

# Work Ability of the Personnel of a Petrochemical Company and the Relationship Between Age and Physical Activities

Sedighe Abbasi,<sup>1</sup> Hassan Asilian Mahabadi,<sup>2,\*</sup> and Shahram Vosoughi<sup>3</sup>

<sup>1</sup>Faculty of Medical Sciences, Tarbiat Modares University, Tehran, IR Iran

<sup>2</sup>Department of Occupational Engineering, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, IR Iran

<sup>3</sup>Department of Health Sciences, Faculty of Health, Safety and Environment, Shahid Beheshti University of Medical Sciences, Tehran, IR Iran

\*Corresponding author: Hassan Asilian Mahabadi, Department of Occupational Engineering, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, IR Iran. Tel: +98-9123873932, E-mail: asilia\_h@modares.ac.ir

Received 2016 January 31; Revised 2016 May 25; Accepted 2016 May 25.

## Abstract

**Background:** Given the importance of the fit between workers' physical and mental abilities and their job needs, it is of great importance to assess, maintain and promote the work ability of the people.

**Objective:** The current study, conducted in a petrochemicals company, aimed to assess the work ability of the personnel and its relationship with age and physical demands of work.

**Methods:** The current cross sectional descriptive analytical study was conducted on 208 employees working in a petrochemical company. The authors studied different occupational groups including operators, administrative, laboratory, maintenance and warehouse personnel. The required data were collected from the target groups using self-report work ability index questionnaire. To analyze the data, SPSS software version 21 was used. The analysis was conducted using t-test, ANOVA and Pearson correlation coefficient.

**Results:** According to the results of this study, the mean age of the participants was  $32 \pm 6.1$  years and the mean work ability index (WAI) was  $43.1 \pm 4.4$ . Based on the results of statistical analysis, age did not have a significant impact on the work ability of individuals; however, there was a direct relationship between the personnel's work ability and their activities in terms of physical demands of their job. In addition, according to the study findings, 25.5% of the studied people were at risk of low-medium work ability.

**Conclusions:** Based on the standards proposed by the Finnish institute of occupational health (FIOH) and Kujala et al.'s study, the work ability of the studied individuals was classified as good. Since more than a quarter of the studied personnel were at risk of low-medium work ability, thus reducing the burden of physical tasks and making plans to promote the work ability should be a priority in the intervention programs.

**Keywords:** Work Ability, Occupational Health, Physical Work, Petrochemical Industry

## 1. Background

Ability to work is the foundation of health and well-being of individuals in every community. In many countries, including Iran, the workforce is rapidly aging. As a result, one of the most important issues in every community is to evaluate, maintain, and promote individuals' work ability (1, 2). As the early withdrawal of workers from the workplace is one of the problems of today industry, in recent years the promotion of the work ability is suggested as one of the most effective methods to prevent work disability and early retirement (3). Ilmarinen identified three major categories of risk factors which threaten older people's ability to work as follows: a) Excessive physical activity (such as static muscular work, bending and torsional work postures and transporting loads manually), b) Dangerous and stressful workplaces (such as places with extreme heat and cold, risk of accidents, extreme changes in temperature and dirty or wet jobs) c) Poor organization of

work (such as the role conflict, fear of failure, lack of understanding and confidence in the workplace) (4). When the physical and mental capabilities of workers do not fit the requirements of their jobs, such a condition can lead to several problems including health and safety problems, reduced production and increased costs due to the dismissal of workers (5). The concept of work ability describes the capacities and capabilities of people in terms of physical, psychological and social demands of work. Work ability is the result of an interaction between individual resource (physical, psychological and social) and work demands combined with environmental, social and organizational factors (6, 7). It can be said that the work ability is a descriptive term which defines the workforce associated with physical, social and psychological demands of work in a workplace (8). Work ability is a complex concept that can be evaluated using the work ability index (WAI) (9). Work ability index is a practical tool used to determine the work ability of individuals in occupational health care

systems; it was first developed by researchers at the Finnish institute of occupational health (FIOH) based on the theoretical model of the work ability house (10, 11). Attempts to maintain the work ability of workers are a key function in occupational health care services (12). Health and ability to work are among the most important factors for occupational safety in the oil and petrochemical industry (13); given that the work ability and the fit between work demands and individual resource are among the most important factors to prevent occupational diseases and one of the main business strategies in the petrochemical industry is to maintain the experienced and skilled workers.

