

# The Mediation Role of Physical Activity Level on Quality of Working Life and Memory Self-Efficacy Beliefs in Staff with Different Circadian Rhythms

Masume Shojaei<sup>1</sup>, Parvaneh Shamsipour Dehkordi<sup>2</sup>, Matin Mootabadi<sup>3\*</sup>

## Abstract

**Background:** This study aimed to compare quality of working life and memory self-efficacy beliefs in people with different circadian rhythms and physical activity levels. **Materials and methods:** The study took a causal-comparative method. Subjects consisted of 149 fixed and rotating shift employees, working in health centers and hospitals that were participated based on inclusion criteria. The subjects completed demographic, international physical activity, quality of working life and memory self-efficacy questionnaires. All data were analyzed using two-way ANOVA and Bonferroni post hoc test. **Result:** The results show that the quality of working life and memory self-efficacy are different in fixed and rotating shift employees at three levels of high, medium and low physical activity. Employees with fixed shift and high and medium physical activity level have higher quality of working life and memory self-efficacy than other employees. Moreover, quality of work life of fixed shift employees with medium and low physical activity is better than quality of working life of rotating shift employees with medium and low physical activity, and quality of working life of rotating shift employees with high physical activity levels were significantly better than quality of working life of rotating shift employees with medium and low levels of physical activity ( $P < 0/05$ ). **Conclusion:** Choosing active lifestyle is recommended to fixed and rotating hospital employees in order to avoid reduction of quality of working life and memory self-efficacy.

**Keywords:** quality of working life, memory self-efficacy, physical activity, fixed and rotating shifts' memory.

## Introduction

For every institution or organization to succeed, and due to today's economic and technological reasons, shift work is one of the social and economic phenomena. Researchers believe that a shift working individual is mainly influenced by consequences

of the shift work (Boiyin and Boudreau, 2014). In a research on workers who have shift works, Yazdi et al. (2013) concluded that bad sleep quality is one of unwanted consequences of shift work in work force that influences on the quality of working life. However, increasing of quality of working life leads to increase and improvement of the performance of work force (Esmaeeli lahmani, 2013). Yousefi et al. (2012) defined the quality of working life as personnel's mental image and understanding of physical utility of work place. In some organizations, the program of quality of working life aims to

1. (Associate Professor), Faculty of Physical Education and Sports Sciences, Alzahra University.
2. (Assistant Professor), Faculty of Physical Education and Sports Sciences, Alzahra University.
3. (MS Student). Faculty of Physical Education and Sports Sciences, Alzahra University.

\* Corresponding author: M. Mootabadi, Faculty of Physical Education and Sports Sciences, Alzahra University, Email: Matin.ph370@yahoo.com

increase personnel's trust, engagement, and ability of problem solving, and consequently, satisfaction and efficiency of the organization.

In addition to dramatic effect of quality of working life on individual behavior in organization, the researchers have argued that one of the other important factors associated with individual occupation is the employee's belief in his or her strengths and weaknesses that Bandura (2006) calls it self-efficiency. Self-efficiency is related to individual's belief in his or her abilities, and it could include people's beliefs about his or her performance or memory capability (Wells, 2001, quoted by Nikdel et al. 2009). Bandura (1989) defines memory self-efficiency as individual's beliefs about his or her abilities in effective use of memory in different situations. On the other hand, Hertzog, Hultsch, and Dixon (1990) also believe that memory self-efficiency is individual trust in his or her abilities in doing tasks and activities associated with memory. Circadian rhythm or circadian clock is one of factors affecting increase or decrease of the quality of working life and memory self-efficiency. The task of circadian rhythm is preparing brain and body to sleep or wake in specific hours of day (Grierson et al. 2016). Fast changes in sleep-wake cycle due to shift work program, losing environmental cues (light and darkness) to adjust circadian rhythm, and individual differences could lead to a 10% to 20% growth in shift work disorder in employees (Riedel et al. 2011; Ohayan et al. 2010). Findings of several studies show that disorders associated with shift work have considerable negative impact on the neural performance and behavior such as increasing risk of accidents, medical conditions, and cognitive changes (Gumenyuk et al. 2010).

