The psycho-physiological effects and symptoms among computer's operators

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Abstract:

The present study dealt with the psycho-physiological effects and symptoms among computer's operators. It was found that these operators suffer from effects and symptoms due to bad work place design and organisation as well as to bad environmental conditions let alone their suffering from stress and burnout because of higher work load and absence of rest pauses in particular and the bad organisation in general.

Things that will have a negative reflect on their psychological state as well as family and social life. This has made it easier for the appearance of many physiological and psychological symptoms among them, such as vision troubles, musculoskeletal symptoms, the cognitive operations like memory trouble and diversity of attention and difficulty of concentration, in addition to different stress symptoms like anxiety, depression and nervousity. nervousness

1. Introduction:

The computer has become our most common tool and one of the absolute necessities nowadays and as a sign of modern technological development. It has become so useful everywhere as if nothing can be done without it. Its use is essential to all sectors and services such as administrations, health services, education, as well as financial and commercial services …etc. People do not rely on it just at work, but they use it even at home and in their free time.

Moreover, children of all ages are fond of this machine that provides them with information, games, and different services, let alone when they start working. For example, in Sweden more than one worker out of two uses a computer in his work, and about a third of workers spend more than half of their working time sitting in front of the computer (National Institute for working life, NIWL, 2004).

It is true that the computer has introduced many changes and made life easier for people to do so many tasks in a short time and with great efficiency and accuracy. However, the question behind all that nowadays is whether the overuse of computer can have any physiological and psychological effects on individuals using it, which may lead eventually to some negative drawbacks on their health. Especially in the wave of the quick widespread and continuous overuse of computer. Perhaps that is why more and more information is appearing concerning working conditions and health effects on computer's operators.

Despite the differences of these conditions from one company to

another, the high performance requirement, stress of time and the difficult working conditions, in addition to the miss management and absence of ergonomical principles at the workplace, have all been related in one way or another to problems that computer's operators are suffering. These matters have drawn the attention of more researchers to study the negative effects on their well-being as well as their work performance (Lips et al, 2003, NIWL, 2004).

Furthermore, the rapid development of visual displays means in recent years, and the increasing number of screen workplaces, have certainly introduced many changes on the working conditions and provided many subjects and fertile fields for scientific studies. All this in order to answer different questions put forward as consequences of using this type of technology by the human being. Perhaps what really distinguishes this job and adds to its complexity is the variety of tasks performed by the operator, the technical differences among screens themselves, in addition to the organizational aspects that guide the operator as a whole such as the importance of the task and its diversity. There are also individual differences among operators, both on the level of performance and the visual reaction of every one, in addition to the appearance of some visual symptoms among them, which might lead to negative consequences on the operators that need the appropriate preventive precaution (Lips et al, 2003).

In general, any job that needs keeping still posture for a long time can cause musculoskeletal discomfort, and it seems that the variations of the human operator's posture in proportion to the flow of information. For example, Fourcade et al (1975) has pointed out that the reading distance has a leading influence on the determination of postures. Therefore, the static forward posture enforced by visual, auditory and manipulative tasks seemed likely to explain the work-attributed symptoms (Ferguson, 1976). Hence, it seems that bad design of work place and job contributes in the appearance of discomfort. Duncan and Ferguson (1974) have strongly confirmed that the occurrence of symptoms was strongly related to operating posture of hands, arms, and trunk as well as to work height and equipment design.

Mathiew (1997) studied the development of visual functions of hundreds of computer users. He concluded that there was no decrease in their visual acuity compared to other people in the society. However, he found that the bad correction of vision was the cause of some symptoms like visual fatigue and found out that 40% of the subjects wearing medical glasses suffer from unsuitable vision correction.

Furthermore, Boudrifa et al (2000) found that computer's operators have negative attitude towards wearing medical glasses due to some sociological and psychological factors and cultural values despite the fact that their visual acuities were low and complained from many visual symptoms. This negative attitude does not concern just this type of operators, but it is wide spread among a great number of people, and even school children have similar negative attitudes towards medical glasses. They are all squared from being nicknamed "blind" "four eyes" and so on. Yet, they all rush to wear sunglasses as fashion without any negative or even preventive ideas in their mind.

Elias, R and Cail, F (1982) think that the age and the use of medical glasses are contributing factors in visual fatigue among computer users even with good vision correction, and that job requirement on the screen and its accuracy show the vision defect even if it is slight (Yaout, P.T and Taylor, S.P, 1990).

Perhaps the variety and content of tasks aggravate the degree of visual fatigue because information from documents and writing it on the screen need frequent eye movements between the document and the screen, and every time the eye needs to accommodate because of the contrast between the background and the screen documents. This factor increases the vision fatigue, especially when doing a lot of work for long periods without having breaks for recovery from visual fatigue (Rossignol, A and Porsee, E, 1987, Osthergo, S.M, 1987)

2. Method:

2-1 Subjects:

Twenty-five operators who work at the postal office center for cheques and (CERIST) participated in this study. Some of their individual characteristics are shown in table (1). The interview took 30 to 40 minutes. An interview guide was especially prepared for this purpose in both Arabic and French due to the difference in the education level and language in which each operator was educated.

Characteristics	Sex		age			Educ. level			Status			Actual job		Job experience			Basic training		
Categories	Male	female	20 - 30	31 - 40	41 - 50	middle	secondary	higher. educ	Single	Maried	Divorced	Employee	Engineer	0 - 1	2 - 10	11 - 30	Technicien	Higher Tech	Engineer
Frequency	9	16	12	07	06	03	10	12	15	09	01	14	11	02	14	09	03	10	12
Percentage	36	64	48	28	24	12	40	48	60	36	04	56	44	08	56	36	12	40	48

Table. (1): individual characteristics.