## 2. Objectives

The current study aimed to investigate the WAI of the personnel and the relationship between age and physical demands of work in a petrochemical company.

## 3. Methods

This cross sectional study was conducted in 2015 in a petrochemical company. Work experience of more than one year was selected as the inclusion criterion. All of the Petrochemical Company's employees were invited to the study (n=500). The response rate was 50% (n=250) and those who incompletely answered to the WAI questionnaire (11.6%, n=29) and those who had a Work experience of less than one year (5.2%, n=13) were removed from the analysis. Therefore, the study group consisted of 208 people. Different occupational groups including operators administrative, laboratory, maintenance and warehouse personnel were studied. The participants were randomly selected and the WAI questionnaire was used to collect the data. Before distributing questionnaires, the members of all occupational groups were trained to answer the questions. The WAI questionnaire is designed to measure the workability of individuals in different work environments. The questionnaire was first developed by professor Ilmarinen, a member of FIOH (10, 14). The reliability and validity of the Persian version of the questionnaire in Iran was tested and verified by Mazloumi et al. (15). The WAI contains seven different domains. The final score of the WAI is calculated through summing up the scores earned from the items in the seven fields, as follows: current work ability compared with the lifetime best work ability regarding physical, mental and psychological demands of work, number of current diseases diagnosed by physician, estimated work impairment due to diseases, sick leave during the past 12 months, own prognosis regarding work ability two years from now and mental and psychological re-

sources as shown in Table 1. According to the Finnish Institute of Occupational Health (FIOH), the final score of WAI is between 7 and 49, where 49 is the best possible estimate of the index, and 7 is the worst score. The scores are categorized into four different quality classes including, poor (7-27), moderate (28-36), good (37-43), and excellent (44-49) (14). Cronbach's alpha was used to assess the internal reliability and to analyze the data SPSS software version 21 was used. The normality of the data is approved by using the Kolmogorov-Smirnov test ( $P > 0.05$ ). The analysis was conducted using T-test, ANOVA, and Pearson correlation coefficient.

**Table 1.** The Work Ability Index Seven Dimensions and Ranges of Each Item

Ranges of Each Item	The WAI Items
0 - 10	1- An individual's current work ability compared with his/her lifetime best
2 - 10	2- The work ability in relation to the demands of the job
1 - 7	3- The number of diagnosed illnesses or limiting conditions from which they suffer
1 - 6	4- The estimated impairment due to diseases/illnesses or limiting conditions
1 - 5	5- The number of sick-leave they had taken during the last year
1 - 7	6- The own prognosis of the work ability in two years' time
1 - 4	7- Mental resources

## 4. Results

Totally, 250 people participated in the study, of whom 96% (n = 240) were male and 4% (n = 10) female. Only 83% of participants (n = 208) who had fully completed the questionnaire were included in the statistical analysis. The mean age of the participants was  $32 \pm 6.1$  years, with an age range of 21- 60 years. The mean work ability of the personnel was  $43.1 \pm 4.4$ ; according to the standards proposed by the FIOH and Kujala et al.'s study (12), the work ability of the studied individuals was classified as good. Of all the studied people, 66.35% (n = 138) were married and 33.65% (n = 70) were single. To analyze the data obtained from the questionnaire, Pearson correlation coefficient, ANOVA (one-way analysis of variance), and T-test were used. The results of one-way ANOVA did not show a significant relationship between the mean scores of WAI, age and work job tenure ( $P > 0.05$ ). The mean score of work ability showed a significant relationship with leisure-time physical activity ( $P \leq 0.05$ ). Accordingly, the results of the statistical analyses showed that the mean work ability score of people

