Sleep profile status based on substance use, lipids and demographic variables in Tabari cohort study

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Abstract
Background: This study aims to investigate the situation of sleep proﬁle and its related factors in the Tabari Cohort Tabari (TCS) population.

Methods: The information of 10255 of the Tabari cohort population in the enrolment phase was used in this study. The sleep proﬁle data was collected and recorded by trained questioners. The sleep duration in day & night, the time interval between going bed and falling asleep, continuous use of sedatives, involuntary nap, limb hypermobility during sleep and shift working were determined for each person. Data analysis was performed by independent T test and Pearson correlation coefﬁcient.

Results: Mean, standard deviation, median, minimum and maximum of sleep duration in this population were 7.6, 1.6, 7.5, 0.5 and 17 h. Frequency of sleeping less than 6 h, 6 h-10 h and more than 10 h were 1168(11.4%), 8463(82.5%) and 624(6.1%) respectively. Prevalence of sleeping more than 10 h among men and women were 5% and 6.8% respectively (P < 0.001). Prevalence of sedative routine use among men and women were 4.7% and 9.6% respectively (P < 0.001). There were signiﬁcant relationships between sleep duration and area residence, age group (P < 0.001), education level (P < 0.001), socioeconomic level (P < 0.001), triglyceride (P = 0.002), HDL-cholesterol (P = 0.013) and Cholesterol total (P = 0.021). There was a negative correlation between age and sleep duration (r = -0.062, P < 0.001).

Conclusions: The results showed the association of the quality and quantity of sleep with personal, social, environmental and biological factors such as gender, age, economic status, educational status, and lipid proﬁle. Therefore without proper intervention, the incidence of outcomes associated with these risk factors can be predicted in TCS In later years.

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1. Background
Sleep is a behavior, process and brain status with complex relationships with each other in different times and spaces [1,2]. Studies have shown an association between general health and 7–8 h of sleep [3]. Sleeping less than 7 h per day or low quality sleeping can lead to several disorders such as diabetes mellitus and insulin resistance, obesity, hypertension, cardiovascular problems and increased risk of death [4–6].

Patients with sleep disorders are classified to: those cannot sleep, those would not like sleep, those have excessive drowsiness during day and those with restlessness during sleep [7]. Age and gender are factors associated with such disorders which are more common among women as well as in the elderly. Women are complaining of difﬁculty in falling asleep, while, men are often suffer from light sleep, persistent sleep and respiratory disorders during sleep [8].

Sleep profile consists of two main aspects, sleep duration and sleep quality [9]. Sleep profile in various population has been investigated in previous studies mostly in diseased population [10,11], Few studies have been carried out regarding the quality and quantity of the sleep and its association with personal, social and biological factors among general population [12]. In present study
Data of more than 10,000 participants, collected in enrollment phase of Tabari cohort has been utilized. The participants were enrolled from urban and mountainous regions of Sari district (North of Iran). These two populations differ significantly regarding epidemiological and lifestyle related risk factors; [13]. Since the sleep pattern can play a main role in the daily function, the aim of present study was to investigate the sleep profile and its associated factors among the Tabari cohort population.

2. Methods

Data collected in the enrollment phase of the Tabari cohort was used in the current study. This study was approved by Mazandaran University of Medical science ethical committee (IR.MAZUMS.REC.1395.2524). Written informed consent form was obtained from all participants based on Declaration of Helsinki.

Tabari cohort is a part of the national cohort named as Prospective Epidemiological Research Studies in Iran (PERSIAN) [14,15]. More details of Tabari cohort has been explained in the cohort profile paper [13]. In the enrolment phase of the Tabari cohort, 10,255 individuals aged 35–70 years old (7012 urban residents and 3243 rural residents) were recruited from Sari district (capital of Mazandaran province-North of Iran) using census method. The information of the Tabari cohort was collected using relevant questionnaire and blood sampling. Details of the standard questionnaire applied in the cohort has been explained elsewhere [13–15].

Some of the main variables measured in the cohort were as following:

Anthropometric factors including weight, height, waist circumference and hip circumference which were measured by trained staff according to a standard protocol. Height was measured by SECA 226 (SECA, Hamburg, Germany) meter. The weight was also measured using SECA 775 scale (SECA, Hamburg, Germany).