Scott et al. (2015) and Vorster and Born (2014) have concluded that significant changes have occurred in people's cognitive performance and memory due to sleep and circadian rhythm. Moreover, a negative correlation is seen between sleep disorder and cognitive performance in the tests of cognitive

disorders (Eckle et al. 2016), working memory (Lin et al. 2012), memory encoding, memory retrieval, and memory improvement (Youngstedt et al. 2016). Meanwhile, Sherman et al. (2015) and Feng et al. (2016) concluded that there is a significant relationship between circadian rhythm and memory performance so that disorder in circadian rhythm causes disorder in memory performance. Covney (2014) concluded that the quality and quantity of sleep are related to the quality of people's occupation. Chiu et al. (2013) and Chen et al. (2013) believe that insomnia and disorder in circadian rhythm lead to considerable problems in work place and put the working life at risk.

Physical activity and the risk of various kinds of deaths and the inability of the cardiovascular system and blood pressure and psychiatric domination (Johansson and Sundquist, 1999; Mansi et al. 2013). Many specialized groups believe that physical activity is important for health, pain reduction, life quality increase, memory and self-efficiency and performance increase (Kassavou et al. 2013). In recent decades, the results of investigations regarding the positive effect of physical activity and sport on the economic, psychological, and social functions has made some managers of different organization to plan some sport programs for their personnel (Nieman, 2003). Youngstedt et al. (2016) and Sherman et al. (2015) believe that sport and physical activity could have a positive effect on physical and mental performance of employees with rotating shift work. Additionally, physical activity could be considered as a desirable and effective factor to provide health and happiness, and in addition to The researchers believe that physical activity could have a positive effect on the quality of working life and beliefs of memory self-efficiency (Kassavou et al. 2013; Sa'atchi, 2001; Soleymani, 2005). Since there has been no investigation on mutual effect of physical activity and circadian rhythm on the quality of working life and memory self-efficiency beliefs, in this study, the researchers aim to answer the question

that whether physical activity could influence on the quality of working life and memory self-efficiency beliefs in employees with natural and unnatural circadian rhythm.

## Methodology

### Participants

It is a descriptive and causal-comparative method. Data gathering was done by a survey. The statistical populations of the research include fixed and rotating shift employees who have been working more than five years in Hospital. The employees of Shohada Hospital, Milad Hospital, Taleghani Hospital, Ramtin Hospital and Alborz Hospital were selected as the participants of this study. They were selected based on some criteria like mental health, lack of depression, and more than five years experience in their career. One hundred forty nine employees were chosen by purposive sampling based on inclusion criteria by using international physical activity questionnaire-IPAQ. Employees were classified in different groups including: 1) fixed shift employees with low physical activity, 2) fixed shift employees with medium physical activity, 3) fixed shift employees with high physical activity, 4) rotating shift employees with low physical activity, 5) rotating shift employees with medium physical activity, 6) rotating shift employees with high physical activity groups.

### Measuring Tools

The measuring tools of this study are named as follows:

1- Questionnaire of demographic information. Contain some questions such as age, level of education, level of physical activity, hours of doing sport a day, history of professional sport, kind of shift work, history of mental and physical illness, and drug use. Quality of working life questionnaire, memory self-efficiency questionnaire, and international physical activity questionnaire were used.

2- Questionnaire of working life quality (QWL):

this questionnaire includes eight factors related to working life quality in 50 questions. Sub-scales includes fair pay of payment, rule of law, the power of steady growth, social attachment, and security, development of individual capabilities, safety, and social integration. Mirsepasi confirmed the validity and reliability of the questionnaire (Saedi et al. 2010).

3- Memory self-efficiency questionnaire (MSEQ): this is 50-item questionnaire and it has 10 memory tasks with different difficulty level. Four tasks include daily memory situations (remembering list of stores, place of things, telephone numbers, and guidelines), four tasks, which include two other tasks, demonstrate the situations of memory (vocabulary list, images, numbers, and remembering paths). The level of self-efficiency is measured by subjects' yes/no answers and counting the number of "yes" answers, which is varies from 0 to 5 in each task. The section of trust to answers shows 10 to 100 percent of the power of memory self-efficiency. This value is calculated by the average of the values of trust to "yes" answer and "no" answer (MacDogal, 1999; Nikdel et al.2009). Berry et al. (1989) quoted by Bush (2002) reported alpha coefficient 90 percent for memory self-efficiency level and 92 percent for the power of memory self-efficiency.

