Measuring the levels of acetylcholinesterase and plasma thiol groups in selected technical personnel of National Iranian Gas Company

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Abstract

Background and aims: Over time new energy sources and advanced technologies will be needed. Fossil fuels such as gas energy play a major role in the energy demand of world. Natural gas (NG) containing of methane as a primary fuel is used in urban and building application. Moreover, development of technological methods for gas extraction increased the use of this resource. It is also a source of raw material for petrochemical industry. Although methane is often regarded as a non-toxic chemical but high concentration can reduce the percentage of oxygen in the air. Natural gas distribution, lower extraction cost and less environmental contamination are the advantages of natural gas consumption. In these years, natural gas as a source of energy basket was used due to environmental issues and decreasing of oil reserve in world. However, natural gas is the most important alternative instead of fuel. After extraction of natural gas, it sent to refiner. By finishing the refining and processing procedure, natural gas is chemically ready to use but it is colorless and odorless gas as physically. From a safety point of view, a change must be made in natural gas to be quickly and easily identifiable. In the gas distribution process for industrial and public use, insurance of the user safety is important. Many accidents are reported where gas leak cause these difficulties. Therefore, in this industry, sulfur containing compounds as a leak warning was added to transmission system in order to recognize gas egression. In the city station; natural gas with the maximum pressure of 700-1000 PSIG and a minimum pressure of 300-350 PSIG was transited and then pressure was reduced in the level of 250 PSIG. The compounds are used to prevent the potential risks of leaks and explosion. Sulfur containing compounds have a very prominent odor; so that is detectable by the sense of smell at the lowest level of release. These compounds could cause eye and throat irritation and bronchitis. Inhalation exposure of hydrocarbons increased the risk of headaches, eye irritation and asthma. However, occupational exposure to natural gas in this industry is considerable and the natural gas toxicity in workers is a health risk for gas staff industry. Although exposure to natural gas in homes is very low, exposure to natural gas for technical personnel in gas industry is an important concern.

Keywords
Natural gas
Colinergic activity
Neurotoxicity risk assessment
Plasma thiol group

Received: 2019-03-12
Accepted: 2020-02-04
Technical personnel monitor troubleshooting of gas system. However limited number of investigations have studied the effect of airborne exposure to natural gas. Therefore, the purpose of this study is to evaluate the effect of occupational exposure to natural gas compounds on cholinergic activity and plasma thiol groups. Plasma thiol was evaluated to show the balance between the generation and deactivation of free radicals.

**Methods:** This research is a descriptive with comparative design that was carried out in Chaharmahal va Bakhtiari Gas Company in the year of One hundred ninety eight and One hundred ninety nine. In this study, eighty men workers from the technical personnel of the gas company as the exposed group and also eighty men employees from the administrative section of the company were selected as the control group. Demographic information including age, work experience and smoking was collected using a worksheet. The health status of subjects was evaluated by their medical examination file. All participants in the study had no specific disease and did not use particular drug. Subjects fill General Health Questionnaire for entering to study. The questionnaire assesses physical symptoms, anxiety, social dysfunction and depression. The scoring method in this questionnaire is from 1 to 4 for options a through d. The test scores in each sub score was between 4 to 28. A score higher than 14 for each sub-scale indicate a probability of a problem. Because of statistical test age, official personnel, smoking and work experience in unexposed subjects were matched with the technical staff. Age of technical personnel was 37.41±6.42 year. At the end of the shift, for each person two mL blood was sampled and collected in an anticoagulant tube. Blood samples were centrifuged at three thousand RPM for ten min and plasma was prepared. Workers of natural gas industry have tasks such as trouble-shooting and adjustment activity. In these tasks leakage, filter replacement and regulator adjustment was performed. In addition, technical staff monitor the various station daily. Health risk was determined by the levels of plasma thiol as an indicator of oxidative stress and evaluating the activity of the parasympathetic nervous system in both groups of technical and administrative subjects. Thiol groups in body proteins are an important antioxidant and is one of the major intra- and extra cellular reducers. Thiol group exist in the structure of proteins and indicate antioxidant properties of plasma. It has an anti-oxidant role while by reacting with oxidizing agent reduced oxidative stress. Plasma thiol levels were measured using the Hu method. In this method, 5,5'-dithiobis-(2-nitrobenzoic acid) is reduced by thiol groups to 2-nitro-5-mercaptic acid. Anion 2-Nitro-5-mercaptopuric acid is a yellow compound. Therefore, the intensity of the dye produced in the reaction will be proportional to the total thiol concentration of the reductant. The absorbance of the thiol solution is measured at 412 nm. The outcome of results were analyzed by the software of SPSS version twenty one. The level of statistical significance was set at pre value of 0.05. Data normality were analyzed using Kolmogorov Smirnov test. Data were presented by Mean ±Sd. for normal distribution of data, the difference between exposed and control subjects was evaluated by two sample student t-test. If samples have not normal like distribution Mean Whitney U test was applied.