2-2 The Study tools:

A primary study was carried on the physical and psychological effects and symptoms among computer's operators by asking them about their frequency and causes, in addition to what was achieved by different researchers in this field. This has helped to point out the necessary steps for this study through the expected hypothesis that might be the reason of bad adaptation between man and his job because of the bad design or the lack of organization.

It became clear that jobs requirements are different which has made the physical and psychological effect and symptoms vary from one operator to another and from one job to another. For this reason, a general interview guide was designed, in order to study the physical and psychological effects and symptoms among computer's operators. This has ended up by setting nineteen open-ended questions for this purpose. The interview guide was then applied in the field by recording the

operators' answers on a small tape-recorder as well as observing the behavior, they adopted with each question.

2-3 . Description of the study tool:

In order to clarify the importance of the computer's workplace design and its effect on the operator effectiveness and his psychic as well as his physical health, an interview guide was prepared as a tool to carry out a constructive interview. It was designed in order to collect as much information as possible about the psychological and physiological effects and symptoms among computer's operators due to the bad interaction of the system man-environment-machine.

This guide consists of an introductory instruction and nineteen open ended questions. The aim of all that is to get the operator's views about the design of the workplace, its effects on his psychic and physiological health and the conditions in which he is doing his task. In addition to matters of organization and relation, as well as economical, financial, and living conditions for doing this job.

The following principles were taken into account in the design of this interview guide:

1. Graduation of questions from general to specific.
2. Ordering questions from simple to complex ones in order to facilitate the flow of ideas.
3. The questions were open-ended aiming to provoke the subject in order to collect the maximum of information about different design and organizational factors as well as his psychic and health effects.
4. The questions were asked in an indirect way to avoid psychic resistance and inhibition of the subject.
5. The questions were constructed in order to help conducting an oriented interview.
6. To facilitate the beginning of the conversation, the subject was asked to give some general information about his individual characteristics.

2-4 . Description of the interview guide:

The interview guide contains an introductory instruction to identify the study and explain what is required from the subject and to give some general information about his individual characteristics. This guide also consists of 19 questions distributed over the following axes:

Axe 1: design factors

This is treated through the two questions number 1 and 2. Question 1 deals with how convenient is the workplace furniture to the performance of the task but the second question covers the use of computer and the different adjustments of its parts.

Axe 2: Environmental conditions:

They are dealt with in question 3 by searching on to what extent the environmental conditions affect the computer's operator during his work.

Axe 3: work difficulties and the organization of working hours and rest pauses.

It is dealt with through questions 4,5,16 and 18. Questions 4 looked at difficulties facing the computer's operator to carry his different tasks. While questions 5 treated problems, he could encounter in organizing his work according to working hours and rest pauses. Questions 16 raised difficulties facing operator at the beginning or end of his daily work. Questions 18 checked whether the operator uses the computer outside his work for other purposes like training, entertainment, completing the work…etc.

Axe 4: Cognitive operations:

It is dealt with in question six by asking about difficulties facing the computer's operator concerning the cognitive operations such as concentration, and attention memory

Axe 5: Physical and psychic symptoms:

The questions number 7, 8, 14 and 15, look at how the computer's operators could suffer from physical and psychic symptoms and to what extent does it affect his psychological state. In addition to the difficulty to adapt the right posture during his work, as well as the different effects and drawbacks, related to long working hours on the computer.

Axe 6: The effect of work on social life.

It is dealt with through question 9 by wandering on the effect of work on the operator's family and social life.

Axe 7: occupational stress:

It is treated in question 10 and 11, by asking the subjects about some of the symptoms and effects that appear when they are exposed to occupational stress and what their methods of resistance are.

Axe 8: vision and its correction:

Both questions 12 and 13 deal with the investigation concerning visual difficulties faced by the operator during his work on the computer and whether he is seeking any protective means.

Axe 9: Proposed Modifications for Future Prospects:

It is dealt with through questions 17 and 19, by trying to know the operators proposed modifications for future prospects in order to improve his performance in addition to raising the question on how much does he relate his future to computing field.

2-5 . The Interview Recording:

1. The interview was recorded on auditory tape by using a small tape recorder after going through the following steps:
2. To begin with, the interviewers trained on each other by trying to apply the interview guide on each other as a first step to get used to the question used in it.

3. An appointment was fixed in advance with the operator.
4. The interviewer tried to prepare a suitable room for recording the interview; however, the working situations as well as the task requirement were not favorable. This has forced the interviewer to carry the interview most of the time at the workplace, and even while the operator was doing his task when the working duties obliged him to do so.
5. The interview was recorded in an individual way for each operator and by one interviewer.
6. Each time, the interviewer introduced himself to the operator before starting the interview in order to make the atmosphere suitable for carrying a friendly conversation (psychological preparation).
7. During the interview, the operator was made comfortable to express himself smoothly and freely so; the interviewer interferes only when he sees some psychic inhibition or the operator does not react to the question. These interventions were usually made by using the clarification key words supplied between brackets as examples to provoke the subjects.

1-1 . Method of treatment of the results:

8. Listening to the recorded interviews in general as a primary step.
9. Analyzing the auditory content by classifying contents in a special table for their frequency in order to identify most items related to each question.
10. After the operation of classification, three researchers listen each recorded interview separately, so that each one would have expressed its content using the same unified model for classification.
11. The common content analysis was achieved after a discussion between the analysts.
12. The technique of content analysis focused on the ideas instead of items or sentences or words. The meaning and their frequencies were taken as units for analysis in order to identify important factors related to each question or axe.
13. After making the necessary addition, the research corpus was then obtained. this was considered as the main data to use for any analysis.