4-International physical activity questionnaire (IPAQ): this questionnaire includes questions that investigate the level of physical activity in three levels of low, medium, and high. In Iran, Hazavehi et al. (2008) confirmed its reliability and validity. In this questionnaire, the intense of physical activity is determined according to MET (the measuring unit of physical activity level of metabolic equivalent in minute). The present questionnaire evaluates the level of physical activity in the past seven days, and the intense of activity is determined according to final score. The scoring method is that activities like aerobics, cycling with high speed, climbing, and basketball that need energy consumption more than 1500 MET in minute are introduced as physical activities with high intensity, activities such as

volleyball, badminton, walking, and cleaning room that need energy consumption between 600 to 1500 are introduced as physical activities with medium intensity, and activities that need energy consumption less than 600 MET in minute are introduced as low level physical activity.

### Procedure:

To gather the data, interviewers have been trained. They were told about necessary explanations before distribution of questionnaire including accuracy in completing questionnaire and imminent and on-time return. Then, regarding questionnaires were given to the participant as the sample of the research. Afterwards, the demographic information, QWL and MSEQ questionnaires completed by the employees of the hospitals were gathered after at most one week and they were studied.

### Results

Descriptive information related to working life quality and memory self-efficiency of fixed and rotating shift work employees with low, medium,

and high physical level is provided in table 1. Table 1 show that active employees group have more working life quality and memory self-efficiency than other groups, and rotating shift employees with low physical activity have a lower working life quality and memory self-efficiency in comparison to other employees of the hospital.

To determine the significant difference between working life quality in fixed and rotating shift employees with different physical activity level, two-way ANOVA was used (table 2).

The results of two-way ANOVA showed that there is a significant difference in employee's working life quality. It revealed that the average of working life quality in fixed shift employees is better than the average of working life quality in rotating shift ones. The main effect of physical activity level was significant. The result of Bonferroni post hoc test showed that the average of working life quality in employees with high and medium level of physical activity is better than the average of working life quality in employees with low level of physical activity. Interactive effect of fixed and

**Table 1.** Average and standard deviation of working life quality and memory self-efficiency

Shift type	Physical activity level	Variable	Average $\pm$ Standard deviation
Fixed	Low	Quality of working life	91.56 $\pm$ 25.92
		Memory self-efficiency	32.48 $\pm$ 4.51
	Medium	Quality of working life	123.90 $\pm$ 26.03
		Memory self-efficiency	37.36 $\pm$ 5.32
	High	Quality of working life	126.73 $\pm$ 25.99
		Memory self-efficiency	35.73 $\pm$ 3.99
Rotating	Low	Quality of working life	70.32 $\pm$ 19.72
		Memory self-efficiency	28.17 $\pm$ 5.53
	Medium	Quality of working life	79.29 $\pm$ 19.93
		Memory self-efficiency	36.22 $\pm$ 5.26
	High	Quality of working life	100.41 $\pm$ 28.07
		Memory self-efficiency	36.01 $\pm$ 4.66

**Table 2.** Two-way ANOVA analysis for working life quality in fixed and rotating shift employees

Variable	Sum of squares	df	F value	Significant level
shift	30743.52	1	54.47	*0.001
physical activity	24988.75	2	22.140	*0.001
shift $\times$ Physical activity	4058.12	2	3.59	*0.031

Significance in level ( $p < 0.05$ ).

rotating shift work on high, medium, and low levels of physical activity was significant. The results of post-hoc test and the study of averages showed that there is a significant couple differences between working life quality of fixed and rotating employees in three levels of low, medium, and high physical activity. By analyzing the results of post-hoc test and averages in table 1, it is determined that fixed shift employees with high level of physical activity have the best working life quality among other employees. Additionally, the working life quality of fixed shift employees with medium and low level of physical activity is better than working life quality of rotating shift employees with medium and low level of physical activity. Moreover, the working life quality of rotating employees with high physical activity is significantly better than working life quality of rotating shift employees with medium and low level of physical activity.

