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# Relationships between Age, Morning-Type and Rigidity Sleeping Habits with Shiftwork Tolerance

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## ABSTRACT

Shiftwork is now a major feature of working life across a broad range of industries and circadian rhythms play an important role in shiftwork tolerance. So, the aim of this study was examine the relationships between age, morning-type and rigidity sleeping habits with shiftwork tolerance among shiftworkers of Karun Oil and Gas Exploitation Company. The sample consisted of 295 shiftworkers of Ahvaz, Iran, selected according to the stratified random sampling. Survey of Shiftworkers (SOS) was used to measure the variables of this study. The results indicate that correlation coefficients between the shiftwork tolerance with age, morning-type and rigidity sleeping habits were negative and significant ($p$<.0001). Stepwise multiple regression analyses yielded $R_1$=0.449, $R_2$=0.532 and $R_3$=0.547 between shiftwork tolerance and independent variable. The results showed the importance of age, morning-type and rigidity as predictors of shiftwork tolerance. At a more practical level the main implication would be that we should attempt to select people for shiftwork systems according to their circadian rhythms (morningness /eveningness), sleeping habits (flexibility/rigidity) and demographic variables (such as age).

**Keywords:** *Age, Circadian type, Morning/evening-type, Flexibility, Sleep, Shiftwork tolerance*



## INTRODUCTION

Shift work scenarios are increasing in modern society and one factor thought to affect shift work tolerance is related to the nature of the endogenous circadian rhythm of the individual. While, the majority of individual have a circadian rhythm system that maintains an appropriate phase for the external solar clock time, some individuals tend to experience a consistent phase-advance or phase-delay of their circadian rhythm system. These differences have been externalized and measured as the circadian type of the individual. The two extremes of circadian type are the morning-type (or "larks") and the evening-type (or "owls") [1].

These differences in circadian type are thought to affect the ability of the individual to tolerate shiftwork [2]. Scott and Ladou (1990) give examples relating these differences to the shift work situation as: evening-types tend to adapt to night shift work more easily than morning-types; morning-types are more physically fit during the morning shift, and evening-types are more physically fit during the evening shift, and the sleep of the morning-types is more disturbed when working the night shift than it is for evening-types [3]. Åkerstedt and Torsvall have shown morning-type to be associated with poor adjustment to shift work overall (i.e. rotating shift work) [4].

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Pre-existing preferences for morning-type or evening-type may influence both a worker's preference for and their ability to adapt to shift work, with evening-types being more likely to select and more able to adapt to shift work than morning-types. This may be because evening-types typically show a greater flexibility in their sleeping habits and a greater ability to overcome drowsiness than morning- types, both of which make shift work easier. Evening-types are also more likely to have a better sleep length and quality after a night shift than morning-types, and which may improve over a series of night shifts for evening types much more than for morning types [5]. Harma suggested that the earlier circadian phase position of morning-types would slow their adaptation to night work, which requires a delay of the circadian phase position [6]. Non-tolerant shift workers are particularly sensitive to the internal desynchronization of their circadian rhythms [7].

Therefore, there is some evidence that the circadian rhythms of evening types may show rather better adjustment to a shift system than the rhythms of morning type [8]. Thus for the evaluation of a person's capability to perform night work or shift work should take into account chronotype [9].

Psychological dimensions which may affect shift work tolerance are flexibility-rigidity sleeping habits, which is a measure of the flexibility of an individual's sleeping habits [10]. Flexibility of sleeping habits represents the ability to sleep at unusual times and vice versa [11]. These variables are correlated to shift work preference or tolerance [12-16]. However, conflicting data do exist [17-18]. A combination of these two measures may provide a better indicator of shift work tolerance than the circadian type measure (i.e. morning type vs. evening type) [19].

Furthermore, with the percentage of workers involved in shift work increasing, and the population as a whole aging, it is inevitable that older individuals will be involved with shift work. Increasing age is thought to be associated with decreased shift work tolerance [20-23]. Shift workers sometimes become intolerant to their work schedules when they reach ages between 40 and 60 even though they have done shift work successfully for many years (1). Harma and Ilmarinen (1999) reviewed the literature relating to shift work and the older worker. Older shift working individuals appear to be less able to cope with the demands of shift work, despite having many years of experience [24].

Since identification of behind individual factors is important for understanding the process of shiftwork tolerance, therefore the goal of this study was to identify factors (predictors) that can determine shiftwork tolerance. The present research was carried out to determine the correlation of age, morning-type and rigidity sleeping habits with shiftwork tolerance. The following hypotheses were tested in the present study:

1. There is a negative correlation between shiftwork tolerance and age
2. There is a negative correlation between shiftwork tolerance and morning-type.
3. There is a negative correlation between shiftwork tolerance and rigidity sleeping habits.
4. There is a multiple correlation between age, morning-type and rigidity sleeping habits with shiftwork tolerance.

## MATERIALS AND METHODS

The population of this study was consisted of the shiftworkers in Karun Oil and Gas Exploitation Company in Ahvaz, Iran (No=587). The sample consisted of 295 men shiftworkers worked in 8-hour shifts and with Clockwise Rotation. Subjects were selected using stratified random sampling. Each of them received the questionnaire in person in their workplace and complete it, then return to the researcher. Participants in this study signed written informed consent.