3. Results:

3.1. The workplace design factors:

It appears from table (2), that most subjects expressed their dissatisfaction towards the bad furniture used at their workplaces. It is either the chair is not suitable, or the desk is bad, and sometimes both of

them are unsuitable. Perhaps what is most important to notice is that the operators are very conscious and aware of the furniture quality and its importance? They mentioned the role of adjustable chairs and the necessity of the compatibility between the chair and the table. They also singled out the importance of the screen filter and its role in preventing risks for the vision. Moreover, they stressed on the fact that the equipment is old and does not go with the actual development or the task requirements. Things that could provoke the appearance of many obstacles during work like work overload, being late, or making delays.

It appears from table (2), that subjects complain and suffer instead from bad seat and desk design as well as computer's component and everything that can weaken the necessary adaptation between all the components that can affect the system: man- environment-machine. The objective of workplace design for computer work can be achieved only if all its components mach each other and interact in a way that is suitable for the common objective. This is because the effectiveness of each component can only be measured in the general context of the workplace.

The design can go wrong when does not take into consideration all the anthropometrics, biomechanics, physiologic and behavior characteristics of the worker. The beginning of designing the system: man- environment-machine, what is usually done by designing the workplace and then adding to it the chair and other things as supplementary ideas. This is usually done without taking into consideration the internal constraints of the operator's body and the external constraints imposed by the type of work and its environment. This can force the worker to seat in a difficult posture, usually without a legroom, and even if it exists, it is often not deep or narrow or with low. As it is the case for the workplaces in which the subjects of the present study work. The same can be said about the rest of the concerned elements like the footrest that is not supplied. The heights of both the seat and the table are not adjustable, despite the individual differences in body dimensions between the subjects. The seat and the other elements should be adjustable so that the operator can sit comfortably when his feet are put flat on the floor, and the angle between his knees and buttock is about 110 to 120. The right height helps the worker to rest his feet on the floor; otherwise, the body posture of the worker becomes so stressful. (Boudrifa, 1979, 1984, 1996).

The working surface height should be adjustable because if it is low it will make it impossible to reduce the load imposed on the worker. In this case the key board and mouse are placed in a position that makes the wrist often raised up, And if the work surface is too high, this will force the sitter to raise his shoulders and his arms sideways to help his low arms reach the work surface, which often causes problems at the neck level, upper back and shoulders (Boudrifa, 1979, 1984, 1996).

The keyboard should be right in the front by about 12-15 cm, to allow the wrist to get support from the table surface between the table edge and the keyboard. All other The devices should be at the same height as the keyboard, so that the operator can work with his upper arms near to his body while keeping his lower arms supported on the table (Lips et al 2003, National Institute for working Life, 2004). The screen should

be in front of the worker by about 60-80 cm, so that he can look straightforward by leaning slightly forward by about 20-30°. In case, the screen is near, it becomes so difficult for the worker to see displays, and often suffers from flickering, but if these displays are so high, they will cause eye and neck problems. (National institute for working Life, 2004, Lips et al, 2003).

Items:	Freq	%	Items:	Freq	%
The chair is unsuitable.	22	88%	The backrest is not suitable.	23	92%
The table is unsuitable.	24	96%	The covering of seat is not suitable	10	40%
The chair does not go with the table's surface.	22	88%	The screen is bad for the eyes.	18	72%
The arms rests are obstructing.	10	40%	The absence of screen filter.	23	92%
The height of the working surface is low	22	88%	The absence of copyholder.	25	100%
The absence of footrest.	23	92%	Tie mouse is not comfortable for the hand.	22	88%
The desk is too small.	23	92%	The effect of light on the screen.	23	92%
The chair is not adjustable.	22	88%	The key board is not suitable	20	80%
The desk is not isolated	14	56%	Difficulties and obstacles at the level of programming	20	80%
The furniture is not adapted for computer work.	22	88%	Ageing of the equipment.	20	80%

Table (2): The workplace design factors.

3.2. The Environmental working conditions:

The results of the present axe concerning the physical environment showed that the majority of subjects expressed their dissatisfaction about the environmental conditions. The discomfort was so obvious through expressions related to high degree of humidity, noise, unsuitable light, and lack of hygiene. This indicates that physical conditions were not suitable for working on the computer.

The results shown on table 3 emphases on the fact those most computers' operators suffer from bad environmental conditions at the work place. They complained of the lack of light because good vision is one of the most important requirements of working on the computer. Hence, special attention should be paid to the design of good lighting in the workplace, like avoiding the existence of strong source of light in the operator's visual field; the screen should not be in front of or near the windows.

It appears from the operator's complaints that most of the ergonomical principles are missing at the workplace; bad lighting, unsuitable wall painting, no curtains for most windows, a lot of dust and electricity interruption from time to time, All these factors might reduce the level of lighting which should not be less than 500 lux at the workplace.

Moreover, subjects complained of annoying noise caused by workers talking loudly in workplaces. It should be pointed out that the standard sound level should not exceed 40 decibels. Perhaps this is because a lot operators share the same office. This does not facilitate concentration and affects the level of ventilation. This situation does not meet the standard level set for each individual as 10 m^2, whether the office is for one person or for more. At the same time, long offices should be avoided, and in all cases, their length should be double their width for offices less than 25 m^2. As for those bigger than that, the length should be three times the width.

