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Original

Relationship between Mental Workload Index and Work Ability Index in a Food Industry

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Abstract

Background: Spending a significant part of the daily in workplace has led to reduction in the time of rest and recreation of people. Therefore, considering the importance of the potential effect of mental work load on work ability, the present study was conducted to determine the relationship between mental workload and work ability in workers of a food industry. **Methods:** This cross-sectional study performed on 40 workers in a food industry in Qom province, Iran in 2017. Three demographic questionnaires, NASA-Tlx mental workload index and work ability index (WAI) were used for data collection. Finally, data were analyzed using SPSS software. **Results:** The results obtained from examining the relationship between work ability index and mental workload index in the studied industry showed high workload index score, however, there was no significant relationship between these two indexes (P = 0.07). results of regression analysis showed that only age of people has a significant relationship with the results of WAI. **Conclusion:** The mental workload index among workers of food industry was very high, which can be attributed to strict supervision due to the importance of food hygiene. High mental workload can affect human error and work efficiency of the worker.

Keywords: Mental workload index; Work ability index; Food industry; Job stress

Introduction

Attending work environments and spending a significant part of the day to work has led to a lot of mental and psychic workloads and people do not have adequate time to rest and relax in their leisure and recreation time.[1]Mental workload has been defined as a "level of cognitive or thinking or analytical effort required by the worker or the employees to fulfill the physical and temporal demands of a given task"; it has a multidimensional and complex structure that is influenced by the external needs of duty, environment, organizational and psychological factors and administrative and cognitive abilities of a person.[2,3] Various studies have shown that in jobs with a lot of mental workload, due to fatigue and inappropriate scheduling, efficiency is reduced and it leads to reduce memory, damage to the thinking process, irritability and early suffering, and it reduces person's learning.[4,5]Also, tired people are more likely to choose risky behaviors, such as doing shortcut tasks for their tasks.[6] Based on the fact that mental workload has a direct relationship with person's function and is one of the effective components on the health, safety and

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comfort of individuals, it has turned the subject of mental workload in recent decades and its effects in organizations have become one of the major issues of organizational behavior.[7,8]

The NASA-TLX Index is a questionnaire that was designed for the first time by Sandrahart in the United States National Aeronautics and Space Administration (1988) in order to assess the mental workload of a flight simulator.[9] The main reason for the popularity of this tool is its ease of implementation among researchers. NASA offers a more accurate analysis than other techniques that rank the mental load.[10]A study conducted by Hill et al (1992) showed that the four tools that assessed mental workload (Cooper-Harper tool, TLX mental workload, overall workload of OW, and Mental Work Load Assessment Technique), had the necessary accessibility, in terms of sensitivity, operator acceptance, required resources, and specific methods, but the two of TLX and OW tools had a better sensitivity and acceptance.[11,12]

In addition to mental workload, factors such as work ability can also affect employees. Hence, it is reasonable that work related demands are not set less or more than individual ability in order to achieve safety, comfort in the workplace and increase the efficiency and performance of employees in long-term.[13]Some methods for determining the work ability are qualitatively and based on individual capabilities and the physical and psychological needs of the work. The work ability index (WAI) is a useful tool for determining the ability of people to work in professional health care systems, which was developed by researchers at the Finnish Institute of Occupational Health (FIOH) and based on the theoretical work ability house model.[14]This equation evaluates the ability of a person by presenting a multidimensional picture of work ability including health status of employees, individual capabilities, and factors related to work. This model was presented in the form of a seven-part questionnaire entitled questionnaire on work ability during a large clinical evaluation. The best possible estimate of the WAI is the score of 49 and its worst situation is 7. Finally, based on the obtained score, the work ability has been grouped into four classes, namely weak and moderate, good and excellent.[15.16]A large percentage of community workers work in the food industry, these industries are very sensitive because they are related to the health of the community, and this factor causes increase in inspection and, consequently, increase in mental workload. In addition, food industry is often required to have a high physical ability due to increased production. The aim of this study was to determine the relationship between the mental workload and work ability in workers of a food industry in Qom.

Methods

This cross-sectional study performed on 40 workers in a food industry in Qom in 2017. The personnel in this industry are working in laboratory, production and packaging units with different degrees of workload and ability to perform physical work with different work experiences. The studied industry has 40 employees in laboratory, production and packaging units, and all of them work in the morning shifts. This study was conducted in census-form on all 40 personnel. The inclusion criteria include lack of history of diseases affecting the musculoskeletal system, spinal fractures, rupture and hernia of the disc and none of the subjects studied have had the above-mentioned complications. All workers who did not complete the informed consent were excluded from the study. This study was approved by the code of ethics committee of Shahroud University of Medical Sciences with number IR.SHMU.REC.2017.113.