The Survey of Shiftworkers (SOS) was used to measure morning-type, rigidity and shiftwork tolerance. SOS is shorter version of Standard Shiftwork Index (SSI) produced by Barton et al. (1995) [25]. It consists of questions and rating scales covering: General information, individual difference measures and tolerance to shiftwork measures such as timing and duration of sleeps, sleep quality, chronic fatigue scale, alertness rating, neuroticism, social and domestic disruption, physical health and general health questionnaire.

SOS was specially developed for research on shift workers and has been shown to have satisfactory reliability and validity across various occupational samples as well as diverse cultures [25-26].

Evidences of reliability of the SOS, as administered to Iranian relevant populations, in this research, by Alpha Coefficient are 0.86 and by Split-half is 0.68. The validity Coefficients of questions and rating scales SOS are between 0.21 and 0.73 that all the validity Coefficients are significant at $p<0.0001$.

Statistical analyses were performed using SPSS (version 18). Multiple regression analysis (stepwise) was used to assess associations between variables (age, morning-type and rigidity) and shiftwork tolerance.

## RESULTS

Research findings are presented in two sections: the descriptive findings and the findings relevant to hypotheses. Descriptive findings, consisting of the means, standard deviations, ranges and simple correlation coefficient between age, morning-type and rigidity sleeping habits with shiftwork tolerance are presented in Table 1 and Table 2.

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**Table 1.** Means, standard deviation and range for shiftwork tolerance, age, work experience, shiftwork experience, morning-type and rigidity sleeping habits

| | Mean±SD | Range |
|---|---|---|
| Age (yr) | 41.84±9.33 | 23-59 |
| Work experience (yr) | 19.86±9.03 | 2-38 |
| Shiftwork experience (yr) | 16.51±9.40 | 1-35 |
| Morning-type | 7.21±2.38 | 1-9 |
| Rigidity sleeping habits | 7.49±2.09 | 1-9 |
| Shiftwork tolerance | 190.05±26.03 | 132-291 |

**Table 2.** Simple correlation coefficient between age, morning-type and rigidity sleeping habits with shiftwork tolerance

| | Age | Morning-type | Rigidity | Shiftwork tolerance |
|---|---|---|---|---|
| Age | — | | | |
| Morning-type | 0.309* | — | | |
| Rigidity | 0.334* | 0.356* | — | |
| Shiftwok tolerance | -0.410* | -0.449* | -0.342* | — |

*$p$<.0001

Table 2 indicate that correlation coefficient between shiftwork tolerance and age is -0.410, coefficient between shiftwork tolerance and morning-type is -0.449 and the correlation coefficient between shiftwork tolerance and rigidity sleeping habits is -0.342, that statistically significant at $p$<0.0001. These results confirm our first, second and third hypothesis.

The results of the fourth hypothesis, i.e. there is a multiple correlation between age, morning-type and rigidity sleeping habits with shiftwork tolerance, are in Table 3 containing the results of the stepwise multiple regression analysis that indicate, age, morning-type and rigidity have significant multiple correlation with shiftwork tolerance, which is equal to 0.547, and explain 30% of variance of the criterion variable.

## DISCUSSION

The purpose of this study was to investigate the relationship of age, morning-type and rigidity sleeping habits with shiftwork tolerance. The results of simple correlation indicate that age is correlated significantly with shiftwork tolerance. The correlation coefficient was -0.416. These results are consistent with findings of other researchers [21-24]. Increasing age is thought to be associated with the age-related changes that occur with the circadian rhythm system and with sleep architecture. With increasing age, the circadian rhythm system tends to decrease in amplitude (i.e. it flattens), there is an increased tendency for internal desynchronisation, and due to a shortening of the period length there is an increased tendency for phase advanced rhythms, resulting in more "*morningness*" [21-27]. Sleep architecture also changes with age, with sleep becoming lighter and more fragmented on average with increasing age, resulting in an increase in sleep complaints [28]. Therefore, increasing age is thought to be associated with decreased shift work tolerance.

The results of simple correlation indicate that morning-type is correlated significantly with shiftwork tolerance. The correlation coefficient was -0.456. These results are consistent with findings of other researchers [1, 3-4]. Evening-types being more likely to select and more able to adapt to shift work than morning-types. This may be because evening-types typically show a

**Table 3.** The result of the Stepwise Multiple Regression Analysis of age, morning-type and rigidity sleeping habits with shiftwork tolerance

| | Statistical indices / Predictive variable | MR | RS | F | t | *p* |
|---|---|---|---|---|---|---|
| 1 | Morning-type | 0.449 | 0.201 | 73.58 | -5.87 | 0.0001 |
| 2 | Age | 0.532 | 0.283 | 57.40 | -4.97 | 0.0001 |
| 3 | Rigidity | 0.547 | 0.299 | 41.27 | -2.59 | 0.010 |

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greater flexibility in their sleeping habits and a greater ability to overcome drowsiness than morning- types, both of which make shift work easier. Evening-types are also more likely to have a better sleep length and quality after a night shift than morning-types, and which may improve over a series of night shifts for evening types much more than for morning types [5].

The result of simple correlation indicates that rigidity sleeping habits is correlated significantly with shiftwork tolerance. The correlation coefficient was -0.344. These results are consistent with findings of other researchers [11-16]. This individual characteristic should help people to sleep when it is possible and not only when there are the best circadian conditions. Thus, flexibility of sleeping habits should be related to a greater ability to sustain continuous operations and to work at unusual hours, as a matter of the fact, flexibility of sleeping habits is related to better long-term tolerance to shiftwork [12-13].

In conclusion, age, morning-type and rigidity sleeping habits have important role in predicting of shiftwork tolerance.

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