It is perhaps normal for subjects to complain of unsuitable temperature and the lack of ventilation, high level of humidity, and bad smell, in small offices crowded with individuals. It is expected in this situation that the ergonomical principles for these factors are not met. Usually the internal ventilation is adapted to the number of individuals, computing equipments and the rest of machines in that particular workplace. Otherwise, the latter will be transferred to a warm area, with dust and poor air quality. Whereas the normal working environment should be with 20-22° of air temperature, 150 mm/s air speed in winter and 250mm/s in summer. (National Institute for working Life, 2004)

It should be pointed out however, that in addition to all these bad environmental conditions, there are enormous individual differences between operators, which made it almost impossible to find the right environmental conditions for all of them. This is not only because of all factors mentioned above, but mainly due to the fact that most of them

suffer from different illnesses, like respiratory, vascular, rheumatism, and musculoskeletal diseases which made them very sensitive to any environmental change, and what might be comfort for one person might well cause discomfort for another.

Hence, In addition to the discomfort caused by bad workplace design for working on computer especially the chair and the table, the unsuitable physical conditions add in their turn in the level of the operator's discomfort and fatigue. This matter can increase the level of stress and all what can result from that as symptoms like anxiety, frustration. Especially with the frequent electrical interruption, the increase of workload, difficulties facing operators to read documents and the lack of rest pauses for ones and its non-existence for others. Adding to that the problem of crowded offices and the tense social relation between operators.

Items:	Freq	%	Items:	Freq	%
The light is not suitable	22	88%	Electrical interruption	23	92%
Too much dust	23	92%	The painting is not suitable	20	80%
Excessive noise	23	92%	High degree of humidity	22	88%
Lack of ventilation	24	96%	Absence of curtains	20	80%
Too much smell	23	92%	Lack of maintenance	20	80%
The temperature is not suitable	20	80%	Lack of hygiene	19	76%

Table (3): The Environmental working conditions.

3.3. Work difficulties and the organization of working hours and rest pauses:

It appears from the results obtained by analysis of the axe related to work difficulties and the organization of working hours and rest pauses (see table 4), that computer's operator are suffering from various difficulties related to this job. Some of them have to do with difficult working conditions, others with bad relations, the lack of communication at work, and task difficulties such as obscure documents. The analysis of results of the present axe also shows that the task of working on computer is related to so many difficulties that affect work. This has made worker repeat expression such as "Increase work load".

The results also demonstrate that most subjects suffer from frustration due to the absence of any encouraging incentives, and that work is well over the ability of the individual. Perhaps, that is why the job of the computer's operator is described as: "the job that does not finish" when considering time and space. The Time shortages, and lack of recovery, especially what is related to the stress of working for long time on computer, is often behind the stress caused by fatigue that is associated with feeling of depression and burnout. In addition, to the fact that computer's operators are usually exposed to dissatisfaction of both their supervisors and the customers in the case of not being able to finish work that does have an end, or making mistakes due to reasons that are out of their reach, like dealing with obscure document with

information to be fed into the computer.

Hence, workers are exposed to high level of stress because of being responsible for protecting or defending themselves against personal allegations due to delays or errors. In addition, to the absence of any encouraging incentives and recognition of their efforts, Despite the fact that the latter is often greater than the individual abilities and most of them (96%) are forced to continue their work outside working times or delay their leaving work by one to one hour and half at the end of the day. This stress caused by long time during work on computer, the insufficient recovery, and the lack of rest pauses, can contribute to the feeling of the worker of being overcame and unable to control the work, especially if he does not find the necessary support and understanding and cooperation from his colleagues and management. This matter aggravates their anger towards the management, especially that these supplementary hours are imposed without warning and without any financial compensation for this unexpected extra-effort.

Items:	Freq	%	Items:	Freq	%
High work load	25	100%	Problems related to supervisors	22	88%
Difficulty to work in noisy places	25	100%	Absence of encouragements an appreciation of efforts	25	100%
Absence of clear and readable documents	23	92%	Obligation to continue work outside the working hours	24	96%
Difficulties related to work conditions	22	88%	The work load exceed the abilities of the operators	24	96%
Relationship problems	23	96%	Thinking about work even outside the working hours	25	100%
Lack of transports	25	100%	Preferring early start and leaving	25	100%
Absence of restaurants	25	100%	Reducing the volume of working hours and family life	24	96%
Shortage of time	25	100%	Contradiction between working hours and family life	20	80%
Irregularity in receiving documents	20	80%	Claim for flexibility in working hours	24	24%
Stress of feeling responsible	22	88%	Using computer for entertainment and leisure	10	40%
Lack of rest pauses	22	88%	Non-use of computer to avoid exhaustion	20	80%
Difficulty to compromise between work and family	20	80%	Absence of means to use the computer	20	80%
Absence of encouraging incentives for work	25	100%	The use the computer to complete the work	15	60%

The present results also showed that the computer's operators have special preferences; they like to begin their work early in the morning and leave it early in the afternoon. They also hope for reduction in working hours, which show how difficult their job is. Moreover, their use of the computer outside work is limited to entertainment or

continuing work at home for some of them, while others try to avoid even just seeing the computer outside their workplace, whereas there are who like to use it even outside work unfortunately they do not usually have the financial means to do so.

It is therefore necessary to introduce some organizational mechanism whether on the levels of working hours or their timing as well on the duration of rest pauses and their frequencies. In addition, the management should not overload the computer's operators by trying to compromise between the quantity of work to be done and the necessary number of workers to avoid working burnout. It is also necessary to adapt the working hours to the wish of the worker and his individual situation, like introducing flexible working hours, and improving the design of the workplace. Perhaps the effect of burnout will be shown better when treating the cognitive processes in the next axe. (Boudrifa, 1995).