**Results:** The mean of age in technical workers of the gas company were 37.6 ± 41.42 years by work experience of 10.93 ± 5.37. There are no significant difference between work experience and age in the exposed and administrative workers. The results show that cholinergic activity in the technical personnel is significantly higher in comparison with that of the administrative staff by the
pre value lower than 0.02. A total of seventy percent of the cholinergic activity in administrative staff people as base level was set at twenty four unit per liter. The activity of acetylcholine esterase in fifty nine percent of technical personnel was lower than this base value. The rate of decrease relative to baseline ranged from 0.57 to 24.52 U/L. The results of Logistic regression test show the chances of abnormalities of acetyl choline esterase activity in technical personnel are two times higher than to office personnel. The activity of acetyl choline esterase enzyme in the technical personnel has a significant relationship with the levels of thiol levels in the plasma. Median of thiol group in plasma of exposed group was 0.48 from 0.121 to 1.07 micro molar and for unexposed population was 0.5 micro molar by minimum value of 0.012 to maximum level of 0.94 micro molar. The level of plasma thiol groups was not significantly different between technical personnel and office subjects by the pre value lower than 0.642.

Pearson correlation test showed that acetylcholinesterase activity in technical personnel was positively correlated by Pre value lower than 0.05 with plasma thiol groups (r = 0.3). One of the most important reasons for the change in cholinergic activity is the disruption of the balance of oxygen free radicals. The results of this study are in line with the theory that the decrease in cholinesterase activity is correlated with the decrease in plasma thiol groups. The low correlation coefficient between cholinergic activity and thiol group could be due to poor control of various factors to cause oxidative stress in studied subjects such as nutrition and environmental pollution and so on. The results did not show a significant difference in the amount of thiol groups between different tasks of natural gas industry.

**Conclusion:** Investigating the damaging factor in natural gas workers is one of the most important factors in the health controlling among the energy producing industries. Researches have shown no clear perspective on the long exposure for occupational exposure in natural gas industry. In order to prevent the toxicity of chemical agent in the workplace, biological monitoring of workers is an important for the control of chemical exposure. Several decades ago, investigation of enzymatic activity is a suitable biomarker for chemical exposure monitoring. Consequently, odorant compound due to their Organo sulphur structure cause increase in the para sampatic activity then could be effect in the health of technical subjects in gas industry. In this study, the level of thiol group in technical personnel was lower than in office workers but this relationship was not significant. The lack of difference between plasma thiol groups in the exposed subjects and official workers could be related to variation of the compound containing the thiol group. The toxicity of natural gas was not sufficient to reduce plasma thiol group in exposed people.

**Conflicts of interest:** None

**Funding:** None

**How to cite this article:** Rezvan Zendehdel, Faezeh Gohari, Zohre Amini, Majid Mahdian Dehkordi, HakimeNouri Parkestani, Fatemeh Rajabi. Measuring the levels of acetylcholinesterase and plasma thiol groups in selected technical personnel of National Iranian Gas Company. Iran Occupational Health. 2020 (30 Dec);17:77.

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Lighting in the workplace can provide comfortable working conditions, especially when it comes to visual comfort and reduction of daytime disorders in long term. The aim of this study was to evaluate the illumination and color temperature assessment in the office workplaces and determine their relationship with visual comfort in administrative staff in Hamadan University of Medical Sciences, Hamadan, Iran.

Methods:

The study was conducted from December 2016 to December 2017 in a group of 178 employees from the administrative staff of Hamadan University of Medical Sciences, Hamadan, Iran. In this study, the intensity of illumination at the work surface and at the height of the individual eye level was measured at the user’s point of view and the color temperature was measured by a colorimeter. A questionnaire was filled out for each participant to assess their visual comfort.

Results:

The results showed that the average illumination intensity in the workplaces was 98 lux, which is below the standard of 200 lux. The average color temperature in the workplaces was 5500 K, which is above the standard of 4000-5000 K. The correlation coefficient between illumination intensity and visual comfort was 0.26, and between color temperature and visual comfort was 0.30.

Conclusion:

According to the results of this study, it can be concluded that the illumination intensity in the workplaces is below the standard and the color temperature is above the standard, which can affect the visual comfort of the employees. Therefore, it is recommended to improve the lighting conditions in the workplaces to ensure better visual comfort.
مقدمة
در دنیای امروز، گاز طبیعی یکی از منابع تولید انرژی با آلودگی کم محسوب می‌شود که در سال‌های اخیر بسیار مورد توجه بوده است. (1-2) هیدروکربن‌ها و بعضی متان ترکیب کلی اصلی گاز طبیعی هستند. (3) گاز طبیعی غاز قابل اشعاع و بی‌رنگ است و مسئله تشخیص انتشار آن در خطوط لوله و انتقال و آتش‌زدن غاز بی‌پای مطرح در صنعت غاز است. (4) از ترکیبات گاز را در دو گروه همچون هم‌رژه با پوشک پرده گازهای به وسیله پرسنل، این گاز اغلب وسیعی نمی‌پذیرد.