who exercised two or three times a week was 44 while in subjects who did not exercise it was 41.6. The results also showed no significant relationship between the WAI scores and the work schedule; similarly, there was no significant relationship between the WAI and level of education. The P-values for the non-significant results are presented in Table 2. The WAI scores of employees working in three different shift patterns (day shift, two shifts and three shifts) were compared and the results showed that the highest mean score of WAI was observed in subjects working two shifts. The minimum scores of WAI were 47, 30 and 25.5 in subjects who were working two shifts, day shifts, and three shifts, respectively. As a result, the two-shift work pattern had a positive impact on subject's work ability. The results also showed that the mean work ability in works with the physical demands was 41.8 while in works with the psychological demands was 43. The P-values for the significant results are presented in Table 3. The mean score of work ability had a significant relationship with workload ( $P \leq 0.05$ ). The results of statistical analysis showed that the mean work ability score of people with light and heavy workload is 43.5 and 42.4, respectively, (Table 4).

**Table 2.** The P-values for the non-significant results

		P-value	F
<b>Individual factors</b>	age	0.147	1.8
	education	0.625	0.756
<b>Work-related factors</b>	Job tenure	0.618	0.597
	Working schedule	0.176	1.75

**Table 3.** The P-values for the significant results

	P-value	F
<b>Physical exercise during the week</b>	0.026	3.13
<b>Physical work demand</b>	0.025	3.73
<b>Workload</b>	0.026	3.73

## 5. Discussion

The mean work ability of the personnel in the petrochemical company was  $43.1 \pm 4.4$ , and based on the FIOH and Kujala et al.'s (12) study, it was classified as good. As the most important part of the results, it was found that the effect of age on the WAI score was significant only after the age of 45 (7), while the mean age of the studied population was 32 years with a standard deviation of 6.1 years. To justify this mechanism, it might be said that after the

**Table 4.** Work-related factors and their mean WAI score

Characteristics	n	Mean WAI scores (SD)
<b>Work Schedule</b>		
Day shift	74	44.1 (4.3)
Two shift	3	48 (1.0)
Three shift	131	42 (4.5)
<b>Work demands</b>		
Physical	66	41 (6.2)
Mental	45	43.0 (5.1)
Physical-mental	97	43.3 (4.4)
<b>Work load</b>		
Light	2	43.5 (3.5)
Medium	93	44.1 (3.7)
Heavy	113	42.4 (4.8)

age of 40 people face decreased aerobic capacity and consequently they have reduced work ability (16). The effect of age on work ability also depends on the nature of the job. However, with increasing age, nature of the job and the incidence of some occupational diseases remain a significant impact on the work ability (7). The differences observed between the results of this study and those of previous ones may be due to differences in several factors such as work environment, life style, nature of the job and mean age of the workers. Ergonomic corrections in the workstations and work environments was one of the most positive factors in the studied workplace which had a significant impact on maintaining the work ability of the personnel and thus their WAI was placed in a good range (6, 7). In the current study, the WAI had little relationship with age; although some of the participants were younger, they had lower work ability than the older ones (aged over 45 years). However, some studies conducted on populations older than that of the study reported lower mean work ability. In a number of studies conducted in this field, the work ability of the workers was in an acceptable level. For example, the results of the current study were in line with those of Attarchi et al. on workers in a factory (17), Kiss et al. on firefighters (18) and Parker et al. on miners (19).

However, there are some studies in this field which reported lower WAI scores than the scores obtained in the current study. For example, the mean work ability score was 37 in the study by Karazman et al. on drivers working in urban transportation (20), 40 in that of Knezevic et al. on midwives working in a hospital (8) and 37.9 in that of Pohjonen on home care workers (7). Based on the results of the current study, there was no significant relationship

between the mean age and work ability; this finding was in line with the results of studies by Kloimuller et al. (21) and Safari et al. (16). Classification of WAI in Ilmarinen's study was appropriate for people aged more than 45 years. Therefore, the use of this reference range may result in an overestimation of work ability in young workers. Therefore, for sample of workers in their early 30s work ability categories of poor (7 - 36), medium (37 - 40), good (41 - 44) and excellent (45 - 49) are proposed (12). Since the mean age of the studied people was  $32 \pm 6.1$ , the subjects of the current study were younger than the subjects of other studies which reported lower scores of WAI. The frequency distribution of WAI was as follows: 7.2% poor, 18.3% in medium range, 31.25% in good range and 43.25% in the excellent range.