3.4. Cognitive processes:

It appears from the analysis of the results of this axe, that the cognitive processes of the computer's operators are being disturbed because of bad environmental conditions, work difficulty, and absence of good comfortable workplace furniture. The two cognitive processes most affected are concentration, attention that negatively affects the performance of computer's operators, especially, perception that is the base for other operations. Hence, the results shown in table (5), are perhaps just the symptoms and effects as results of what was exposed in the previous three axes.

Items:	Freq	%
Lack of concentration	20	80%
Diversity of attention.	23	92%
Difficulty in memorizing	24	96%
Disorders of cognitive abilities because of exhaustion and bad temperament.	20	80%
Lack of concentration and diversity of attention because of noise.	24	96%
Lack of concentration by the length of the working period	24	96%
Lack of concentration by the raise of work load	24	96%
Lack of concentration because of thinking about personal problems.	20	80%
Lack of concentration because of going and coming of persons.	23	92%

Table (5): Cognitive operations.

3.5. Physical and psychological symptoms:

It can be noticed from the results in table (6), that subjects are suffering from so many negative effects including different biological and physiological functions, as it is the case for the disturbance of blood pressure, and pain at the eyes, shoulder, arms, and hands in particular and physical fatigue in general. (See table 6). In addition to the physical effects, there are also so many psychological effects (see table 7). They include different nervous, psychological, and cognitive aspects and even

temperament.

In this context, subjects have expressed to what extent "the disturbance of their psychological life" as they are living situations of anxiety, depression, stress, and sadness mental fatigue, in addition to loss of appetite and sleep disturbance. It appears therefore, that computer's operators are suffering from physiological and psychological disturbances. This means that this task of working on the computer presents a situation of continuous stress. Perhaps that is why associated physiological or psychological symptoms with stress are usually expressed, not only that, but it could reach the degree of occupational burnout for some of them, which goes with what was concluded by Elias. R and Cail.F (1982)

Both physical and psychological symptoms reflect different types of difficulties from which the computer's operators are suffering. In another way, the different defects in the workplace design correspond to these physical and psychological symptoms, which show the bad adaptation between work and the operator, i.e. between the latter and the machine (computer and its accessories) and what relates between them as physical and social environment. It can be concluded thererefore, that these symptoms are expected through operator's complaints from bad workplace design and deteriorating physical working conditions, in addition to the bad organization of working hours and rest pauses, and the absence of work incentives as well as any encouragements and recognition of their efforts,

Items:	Freq	%	Items:	Freq	%
Physical fatigue	25	100%	body vibration	20	80%
Headache & migraine	24	96%	Disc pressure pain	02	08%
Neck ache	23	92%	Muscle cramp	20	80%
Backache	23	92%	Pins and needles	19	76%
Joint pain	23	92%	Curvature of the fingers	22	88%
Body Heaviness	24	96%	Feet pain	20	80%
Hand pain	24	96%	Fingers Curvature	05	18%
Drowsiness	22	88%	The appearance of skin spots on the arms	20	80%
Skin irritation	22	88%	Feeling of muscles' stiffness.	20	80%
Smell irritation	20	80%	Difficulty of walking after prolonged sitting	23	92%
Vision disorder	25	100%	Buttocks pain	22	88%
Rheumatism	05	18%	Blood pressure disorder	15	60%
Wrist pain	22	88%	Irregular heart beats	15	60%
Upper arm pain	22	88%	Pain in the lumbar region	23	92%
Fingers pain	22	88%	Difficulty of breathing	15	60%
Sleep disorder	19	76%	Pain under the thighs	22	88%
Body exhaustion	25	100%	Pain in the shoulder	20	80%
Eye itching	23	92%	Pain in the elbows	20	80%

Table (6): Physical symptoms.

Items:	Freq	%	Items:	Freq	%
Discomfort	24	96%	Loss of self-control	15	60%
Frustration	20	80%	Free time Anxiety	10	40%
Nervosity	22	88%	Depression	19	76%
Psychological stress	25	100%	Sadness	15	60%
Anxiety	18	72%	Nervous fatigue	22	88%
Anger	15	60%	Feeling of reaching goals	22	88%
boredom	20	80%	Failure of Taking step to move	22	88%
Tension	20	80%	Feeling like machine	15	60%
Wandering	20	80%	Feeling of dominating the computer	12	48%
Talking to oneself	04	14%	Opting for self isolation	10	40%
Insomnia	20	80%	Work Dissatisfaction	12	48%
Annoyance	22	88%	Failure to face work load increase	22	88%
Loss of appetite	19	76%	Psychological disorder	10	40%
Obsession	22	88%	Feeling of isolation	20	80%
Difficulty of work	22	88%	Seeking quietness	24	96%
emperament	20	80%	Choking by seeing the computer	23	92%
Memory disorders	22	88%	Feeling of routing	23	92%
Forgetfulness	20	80%	Psychological conflict	15	60%
Psychological fatigue	23	92%			

Table (7): Psychological symptoms.

3.6. Effect of work on family and social life:

The computer's operators' complaints are not limited by expressing the physical and psychological symptoms, but also extend to the effect of this type of job on social and family life. They show difficulties in compromising between the two due to overwhelmed work load, especially deterioration of social relation including family life and even marital life. Despite all that, working on computer still represents a social value and is a source of gracefulness and showing off, and above all a platform for Self-actualization. This means that despite the fact that working on computer imposes a burden on social and family life, it still represents a sign of personal development.

Items:	Freq	%
Increase of fatigue	20	80%
Life Conditions	22	88%
Taking the work rhythm home	22	88%
Difficulties of compromising between work and home requirements	15	60%
Negligence of children because of exhaustion	10	40%
Lack of rest	19	76%

Absence of weekly holiday	15	60%
Lack of communication with family members	20	80%
Tension of marital	10	40%
Continuous criticism by the family	10	40%
Absence from social appointments	10	40%
Delaying social appointments	15	60%
The nature of job does not allow for delays	20	80%
Source of social value	24	96%
Self-actualization	20	80%

Table (8): The effect of work on family and social life.