Blood samples were collected following 12 h fasting. For each participant 25 ml blood was collected. A portion of collected blood was used for biochemistry tests using BT 1500 (Biotechnical, Italy) and a complete blood count by Nihon (alpha cell counter Kohden, Tokyo, Japan). The rest of collected blood was separated into whole blood, plasma, serum and buffy coat and stored in freezers.

Sleep profile questions were questions regarding the time of sleep beginning (hour, minute), duration between bed time and sleeping time (minutes), time of waking up in the morning, time in which the subjects would like to be waken up (hour, minute), the time in which the individuals sleep during each day, working in the night hours during the last year (9 p.m.- 6 a.m.), limb hyper motility during sleep, napping during days and using sedatives more than two times per week. Finally, sleep duration was calculated and classified as less than 6 h, 6–10 h and more than 10 h. It should be noted that various definitions of these indices has been reported in the previous evidences. However, in the present study, it was define based on the Cappuccino et al. study and the expert opinion [16]. Moreover, the time duration between going to bed and beginning of sleeping was less than 15 min in 56.2% and more than 60 min in 7.4% of the cohort population. The time interval longer than 60 min among men and women was 3% and 10.4% respectively (p < 0.001). Consumption of sedative drugs more than two times per week was reported by 785 (7.7%) of the cohort population. The situation of the other components of the sleep profile has been illustrated in Table 2.

Table 3 compares the sleep profile of the cohort subjects based on demographic, behavioral and laboratory factors. Frequency of sleeping shorter than 6 h in subjects aged 35–44, 45–54 and 55–70 years were 8.4%, 11.1% and 14.5% respectively (p < 0.001). There were no significant relationships between sleep duration and BMI (p = 0.128), marital status (p = 0.351), cigarette smoking (p = 0.371), opium addiction (p = 0.594), hookah (p = 0.051), alcohol consumption (p = 0.096). Frequency of low sleep duration (shorter than 6 h) among subjects with different socioeconomic levels were 15.9%, 14.2%, 10.3%, 9.1% and 7.4% respectively for the first, second, third, fourth and fifth levels of socioeconomic status (p < 0.001). Low sleep duration among subjects with total cholesterol less than 200, between 200 and 239 and more than 240 were 10.7%, 12% and 14.1% respectively (p = 0.021). The time interval between bed time and beginning the sleep based on subjects with different demographic, behavioral and laboratory factors has been illustrated in Table 4.

4. Discussion

This study investigates the sleep profile of 10,255 Mazandaran residents in northern part of Iran (Tabari cohort population). In the present study, the frequency of sleeping less than 6 h/larger than 10 h among urban residents, mountainous residents, men and women was estimated as of 9.1%/7.3%, 16.4%/3.5%, 9.4%/5% and 12.8%/ 6.8% respectively. In addition, frequency of different sleep profiles were more than 10 h among those with and without smoking habit, opium addiction, alcohol consumption and those with different body mass indices. However, significant differences were observed between sleep profiles of the participants with various lipid profiles, educational status, age groups and socioeconomic levels.
In the present study, the prevalence of sleep less than 6 h and more than 10 h in the mountainous area was higher in urban areas. This finding is consistent with results of Xiang et al. conducted among 5926 general population [17]. Another study performed in China, showed prevalence of insomnia among rural residents was significantly higher than urban residents (29.4% vs 25.5% respectively) [18].

Finding of present study showed, average time of sleep was 7.76 ± 1.59 and 7.23 ± 1.71 h in urban and mountainous areas respectively. More than two-third of them had less than 7 h sleep per 24 h. Such amount of sleeping is in keeping with those reported from the other communities [19,20]. Considering the recommendations for enough sleeping for general health [3], such sleep pattern in this population can lead to different disorders in long term. Therefore, it is necessary to plan suitable strategies for improvement of personal behavior such as regular sleep pattern, specifying the exact time for going bed in the night and waking up in the morning, designing a quiet environment, avoiding from electronic devices and lavish meals, alcohol and caffeine.

The current study showed higher rates of sleep duration less than 6 h and more than 10 h among women and also a negative association between ages and sleep duration. Evidences show increasing the amount of complaints of sleep problems with ageing especially among women [20,21].