As 25.5% (a little more than a quarter) of the study population were at risk of poor and moderate work ability, it is necessary to take the necessary measures to detect and remove the factors reducing the work ability of these people. Table 5 shows the classes of work ability by the WAI score. These groups of people were at risk of occupational disorders and diseases, and disability and early exit from the workplace (7). As a result, promotion of the work ability should be a priority in the intervention programs. The measures to promote the work ability can be taken in four different levels (1) including the improvements needed in the physical, psychosocial and social work environments, improvements in health and lifestyle, and upgrading the occupational skills of the personnel. As a result, managers should make the necessary decisions consistent with the work environment.

**Table 5.** The Classes of Work Ability by the WAI Score

Distribution, %	Classes of Work Ability
43.25 (n = 90)	Excellent (44 - 49)
31.25 (n = 65)	Good (37 - 43)
18.3 (n = 38)	Moderate (28 - 36)
7.2 (n = 15)	Poor (7 - 27)

Average working ability in people who work three shifts in a day in compare to the other people was the lowest. So that the minimum score of WAI in working day and three shifts people, were 47 and 25.5, respectively. One of the consequences of shift work is the sleep and rest disorder. Therefore, disruptions in the sleep schedule of employees as a result of chronic fatigue leads to the loss and drop of consciousness. In this regard, studies have shown that these people own the highest level of depression (22). Studies conducted by Parker et al. and Mazloumi et al. had similar results (6, 19). The mean work ability of individu-

als with physically demanding jobs was 41.8 and 43 in the subjects with mentally demanding jobs. Therefore, it can be concluded that the work ability of individuals in physically demanding jobs was less than that of the work ability of individuals in mentally demanding jobs (7). In addition, the results showed that people with physically demanding jobs, compared with those in mentally demanding jobs, underestimated their current work ability (the first dimension of WAI questionnaire). This finding was consistent with the findings reported by Finnish and Iranian researchers (6, 14, 23). With increasing age, the work ability of workers in physically demanding jobs reduces more than the workers in mentally demanding jobs (7). Because the increase in the age leads to the chronic low back pain and knee pain in these people (24). As a result, the necessary measures should be taken to reform their tasks. Therefore, the physical activities should be reduced in older people. In addition, some facilities should be provided for those working in physically demanding jobs to exercise regularly. According to the results of the current study, the mean work ability had a significant relationship with leisure-time physical activities ( $P \leq 0.05$ ). According to the results of statistical analysis, people who exercised two or three times a week compared to those who did not exercise had higher work ability. This was also demonstrated in a study by Bashore. Based on the results of the mentioned study, as reported by the participants, regular exercise resulted in improvements in 90%, 70%, and 60% of the subjects in physiological, physical and social work ability, respectively. Regular exercise increases oxygen consumption and enhances respiration; as a result it can prevent the early damages to central nervous system (25). In view of that, poor fitness is the most powerful predictor of diseases such as high blood pressure, obesity and high level of cholesterol (26). Based on the outcomes, the mean score of work ability was significantly associated with the workload. According to several studies in the field, the workload increases with increasing levels of job stress. The increased workload can result in reduced performance of job tasks (27). Physiological changes such as increased heart rate, psychosocial effects such as emotionality and behavioral effects such as operator errors caused by workload, is among the issues and problems that have been undertaken in relation to the workload. In fact, the lack of conformity between individual ability and job requirements leads to musculoskeletal disorders (28). The results of this study are consistent with the results of the Gharibi et al. (29).

### 5.1. Conclusions

Work ability index is a tool that can predict the work ability of individuals. According to the results of the cur-



rent study, the mean work ability of the study population was in a good range. Accordingly, the work ability of people with physically demanding jobs (for example, people who were in charge of maintenance tasks) was lower than that of those with mentally demanding jobs. In addition, no significant relationship was observed between age and WAI.

## Acknowledgments

Authors would like to express their thanks to all the personnel working in HSE unit and other parts of the petrochemical company who helped us in this project.

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