3.7. Symptoms of occupational stress:

It appears from the results shown in table (9) that subjects experienced different physiological and psychological symptoms of stress through the various expressions used in this axe. These results emphasized what was found in previous axes. For example, 96% of them suffer from stress, 60% have excessive sweating, 80 % have suffered from fatigue, and 96% have pain in their eyes. All these are indications that shown to which extent the computer's operators are suffering from difficulties in their job and what shape does the evolution of its stress takes. It looks as though there is interaction between the physical and psychological symptoms in addition to the social side, which was also highlighted by the subjects. These symptoms and effects were expressed in nervous indications such as: feeling of crying, introversion, and frustration.

Hence, the stress represents a psychological state that requires effective mechanisms to enable the individual in his resistance and adaptation to these stressors caused by working on the computer. Subjects of this study seem to have adapted three types of strategies. The first one relies on "solving the problem", as is shown in table (10), 72 % of subjects are inclined to work more (make further effort), 60% try to change the task and 80 % prefer to concentrate more on work. The second category is inclined to strategies: "based on emotion" whereas 60% listen to music, 64 % drink coffee, 80% get in touch with colleagues, 40 % read the Koran, and 80% practice sports. The third category is inclined to take "strategies of avoidance", whereas 60% turn to escaping from work, 60% get out of the company, 40% use electronic games, and there are 4% who stay at home and 12% choose to withdraw completely.

It appears from this exposition of results in addition to what is shown in table (10), that the psychological stress generates mechanisms through which the individuals try to cope with the stress so that it will not have negative effect on their physical and psychological health. Moreover, these cooping strategies are different according to different individuals and their type of personality, and to the different work's conditions and its requirements, perhaps that why the computer's operators in this study use the three cooping strategies mentioned above. This matter may need further studies.

What are the physiological and psychological symptoms you get when you are exposed to stress at work?					
Items:	Freq	%	Items:	Freq	%
Making mistakes	15	60%	Communicating with colleagues	20	80%
Silence	15	60%	Eating snack	15	60%
Laughing	10	40%	Using the internet	08	32%
Introversion	15	60%	Lack of concentration	20	80%
Extraversion	10	40%	Nervosity	20	80%
Nails eating	10	40%	Insomnia	16	64%
Reddish face	15	60%	Writing anything on a paper	16	64%
Reading the saint Koran	10	40%	Concentrating on work	20	80%
Digestive disorder	15	60%	Doing sports movements	20	80%
Sitting without working	05	20%	Relaxation	15	60%
Willing to eat	16	64%	Using electronic games	10	40%
Drinking water	18	72%	Making more efforts at work	18	72%
Changing the atmosphere	20	80%	Failure to react in similar way	20	80%
Increasing the speed of work	20	80%	Going to the toilette frequently	08	32%
Walking	20	80%	Facing (facing to solve the problem)	15	60%
Escaping from work	15	60%	Feeling of emergency state	24	96%
Going out	15	60%	Panic	20	80%
Drinking coffee	16	64%	Feeling of failure	15	60%
Changing the work	15	60%	Willing to go home	10	40%
Listening to music	15	60%	Irritability	18	72%
Smoking	08	32%			

Table (9): Physiological stress symptoms.

What do you do when you are exposed to stress at work?					
Items:	Freq	%	Items:	Freq	%
Irregular breathing	10	40%	Talking about one suffering to colleagues	20	80%
Minimizing the routing	10	40%	One's Internal talking to himself (rehearsal)	24	96%
Sweating	14	56%	Reddish face	20	80%
Shaking	18	72%	Vomiting	10	40%
Feeling of hunger	22	88%	Dissatisfaction	15	60%
Headache	20	80%	Feeling of heat	20	80%
Eyes pain	24	96%	Decrease of morale level	16	64%
Drowsiness	20	80%	Expressing ones suffering to colleagues	20	80%
Exhaustion	20	80%	Feeling of being looked down on	20	80%
Stress	24	96%	Feeling of shortage of time	20	80%
Willing to cry	20	80%	Frustration	19	76%
Staying at home	01	04%	Irregular heart beats	15	60%
Withdrawal	03	12%	Feeling sleepy	08	32%
Praying	15	60%			

Table (10): Psychological stress symptoms.

3.8. Vision and its corection:

It appears from table (11), that computer's operators suffer from different vision disorders through so many vision symptoms such as:

- Red eyes 92%
- Annoyance from light 88%
- Lack of vision 80%
- Visual fatigue 80%
- Temporary loss of vision 60%
- Burning eyes 80%
- Difficulties in vision 80%
- Difficulties in discrimination of colors 80%
- Vision weakness 80%

It is obvious from these high percentages of complaints, that computer operators are suffering enormously from the problem of vision, of course these things are almost expected regarding previous complains from the over work load, the environmental working conditions and the lack of rest pause, let alone the old and deteriorating state of the equipment they are using.

Moreover, 72% of the subjects are wearing medical glasses, and all of them are aware of their importance and even those who have not worn them yet, they are ready to do so, and consider them as a very necessary means of protection against the effects of using the screen. (See table 12).