The time duration between bed time and sleeping time was 1.71 h in urban and mountainous areas respectively. More than two-third of women had less than 7 h sleep in the morning, designing a quiet environment, avoiding from electronic devices and lavish meals, alcohol and caffeine.
just 7.4% of them had sleeping time interval longer than 60 min. Exelmanns et al. showed such interval shorter than 15 min in one-fifth of the Belgian adults, while, 9.5% of them needed more than 1 h to sleep [22]. Such difference might be partially due to the different urban/rural composition of the Tabari cohort population and the populations investigated in the other studies. However, no appropriate evidences were found regarding the relationship between this index and the residence area. Out of our population, 7.7% reported using sedative drugs at least two times per week which was similar to those reported from Brazil. (7.6%) [23].

Involuntary naps in the present study was 20% which was in agreement with that reported by Ohayon et al. [24]. However, Van der Spuy et al. reported lower rates and also introduced several evidences regarding the relationship be-

In the Tabari cohort population, night work was considerably higher among men than women. This characteristic can be considered as a medical problem so that 32.1% of people with shift work and 26.1% of those with shift work switching between days and nights had reported minimum criteria of sleep disorder. These shift work switching has been investigated from different aspects indicating changes in the circadian rhythm of the persons leading to sleep and mental disorders as well as different work errors and high economic costs in long term [28,29].

Our results showed that approximately half of the Tabari cohort population had day time sleeping which was much longer than the times reported for the most other communities in the previous literature [30,31]. Although we did not find any relationship between short sleeping and BMI, previous evidences showed negative correlations between BMI and sleep duration so that those with shorter sleep durations have higher risk of developing obesity [32,33]. A study carried out among US population aged over 40, mean BMI of patients with insomnia (32.9%) was significantly higher than those without insomnia (28.5%)[34].

We found negative association between the educational level and short sleeping. Our results was in agreement with those in the Netherlands and United States [30]. Although we did not find any relationship between sleep duration and tobacco or alcohol use, the results showed that those having these habits fall in asleep much faster than the other individuals. Previous studies indicated that tobacco smoking or secondary exposure to its smoke and also caffeine and alcohol consumption lead to onset of different sleep disorders [35,36]. Current cigarette smoking and current alcohol drinking caused significantly 47% and 26% higher odds of developing insomnia in general population [18]. Khazaei et al. showed that opium dependent patients without treatment had higher prevalence of sleep disorder compared to those receiving methadone maintenance therapy [37].

### Table 3

Sleep status of Tabari cohort population based on different factors.