To determine the significant difference between memory self-efficiency in fixed and rotating shift employees and different levels of physical activity used two-way ANOVA was (table 3).

The results of two-way ANOVA test showed that the main effect of shift is significant ( $p = 0.019$ ), and the average of memory self-efficiency in fixed shift employees was better than the average of memory self-efficiency in rotating shift employees. The main effect of physical activity was significant ( $p = 0.001$ ). The results of Bonferroni post hoc test showed that the average of memory self-efficiency in employees with high and medium level of physical activity is better than the average of memory self-efficiency in employees with low level of physical activity. Moreover, the average of memory self-efficiency in employees with medium level of physical activity

is more than memory self-efficiency in employees with high level of physical activity. The interactive effect of fixed and rotating shift is significant in low, medium, and high levels of physical activity ( $p = 0.026$ ). By studying the results of post-hoc test and averages in table 1, it is specified that fixed shift employees with medium level of physical activity have the best memory self-efficiency compared to other employees. Memory self-efficiency of fixed and rotating shift employees with high and medium level of physical activity is better than memory self-efficiency of fixed and rotating shift employees with low level of physical activity. Moreover, memory self-efficiency of rotating shift employees with high and medium level of physical activity is more than memory self-efficiency of fixed and rotating shift employees with low level of physical activity.

### Discussion and conclusion

This study aimed to investigate efficiency of different levels of physical activity on working life quality and memory self-efficiency by mediation role of circadian rhythm. The results support a significant difference between working life quality of fixed and rotating shift employees with different levels of physical activity. The analysis of averages showed that fixed shift employees with high level of physical activity had a better working life quality than other employees. Working life quality of fixed and rotating shift employees with high level of physical activity was better than working life quality of fixed and rotating shift employees with medium and low physical activity. The findings of this research are in line with the findings of Skinner and Dorrian (2015), New et al. (2013) and Chiu et al. (2013). New et al. (2012) showed that nurses who work at night shift

**Table 3.** Two-way ANOVA analysis for memory self-efficiency in fixed and rotating shift employee

Variable	Sum of squares	df	F value	Significant level
shift	97.16	1	5.61	*0.019
physical activity	1353.76	2	39.13	*0.001
shift×Physical activity	129.86	2	3.75	*0.026

Significance in level ( $p < 0.05$ ).

experience a lower life quality. Moreover, patients' objection to nurses who have long and rotating shifts in hospital have been increased due to nurses' lack of appropriate communication and care.

Stemphel et al. (2012), Moonsing et al. (2011), Levin et al. (2010) and Dicastro et al. (2010) concluded that nurses who just work at night shift are more at risk of damages related to work and illness and they have low working life quality. In their research, Skinner and Dorrian (2015), also, concluded that insufficient sleep and fatigue, followed by low life quality, are consequences of non-standard working hours and shift work. In spite of the fact that increasing physical activity could increase the person's capacity and capability to confront with the demands of daily life, and a specified level of physical activity is required to improve performance in most jobs (Yousefi et al. 2012), the advantages of physical activity in shift work employees are almost ignored (Atkinson et al. 2009).

The results of this research are in line with the findings of Tarabi (2003), Soltani (2003), Lipokan et al. (2004), Erikson and Brasgard (2004), Youngstedt et al. (2016), and Sherman et al. (2015) who studied the role of physical activity to deal with stress and working pressures of working shift employees and better life quality. Moreover, in his study, Harington (2001) found out that increasing entertainment – sport equipment are suitable for promoting the shift work employees' health and their life quality. Harma et al. (1988), also, in their investigation, demonstrated that physical activity increase health and work efficiency, and consequently, employees' life quality. In addition, Youngstedt et al. (2016) believed that exercise could increase health and consequently eliminate stress of work and increase quality of life. On the other hand, the finding of this research is not in line with the research findings of Mostahfeziyan et al. (2009). Kizo Ji Ji (2003), also, believes that physical activity could reduce performance and lead to inability of work and consequently a reduction in life quality. In this regard, Zhang et al. (2009) believe

that the main reason of this difference is probably due to difference in methodology, number, and type of subjects, their sport activity type, lack of control group, large number of variables, and difference of tools.