Most researchers are in total agreement that working on the computer requires good vision ability, and that both the body and the eyes need to take postures or positions that provide the best vision's conditions. They also emphasis that there are different design and organization factors that can over exhaust the eye, as is the case when displays are put sideways or high. In which there is a need for the operator to raise his head or turn it sideways in order to see properly. These types of actions will put overload on the neck on the long run because of the continuous use of its muscles. When the displays are high, the eyes will be looking up which will make them wide open, these things will help the appearance of eye dazzle which become tense and dry, This matter will get worse as the need of the individual for more concentration which in itself reduces the movement of the eyelids. Especially that this movement is necessary to ensure the moisture of the eye. In addition, the eyes are easily exposed to exhaustion, fatigue, and the difficulty to function properly when they are forced to read a text while looking upwards compared to looking downward.

Do you have vision difficulties during work?					
Items:	Freq	%	Items:	Freq	%
Decrease in vision	20	80%	Reddish eyes	23	92%
Visual fatigue	20	80%	Seeing flashes	16	64%
Tears	15	60%	Seeing black cloud	20	80%
Burnings	20	80%	Vision disorders	25	100%

Annoyance from light	22	88%	Support glasses	18	72%
Eye pain	23	92%	Having vision examinatio	20	80%
Temporary loss of visio	15	60%	Tingling in the eye	20	80%
Vision weakness	20	80%	Acute visual fatigue	20	80%
Double vision	20	80%	Difficulties in Vision	20	80%
Dazzling	20	80%	Vision ambiguity	18	72%
Difficulty to open the eyes	22	88%			

Table (11): Vision and its correction.

Do ware medical glass during work? Why? and since when did you wear them?		
Items:	Freq	%
Change in vision when working on the screen	22	88%
Non examination of vision	10	40%
The need for good concentration to avoid mistakes	15	60%
Difficulties to discriminate between colors	20	80%
Drowsiness due to continuous vision	20	80%
Feeling of sand in the eyes	19	76%
Temporary decrease of vision	20	80%
Headache due to difficult vision	24	96%
Neck pain due to difficult vision	20	80%
Vision correction due neck pain	20	80%
Thinking of wearing glasses in the future	20	80%

Table (12): Vision and its correction.

9.3. Proposed modifications and prospects for the future:

It appears from the results shown in table (13), that most of the computer' operators, if not all of them, are hoping for changes and modifications concerning their work for better future prospects. The various propositions for modifications indicate that the operators are not satisfied with the present working situation and their annoyance from the bad environmental conditions. In addition, the problem of old furniture and its non conformity to the ergonomical principles, let alone the work load and the deteriorating social and occupational conditions, matters which might emphasis the existence of stress factors and sources.

Most subjects expressed their need for changing the physical, social, and economical present situation. This is because offering positive conditions is the base for good performance and continuity in the same job. In this context, 80% of the subjects indicate their desire to get regular maintenance of equipment and furniture. 80% of them insist on the absolute necessary to change this furniture because they believe that it has become bad on the one hand and it's useless for working on the computer on the other hand. In addition to that, it does not go with the technological evolutions that rely on modern ergonomically principles. Hence, most proposed modifications have fallen in the frame of what was raised of different complaints by subjects through the previous axes, I should be pointed however, that despite all that, computer's operators think that their occupational future will be related

in one way or another to the computer. Hence, if there are not satisfied with their difficult working conditions, it does not mean that they are thinking of changing the job as an alternative solution.

What are the modifications that you propose in order to do your job in the right manner ?					
Items:	Freq	%	Items:	Freq	%
Changing furniture	20	80%	Providing suitable curtains	20	80%
Better organization of time	24	96%	Reducing the working hours on the screen	24	96%
Organization of working hours	23	92%	The appreciation of the good performance	25	100%
Organization of rest pause	20	80%	Rewards and incentives for the performance	25	100%
Varying work	24	96%	Providing suitable documents' holder	25	100%
Adding other activities	20	80%	Providing maintenance for equipment and furniture	25	100%
Enlargement of the field of work	20	80%	Providing restaurant	25	100%
Amelioration of heat level	20	80%	Providing transports	24	96%
Changing the chair	22	88%	Studying the relation: performance, working hours	20	80%
Changing the desk	23	92%	Regularity in the amount of work	24	96%
Changing the computer	20	80%	Amelioration of ventilation level	20	80%
Amelioration of illumination level	24	96%	Allocation of tasks	25	100%
Amelioration of work atmosphere	25	100%	Amelioration of communication between individuals	25	100%
Reducing the work load level	25	100%	Amelioration of the level of cooperation in the company	25	100%
Giving a personal look to the office	25	100%	Reducing the number of operator in the same room	20	80%
Cleaning of windows' glasses	20	80%	Reducing the level of noise at the work place	24	96%
Changing the décor	25	100%	Providing movable and adjustable chairs	25	100%
Amelioration of working conditions	24	96%	Cleaning of workplaces	25	100%
Providing dictionaries for translation	20	80%	Eliminating the dust from workplaces	23	92%
Providing screen filter	25	100%	Eliminating the smell from workplaces	22	88%
Renewing of equipment and furniture	25	100%	Eliminating the humidity from workplaces	20	80%
The good design of all documents used	25	100%			

Table (13): Proposed modifications and prospects for the future.

4. Discussion:

It can observe through the content analysis of the total open-ended question (19), that has formed the principle axes (09) of the present study, concerning the physical and psychological symptoms and effects among computer's operators, that the latter are suffering in general from difficulty of the job. This is due to the bad environmental conditions, missing of application of ergonomical principles in the workplace design, the old and deteriorating state of furniture (table and chair) and the computer itself, and the bad physical and organizational conditions.

The content analysis has included every axe separately, and on the level of each axe, deep analysis was carried out for each item. This analysis was in the shape of sorting out expressions and data from the content of the interview. in this way, the analysis was reach, and covers all sides of the subject. Things that has helped to pinpoint out some of the physical and psychological symptoms and effects among computer's operators.

