified state of excitement and nervous arousal. Bad mood, lack of interests, depression, feeling nervous, reluctance, loudness, blocking thoughts, which results in problems with decision-making process, concentration and motivation. Such problems increase proportionally with the feeling of severe fatigue.

- Frequent recurrent infections (poor body immunity):
the body can signal severe fatigue in many ways. Recurrent colds, various types of infections, low-grade fever, herpes and other skin diseases – if we often experience such symptoms, it is worth not only considering a vitamin supplementation, but also undergoing thorough medical tests.
- Headaches, migraines and dizziness:
other somatic symptoms of fatigue include nervous system problems – headaches of varying severity, as well as migraines with accompanying symptoms such as photophobia, nausea or dizziness. In the event of these and other physical problems, you should always first carefully have your entire body examined and consult a doctor to rule out any underlying diseases.
- Decreased intellectual efficiency (reduction in the level of intellectual functioning):
exhaustion impairs concentration, ability to remember and encourages making mistakes. Work overload may lead to much poorer capability of performing duties and tasks entrusted to us, and thus reduce the quality of our work. Sometimes such situations have serious consequences. Failures at work and dissatisfaction of superiors, in turn, translate into increasing the feelings of depression and stress.
- Poorer work efficiency (disorganization and decreased work efficiency):
another sign of severe fatigue is spending too much time on individual tasks. This results from the symptoms mentioned above, including difficulty concentrating, distraction, reduced intellectual performance, or more frequent mistakes.
- Lack of satisfaction at work, occupational burnout problems:
the work that used to give us satisfaction begins to irritate and tire us, and as a result we are unable to come to work. We run away from any tasks and professional challenges. The work we do makes us feel almost physically uncomfortable and, consequently, unable to continue doing it.
- Eating disorders, nausea, abdominal pain:
digestive problems are often one of the symptoms of severe fatigue. They manifest themselves in various eating disorders, and may also include nausea, vomiting, and severe or chronic stomach aches.
- Skin discoloration:
this symptom is not frequently associated with fatigue, but as numerous studies have shown, fatigue may manifest itself in this type of symptoms.
- Excessive sweating:
sometimes excessive sweating, especially if we have not noticed such symptoms earlier, may indicate fatigue, increased stress or even related pain sensations (Maslach, 1994; Heimpel et al., 2006; Knight et al., 2010).

5. Costs of fatigue

Among the many factors that directly or indirectly affect the quality of managerial staff work, one of the last one considered is often fatigue, which affects everyone, both physically and mentally. Each of us becomes exhausted to a greater or lesser extent after work, and the more time during the day we spend on working, the more tired we become.

Polish employers – obviously not all of them – often perceive work fatigue as an individual problem of a specific employee. They often see it as a lack of organizational skills or insufficient commitment in the subordinate, forgetting about the huge number of assigned duties and tasks to be performed. In addition, in some cases there is also shift work, which also, to a large extent, may contribute to the body's severe fatigue. Research from the last twenty-five years shows that cumulative fatigue combined with shift work, especially at night, leads to an increased risk of diseases such as hypertension, digestive system disorders and long-term insomnia. In addition, companies relying on high work productivity rate can be severely affected when employees are chronically tired, mainly due to a drop in the efficiency of the staff operating the production lines, but also due to the higher risk of accidents, being costly in every aspect.

It should be also noted that overworked employees generate huge costs. Numerous studies and calculations indicate that work-related fatigue consumes significant financial resources in many organizations.

Employees' severe fatigue directly correlates with many aspects, including:

- the costs of production downtimes,
- sick leave score,
- productivity drops,
- increased level of product complaints,
- reduced operating profit.

Unawareness often results in employers not taking proper care of this aspect of work, thus exposing themselves to high overhead costs due to human fatigue.

One of the elements of responsible employee management performed by appropriate managerial staff should be ensuring employees' concentration on work and involvement, among others, through appropriate scheduling, not piling up tasks and providing good working conditions. We should always take into account the costs of work-related fatigue, aspects of monitoring this factor among staff, as well as building solutions to these problems. It is time to understand that high costs, risks and responsibility for people caused by long-term work-related fatigue is unacceptable and should be financed as part of running a responsible business (Strelau, Zawadzki, 2008; Kowalski, 2024; Taylor, 2010; Telzer, 2009).

6. Profession-dependent work rhythms

Many professions involve working at regular, but sometimes very unusual hours, as is in the case of bakers, printers, food and staple product suppliers in large urban agglomerations, who also perform their tasks at night. On the other hand, milkmen and postal sorting employees work in the early morning hours, while health care workers, mid-level practitioners and doctors decide about the lives and health of patients all day and night – the same applies to services responsible for public safety, including the police, city guards, fire fighters and others, they all work 24/7 (Gembalska-Kwiecień, 2017; Witkowski, 1994).

Performing the above professions determines working hours. We can often set the rhythm of our work, but for some reasons we do not always choose the one that is optimal for our body.

Below we present the list of the most popular work rhythms used by employees:

- Machine rhythm – an employee works equally well and in the same rhythm from the beginning to the end of the shift; such people, working “like a machine”, and according to physiologists are not the best employees at all.
- Extreme-spurt rhythm – frequent changes in the employee's performance are observed; going from a very fast pace to a slow pace and back again; work is nervous, jumping from one extreme to another, this mode of working is very unfavorable, leads to rapid fatigue and causes neurasthenic symptoms in the employee (the feeling of inability to cope with work).
- Physiological rhythm – the employees adjust the work pace to the physiological rhythm; they go through the phase of getting used to work (warm-up), which usually lasts about 30 minutes, then their work efficiency constantly increases up to a certain maximum; around noon there is a drop in performance, while in the afternoon it increases again, but without reaching the morning peak, and then it decreases until the end of the shift.

7. Conclusions

One of the priorities in shaping desired organizational behavior is maintaining high efficiency and quality of work. There is no doubt that both efficiency and quality are determined by the employee's well-being. And this is very low if the employee is tired. This results in a significantly reduced efficiency at work. The states of fatigue also affect private life, reducing its quality. They make it difficult to function and cause concentration problems. They also increase the risk of accidents, defects or mistakes at work. Fatigue itself is not a disease. It is just a symptom. Often, the feeling of weariness or sleepiness during the day is just a signal sent by the body encouraging us to take some rest and get enough sleep.

Periods of temporary fatigue or even exhaustion happen to everyone, and there is usually a reason behind it that is worth identifying and addressing. When we become feeling tired, drowsy, weak or deprived of energy, it is good to simply listen to our body and have some rest. However, it should be noted that if the fatigue persists for a longer period, we should consult a doctor. According to general practitioners, chronic fatigue, which persists for no apparent reason, is currently one of the most common health problems reported by their patients. Unfortunately, diagnosing and treating this condition is not easy due to the large number of possible causes and risk factors (Gembalska-Kwiecień, 2017; De Drue, Gelfand, 2008).

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