Significant difference between memory self-efficiency of fixed and rotating shift employees with different level of physical activity was another finding of this research. The analysis of averages showed that fixed shift employees with medium physical level had the best memory self-efficiency in comparison to other employees. Memory self-efficiency of fixed and rotating shift employees with high and medium level of physical activity was better than memory self-efficiency of fixed and rotating shift employees with low level of physical activity. The results of this research were in line with the findings of Alosko et al. (2014), Rozanetti et al. (2014), Sowares et al. (2014), and Gumenyuk et al. (2010). In their investigations, this researchers found out that physical activity promote employees' memory self-efficiency. It also strengthens cognitive functions like memory, attention, and performative function, and finally memory self-efficiency in employees. In their studies, Yasuda et al. (2005) and Bandura (1997), also, found that active employees have high self-efficiency for works that require high capacity of memory, and consequently, they have better memory self-efficiency. Costa (2001) and Leo Junior (2003), in their studies, found that regular sport activities promote movement, and the performance of memory and feeling of memory self-efficiency improve. On the other hand, Rinburg and Ashknazi (2008) and Akinson et al. (2008) stated that rotating shift employees who do regular physical activity are less vulnerable to mental diseases such as depression and job burnout, and their memory performance improves.

Regarding the previous studies and the findings of the present research, it could be concluded that doing regular physical activity for fixed and rotating shift employees could improve working life quality

and memory self-efficiency. Therefore, regarding the adverse effects of shifts on working life quality and memory self-efficiency, and due to the fact that shift work is applied in high frequency in service centers and industry, and reduction or removing shift work is impossible, and since job has an important role in life, physical activity to maintain good performance in work and participating in daily work activities, feeling of happiness, mental health, and in general, working life quality and memory self-efficiency are highly important. As such, managers of health centers and ministry of health are recommended to increase sport equipment in order to increase the performance of their employees and efficiency. Doing high and medium level of activity will increase working life quality and memory self-efficiency, and it allows the employees to think to and deal with other issues in their lives, and consequently bring about health. Moreover, people who have good physical condition are more successful in social and individual activities, and this could lead to a better performance in working life (Mostahfeziyan et al. 2009). Researchers are usually dealt with some limitations in their studies, and the present one is no exception. Since the researchers, in this study, have used hospital employees, the data of this investigation cannot be generalized to other organizations, institutions, and centers with fixed and rotating shift employees (such as fire station centers, police, airline, and so on). The data are related to geographical location of Tehran and cannot be generalized to other provinces. The results of the research can be generalized to employees without mental illness and depression, but for generalization to employees with mental problems, a research with enough knowledge and caution must be conducted. In addition, since the research has been conducted on the employees with the age range of 30 to 59, it cannot be generalized to employees under 30 years old and above 59 years old.

Since the present study is done on the hospital employees and generally, the jobs associated with health and care centers have a stressful nature, it is

suggested that this research be conducted on different working society and the findings be compared. In addition, since the research is causal – comparative type, and the participants with different physical level were chosen by questionnaire, it is recommended that the impacts of high, medium, and low levels of physical activity on variables of the research be studied empirically and by training interventions in another research.

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finally, Authors Should be thanks or special thanks who helped us on this study by filling all questionnaires .all subjects came from follows Iran-tehran hospitals and different wards Shohada Hospital, Milad Hospital, Taleghani Hospital, Ramtin Hospital, Alborz Hospital in Karaj in wards of infants, ICU, CCU, internal surgery, dialysis, maternity, nephrology, and hematology.<sup>1</sup>

### **Ethical statement**

Due to respecting moral considerations, employees were completely informed of objective of the research and they were assured that they would be safe and their names and personal information would be kept secretly. They were also asked to answer the questions honestly and put away their biases.

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