The subjects of the present sample have shown by high percentage that they are suffering from vision disturbances such as: lack of vision, red eyes, burning, stinging, vision difficulties, and that most of them are thinking of wearing medical glasses to avoid the risk of working continuously on the screen. They indicate the physiological disturbances that consist of pains on different levels of the body parts like the head, shoulders, arms etc., in addition to high blood pressure, and difficulty of breathing. It was also found that operators are suffering from psychological disorders such as: anxiety, stress, tension, boredom, sadness, insomnia, annoyance, and psychological conflict. Perhaps the most important of these disturbances is the stress that was expressed through the physiological and psychological symptoms.

The cognitive processes were affected by the lack of ergonomical principles and long work on the computer as is the case for: memory disturbance, lack of concentration and attention, in addition to the workload and the deterioration of physical conditions have all helped the disturbance of the cognitive functions. Besides that, there are the stresses of family and social life, especially when the matter concerns difficulty to compromise between occupational and family life. That may have contributed to the lack of communication on the family level as well the phenomena of neglecting children.

Hence, any modification or change being introduced on the level of the computer's task should be done by consultation and cooperation with the operators. This will make them contribute easily and feel that shared opinion and stages of task evolutions, things that will help to build positive attitudes among operators towards the need of training and communication which should be done well in advance and inn accordance with the requirements of the new equipment.

Furthermore, it is better to introduce variation in task to enable the sitter to change his sitting posture regularly and therefore does not keep it for a long time. The computer's operator should also change the way of sitting from time to time, at least few times every hour, such as learning backward then forward or extending his legs forward or put them under the chair..etc.. Of course, the design of the chair being used and the rest of the furniture should allow change of different postures of the body without any difficulty or any physical strain. It is also possible to vary the type of posture itself by varying the tasks to be done, like working from time to time in standing posture, which is very effective in changing the work and the body posture during work. It is also possible to work even on the computer in this position if the work surface is adjustable in height. It is also recommended to introduce training gradually through stages adapted especially for the concerned operators and in accordance to their educational level as well as orienting the aged persons to different tasks.

5. Follow-up study:

The present study was a simple descriptive and discovery study. However, in a follow-up study, test of stress perception (Davies et al (1997)), together with Freiberg personality test, were applied on 122 computer operators in four companies. The results were overall very interesting. Thy indicate that 41.8% showed good adaptation with occupational stress, whereas, the rest of computer operators were suffering from stress. Although, that was in different degrees, i.e. 36.1% of subjects suffer from occupational stress, and they are in need to take suitable preventive steps. While, 15.6% of them suffer from a high degree of stress, which makes them rather in need to take preventive actions in order to avoid burnout. The latter from which suffer 6.6% of the subjects. The same results also indicated that there were differences from company to another of computer operator's stress. However, the degree of the stress was not affected by individual characteristics.

The results of Freiberg personality test expose the personality trait profile of the computer operators as is shown in Fig.1. This indicated that they were in general well above average. Most interestingly, they were all highly correlated with the stress. Furthermore, when the stepwise regression test was applied, it showed that nervosity, aggression, and depression were the predictable factors that affect the level of stress. And as can be seen these are just samples of a series of studies being undertaken in this primarily study about the psycho-physiological effects and symptoms among computer's operators.

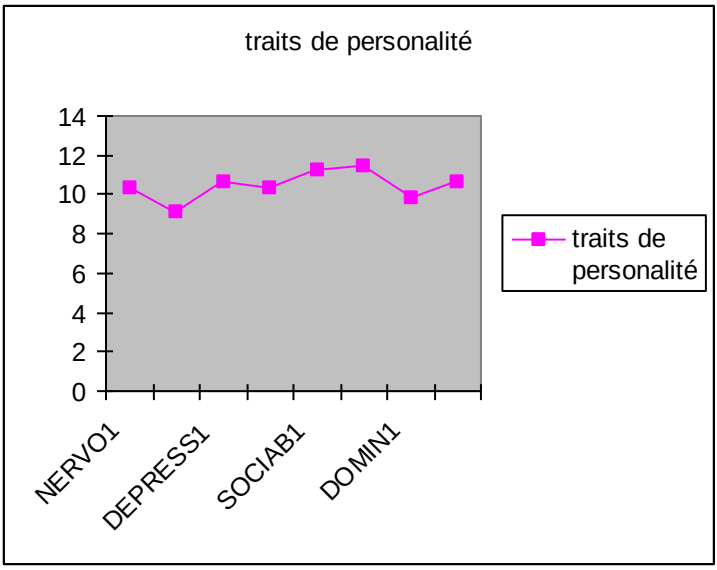

Figure.1: profile of personality trait for computer operators.

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Résumé :

Les effets et les symptômes psychophysiologiques chez les opérateurs de l'ordinateur.

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L'étude actuelle a traité les effets et les symptômes psychophysiologiques chez les opérateurs de l'outil informatique. Il a été trouvé que ces opérateurs souffrent des effets et des symptômes dus à la mal conception et organisation des postes de travail, ainsi qu'aux mauvaises conditions environnementales en plus de leur souffrance du stress et de l'épuisement professionnel du fait de la surcharge du travail et de l'inexistence de périodes de repos en particulier et de la mal organisation du travail en général.

Ceci a eu un reflet négatif sur leur état psychologique et sur leur vie familiale et sociale ce qui a facilité l'apparition de beaucoup de symptômes psychophysiologiques chez eux comme les troubles de la vision, les symptômes musculosquelettiques, les troubles des fonctions cognitives telles que les troubles de la mémoire, la dispersion de l'attention et les difficultés de concentration en plus des différents symptômes tels que l'anxiété, la dépression et la nervosité.