In this research, the subjects were classified into three groups of labs, production and packaging to examine the relationship between the mental workload index and work ability index. A questionnaire was used for collecting data. In order

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to assess the exposure and outcome in this study, three demographic questionnaires, a NASA-Tlx mental workload index and a workability index (WAI) were used for data collection. The demographic questions included age, sex, marital status, and work experience. The process of mental work pressure assessment was performed using the NASA-Tlx mental workload index in three stages of determining load weights, determining the degree of load, and determining the final score of the mental workload index. Weight determination was performed with the aim of determining the priority of the TLX's six scale. Determination of load rating was also aimed at determining the effect of each of the six factors on the creation of mental load. After determining the load weight and load rating by multiplying these two items and dividing the obtained number by 15, the total workload of the individual was calculated numerically between 0 and 100. The reliability of this questionnaire was confirmed by a Cronbach's alpha coefficient of 0.83 for assessing the mental workload of nurses in ICU sections of Isfahan hospitals.[16]

Work ability index (WAI) also includes 6 dimensions, the total score of these dimensions is between 7 and 49, and the best possible estimate of the index, is the score of 49 and the worst estimate, is score of 7. Translating the WAI questionnaire into Persian and determining its validity and reliability in Iran has been carried out by Aristotle et al.[17]

At first, the results were collected using the aforementioned questionnaires and the data were entered into SPSS software Version 21 in order to examine descriptive statistics including mean, range and standard deviation. Compliance with the normal distribution in the data was investigated for the selection of parametric or nonparametric tests. Correlation between values of mental workload and reported work ability was investigated by Pearson and Spearman correlation tests. The level of statistical significance in all tests was set at $P< 0.05$.

Results

The results show that the mean age of male subjects was 36.6 (5.65) and was 33.8 (7.12) years in female subjects. Sixty percent of the population were female and 40% were male and 82.5% were married and the rest were single. The dominant hand is 7.5% of the left while the rest is the right. Some of the results of the demographic parameters are presented in Table 1.

The mean of the mental workload index was 82.76 in the subjects (SD = 11.35). The mean of work ability index was also estimated as 40.07 (SD = 6.20). Correlation test results did not show any significant relationship between these two indexes in studied subjects (p = 0.07).

Regression analysis did not show a significant relationship between demographic indexes and mental workload (Table 2). Results of regression analysis showed that only the age of the people has a significant relationship with the results of WAI and for each increase in age group, WAI increases by 0.57 units Table 3.

Table 1. Results of demographic parameters in the studied industry

Variable/ levels	N (%)
sex	
Male	16 (40)
female	24 (60)
Marriage	
Married	33 (82.50)
Not-married	7 (17.50)
Dominant hand	
Right	37 (92.5)
Left	3 (7.50)
Working history	
Less than 1 year	10 (25)
2 to 3 years	16 (40)
More than 3 years	14 (35)

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Table 2. The Results of the Relationship between Demographic Information and Mental workload index

Variable	B	Std. Error	Sig
Age	0.26	0.26	0.32
Sex	-2.92	3.78	0.45
Job	1.05	0.77	0.18
Dominant hand	5.53	6.79	0.42
Marital status	2.35	3.12	0.45

Table3. The Results of the Relationship between Demographic Information and work ability index

Variable	B	Std. Error	Sig
Age	0.57	0.10	0.00
Sex	-1.31	1.48	0.38
Job	0.49	0.30	0.11
Dominant hand	-2.86	2.65	0.29
Marital status	0.44	1.23	0.72

Discussion

In this study, the mental workload and work ability indexes were examined in the group of employees of a food industry. The results showed that the mental workload index in the workers of the considered industry was very high, but the work ability index was in good condition. Given that the studied industry is a food production industry and the product has low weight and the process is moving at an appropriate speed, it is expected that the work ability should be appropriate. However, much supervision due to the importance of health in the food industry can be a major factor in high mental workload. Taheri et al., in a study, examined the relationship between mental workload and needle stick injuries among nurses. The results of their study showed that work can lead to increase mental workload in conditions that could lead to needle stick injury.[18]The results of this study are in line with the present study. Concerns about Brad Fred's health outcomes and the process, as well as the need for supervision when performing the work, seem to increase the mental workload of workers in the workforce.

The results of examining the relationship between mental workload index and work ability index showed that there is no relationship between these two indexes in the studied industry. The main reason for this can be the high demand and need of the studied industry for mental ability at different levels and, on the other hand, the need for physical ability in almost all jobs. In a study in the steel industry, a significant relationship was found between these two indexes due to the high need of steel industry to both mental and physical abilities.[19] The results of the study on the relationship between demographic variables such as age, sex, marriage, work experience and dominant hand with mental workload and work ability indexes showed that only the age variable has a significant relationship with the work ability index, and the remaining variables have no significant relationship with mental workload and work ability indexes. The reason for the lack of relationship between demographic variables and mental workload can be due to the similarity of the factor causing the mental load on different workers. Considering that the most important factor causing mental load in the studied industry is strict monitoring due to the importance of food health, this factor can have the same effect on different people and makes the effects of variables such as age, sex, low.

In this study, there was a direct relationship between age and work ability index. For each unit increase in age of individuals, the work ability index showed an increase rate of 0.57. Various studies have reported various relationships between age and WAI. Bilat et al. reported a reciprocal relationship between age and WAI in a study.[20]However, another study has reported that this relationship is direct until the age of 35 years and inverse after this age.[15]The main reason for the direct relationship between age and WAI in the current study can be the age range of 20 to 45 years old workers in this industry, which can be said that the young age range is up to middle age and in this range, with increasing age, the work ability increases.

The mental workload index observed among food industry workers was very high. Strict supervision due to the importance of food health

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can be one of the causes. Given that the high level of mental workload can have a negative effect on human error and work efficiency, supervisors are advised to increase the level of health of the food by promoting the level of technology and the use of appropriate and healthy equipment.

Conflict of interest

The authors declare no conflict of interest.

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