| Variable                  | <6 h | 6–10 h | >10 h | P-value* |
|---------------------------|------|--------|-------|----------|
| Area residence            |      |        |       |          |
| Urban                     | 636(9.1) | 5867(81.7) | 509(7.3) | <0.001   |
| Mountainous               | 532(16.4) | 2596(80.0) | 115(3.5) |          |
| Age group                 |      |        |       |          |
| 35–44                     | 280(8.4) | 2842(85.3) | 209(6.3) | <0.001   |
| 45–54                     | 375(11.1) | 2813(83.2) | 191(5.7) |          |
| 55–70                     | 513(14.5) | 2808(79.2) | 224(6.3) |          |
| BMI                       |      |        |       |          |
| ≤<25                      | 287(11.6) | 2057(83.2) | 129(5.2) | 0.128    |
| >25–29                    | 478(11.0) | 3602(82.9) | 263(6.1) |          |
| ≥30                       | 403(11.7) | 2804(81.5) | 232(6.7) |          |
| Education level           |      |        |       |          |
| No schooling              | 291(19.0) | 11172(76.5) | 68(4.5) | <0.001   |
| 1–5 years in school       | 325(13.9) | 1835(78.4) | 172(7.4) |          |
| 6–8 years in school       | 119(10.6) | 924(82.4) | 78(7.0)  |          |
| 9–12 years in school      | 251(8.7) | 2465(85.1) | 180(6.2) |          |
| Marital status            |      |        |       |          |
| single-widow-divorce      | 182(7.7) | 2067(87.1) | 125(5.3) |          |
| Smoking daily             |      |        |       |          |
| Yes                       | 104(11.2) | 778(83.7) | 47(5.1)  | 0.371    |
| No                        | 1064(11.4) | 7685(82.4) | 577(6.2) |          |
| Hookah                    |      |        |       |          |
| Yes                       | 56(9.6) | 502(86.1) | 34(6.3)  | 0.051    |
| No                        | 1112(11.5) | 7961(82.3) | 599(6.2) |          |
| Drug use                  |      |        |       |          |
| Yes                       | 64(10.3) | 519(83.2) | 41(6.6)  | 0.594    |
| Scolar economic level     |      |        |       |          |
| 1 [lowest]                | 326(15.9) | 1642(80.1) | 83(4.0)  | <0.001   |
| 2                         | 292(14.2) | 1626(79.2) | 134(6.5) |          |
| 3                         | 212(10.3) | 1691(82.5) | 147(7.2) |          |
| 4                         | 186(9.1) | 1721(83.9) | 144(7.0) |          |
| 5 (highest)               | 152(7.4) | 1783(86.9) | 116(5.7) |          |
| Alcohol                   |      |        |       |          |
| Yes                       | 75(9.3) | 687(85.2) | 44(5.5)  | 0.096    |
| No                        | 1109(11.6) | 7779(82.3) | 580(6.1) |          |
| TG                        |      |        |       |          |
| <150                      | 712(11.9) | 4944(82.6) | 332(5.5) | 0.002    |
| 150–199                   | 226(13.4) | 1636(82.2) | 117(5.9) |          |
| ≥200                      | 230(10.1) | 1833(82.3) | 175(7.6) |          |
| HDL-C                     |      |        |       |          |
| >40 for male or >50 for female | 375(9.0) | 2399(82.1) | 242(7.0) | 0.013    |
| ≤40 for male or ≤50 for female | 101(9.5) | 911(81.6) | 92(8.4)  | 0.021    |
| Cholesterol total         |      |        |       |          |
| <200                      | 701(10.7) | 5444(83.2) | 401(6.1) |          |
| 200–239                   | 327(12.0) | 2222(81.8) | 167(6.1) |          |
| ≥240                      | 140(14.1) | 797(80.3) | 56(5.6)  |          |

*P-value based on the results of Chi-squared test.

**HDL-C**: HDL-cholesterol.
In this study short sleep duration had negative correlation with the socioeconomic status. These findings are in parallel with the previous literatures revealed that the highest complaints of sleep disorders are among the low socioeconomic groups [38,39]. The exact mechanism for the relationship between sleep status and socioeconomic level has not yet been specified. However, some probable reasons might be involved. For example, socioeconomic status effects on working hours and hard work. The association between lipid profile and sleep status showed longer sleep duration among those with higher triglyceride and lower HDL-C. Many studies carried out in different parts of the world have shown the relationship between abnormal lipid profile and low quality sleeping [40–43].

One of the limitations of the present study was that data regarding sleep quality indicators are subjective and were collected based on self-reporting which can be different from the results of the objective measures. However, it seems that such error is negligible because of the large samples size. It should be noted that the present study aimed to describe the sleep profile of the Tabari cohort population. Therefore causal relationship is not the main focus of the study and multivariate analyses were not used in the study.

5. Conclusion

The results showed the association of the quality and quantity of sleep with personal, social, environmental and biological factors such as gender, age, economic status, educational status, and lipid profile. Since the lack of enough sleep can lead to cognitive, mental and mood disorders, fatigue and weakness, disturbances in physical activities, poor decision making, physiological and hormonal disorders, it is necessary to increase the public knowledge about the importance of the sleep to prevent onset of such consequences.

Ethics approval and consent to participate

TCS was approved by Mazandaran University of Medical science ethical committee (IR.MAZUMS.REC.1395.2524). Written informed consent form was obtained from all participants.

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Authors’ contributions

MM, MK, AE and MA acquired data, performed the statistical analyses, interpreted data, and drafted and revised the manuscript.
for important intellectual content and approved the final version. RA and SHH interpreted data, reviewed the analyses and approved the final version.

Consent for publication
Not application.

Availability of data and materials
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of competing interest
The authors declare that they have no Competing interests.

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