PsIG250 و PsIG350–300

روش بررسی
ابن مطالعه در شرکت گاز استان چهارمحال و بختیاری و بر روی تیم پرسنل فنی شرکت گاز استان انجام شد. در این حداقت 4 و حداکثر 28 باشید. نمره بالاتر از 14 این بر اثر زیرمیکعب قابل بحث و نشانه احتمال وجود مشکل بالاتر است. همچنین خط یابی درب باینگزین‌های مورد وسیل 80 در سال پرسنل‌داری می‌تواند این پرسه با پوشک استفاده از مشکل در حال انتشار و اطمینان با آزمون شدن. پرسنل اداری از لحظه‌ای مصرف سیگار و سیگار با گروه مشابه هم‌رژه دارای روند گردید.

همچنین پرسنل اداری وظایف شغلی خاصی برای کنترل خطوط لوله گاز نداشته‌اند. از مصرفی ورود به مطالعه عدم

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در این مطالعه، داده‌ها با کمک نرم‌افزار SPSS (نسخه ۲۱) تجزیه و تحلیل شد. در نتیجه، توجه در سرمایه‌داری اولین استراز و سطح فعالیت‌های گاز تیول پلاسمای در پرسنل فی شرکت مازندران داده‌ها به صورت میانگین ± انحراف معیار بیان شد. برای مقایسه فعالیت‌های آزمون اولین استراز و شکل‌گیری نسخه‌های سابقه‌دار در میان گروه‌های متوسط و غیرنرمال، نتایج آزمون فی‌ل‌ویک (Mann-Whitney U test) و نمودار در نظر گرفته شد.

با فانتهای پژوهش
نتایج مطالعه نشان می‌دهد تفاوت میانگینی بین پارامترهای سابقه‌دار و سن در افراد مطالعه‌شده وجود ندارد. جدول ۱ نشان می‌دهد که در میان پرسنل ریزداری نشان می‌دهد که بیش از ۲۳ درصد کاردینال میانگین‌ها در یک دست می‌باشد.

در این مطالعه، از روش‌های فیزل‌تی و فیزل‌تی نسخه‌های سابقه‌دار استفاده گردید. به‌طور کلی، این روش‌ها می‌توانند فعالیت‌های آزمون اولین استراز و شکل‌گیری نسخه‌های سابقه‌دار در میان گروه‌های متوسط و غیرنرمال را بیان کنند.

اندازه‌گیری فعالیت‌های آزمون اولین استراز
جدول ۱- مشخصات دموگرافیک پرسنل موجود در بخش ریزداری شرکت مازندران

<table>
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پیش‌بینی یافته نشان داد که فعالیت آنزیم استیل کولین استراز با آزمون رگرسیون لجستیک در گروه مواجهه یافته 0/05 کمک تعاملی دارد تا حالت غیرنرمال بودن فعالیت آنزیم استیل کولین استراز با آزمون رگرسیون لجستیک در گروه مواجهه یافته/012 را با پرسنل اداری جدال نمود.

جدول ۲- مقایسه فعالیت آنزیم استیل کولین استراز با ترکیبات بودارکننده گاز در میانگین بین فعالیت آنزیم استیل کولین استراز در وظایف شغلی پرسنل فنی شرکت گاز در مواجهه با ترکیبات بودارکننده کننده و پرسنل اداری.

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<th>تعداد ( غرفه )</th>
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<th>خطای معیار</th>
<th>SE ( درصد )</th>
<th>کمک تعاملی</th>
<th>رگرسیون لجستیک</th>
<th>داد ( نفر )</th>
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<td>۳۴/۱۵۵۸/۵۰</td>
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<td>۴۳/۲۷</td>
<td>۴۳/۲۷</td>
<td>۴۳/۲۷</td>
</tr>
</tbody>
</table>

*میزان پژوهش یادداشتی نشان داد که با وجود اینکه گروه‌های تیول پلاسما در پرسنل فنی

تفاوت داشته باشد، این تفاوت از لحاظ آماری معنادار نیست. آزمون هیپستسی پیرسون نشان داد میزان فعالیت آنزیم استیل کولین استراز در پرسنل فنی ارتباط معنادار مشابهی (0/5) با میزان گروه‌های تیول

![شکل ۲- مقایسه فعالیت آنزیم استیل کولین استراز با ترکیبات بودارکننده گاز در میانگین بین فعالیت آنزیم استیل کولین استراز در وظایف شغلی پرسنل فنی شرکت گاز در مواجهه با ترکیبات بودارکننده کننده و پرسنل اداری.](image-url)
بحث
تماس با هیدرواکسی و هیدروکورتیزون موجب می‌شود تا سطح همکاران در سطح نیروی انتظامی از نظر عصبی و فیزیکی بهبود یابد. در مطالعه‌ای گزارش شده که این موارد باعث کاهش آنزیم‌های نیکوتین آنزیم‌های دهده در سطح نیروی انتظامی بهبود می‌یابد. در این مطالعه نیز هیپر هنرمندی به عنوان یک کانترل از مبتلایان به نرجسی و همکاران از نظر عصبی و فیزیکی بهبود یابد.

نتایج
این مطالعه برای کنترل همکاران از درجه‌بندی و کاهش آنزیم‌های نیکوتین در سطح نیروی انتظامی اهمیت دارد.

مطالعهANGI 1989; 58(2).

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