Jundishapur J Health Sci. 2018 October; 10(4):e81724. doi: 10.5812/jjhs.81724.

Published online 2018 December 8. **Research Article**

An Investigation of the Prevalence and the Causes of Overweightness and Obesity Among Karkheh Dam Employees

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Received 2018 July 04; **Revised** 2018 September 17; **Accepted** 2018 September 18.

Abstract

Background: Obesity is one of the most important acquired and preventable risk factors for serious complications, such as fatty liver. Currently, due to sedentary nature of many jobs, shift working and improper diet, the risk of developing obesity among employees in occupational settings is a great concern. Periodic medical examination of employees is a major resource for taking preventive measures against the prevalence of work-related disorders.
Objectives: The aim of this study was to investigate the status of obesity and its predisposing occupational factors among employees of Karkheh dam and power plant and providing solutions to reduce the complications of obesity, such as blood lipids and fatty liver.
Methods: In this study, demographic and anthropometric data along with the results from medical examination were extracted from the employees' health records. Weight and height measurements were obtained using a weighbridge scale for determining body mass index (BMI). A frequency food questionnaire (FFQ) was used to measure the employees' dietary intake. Chi-square and Kruskal-Wallis non-parametric tests were also employed to investigate the relationship between the indices.
Results: The results showed that 71.8% of employees were overweight and obese. Furthermore, 25.60% were shift workers, and 34.60% had performed jobs involving static work. According to the LDL, triglyceride and cholesterol levels, 37.2%, 51.3%, and 39.8% of employees were respectively at risk of developing serious illnesses. Based on the Chi-square test, there was a significant correlation between the BMI and the employees' job (static or dynamic) (P value < 0.05). Likewise, there was a significant correlation between the level of triglyceride and BMI (P value > 0.05). There was also a notable relationship between employees' BMI and consumption of fast food, soft drinks, fat and oil, sugar, and pastries and cakes (P value > 0.05).
Conclusions: It is evident that implementation of integrated programs, such as educational, motivational, and physical strategies along with promotion of healthy eating, will prevent BMI increase and incidence of fatty liver among employees.

Keywords: Karkheh Dam, Obesity, Fatty Liver, Employees Nutrition

1. Background

Today, most work environments contain various harmful and stressful physical, chemical, biological, and ergonomic agents, which exert unfavorable impacts on physical well-being, mental status, and general health of employees (1).

Factors, which endanger people's health at the workplace, often bring about direct and indirect costs, such as work-related illnesses and disabilities, work-related ailments, social costs, and even death among the employees. Periodic occupational examination of employees in different professions is one of the significant national health programs in Iran that is usually performed in organizations, companies, and offices on an annual basis to assess, identify, and control the risks of occupational illnesses. There are often two groups of risk factors associated with the development of occupational diseases, which are identified by such periodic examinations. These risk factors include acquired and preventable factors, such as diabetes, obesity, high blood lipids, hypertension, and smoking, and innate and unpreventable factors, including age and genetic disorders, etc. Among the acquired factors, obesity is known to be one of the major nutritional problems and

public health issues (2). According to a report published by the World Health Organization (WHO) in 2016, over 1.9 billion adults in the world are overweight, of which 650 million are obese (Body Mass Index or BMI > 30). Based on this report, 13% of the total adult population around the world (11% of males and 15% of females) are obese, and the proportion of people affected by such disorders has tripled between 1975 and 2016.

Given the fact that obesity is a key contributor to many complications, such as cardiovascular disease, hypertension, lipoproteinemia, type 2 diabetes, heart stroke, osteoarthritis, musculoskeletal disorders (MSDs), fatty liver, and asthma, etc, the growing trend of such diseases has turned to a great concern for health authorities and policymakers around the world. Non-alcoholic fatty liver, which results from elevated levels of fat (triglycerides) in liver cells is also one of the most widespread reversible illnesses caused by obesity (3). The health and treatment costs associated with obesity account for approximately 5% of the total health care costs in some countries. It has also been estimated that obesity and overweightness health costs in the United States account for 9% of the total health care budget, and thus exert a lot of pressure on the national economy (4).

The incidence of obesity in individuals is, in many cases, rooted in their nutritional habits and working conditions (5, 6). Since employees in different professions spend approximately one-third of their time at the workplace and have at least one meal at work, their dietary intake and eating habits in the workplace are considered as two major factors leading to the incidence of obesity and illnesses, such as fatty liver. There are other risk factors involved in work environments, which might accelerate the incidence of obesity, overweightness and fatty liver amongst employees, of which work-related stress, lower mobility, lower job demands, exposure to chemicals (7-9), prolonged sedentary posture, and variables, such as irregular working hours, sleeping patterns and shift work, can be enumerated (10-12). Complications associated with obesity might lead to a significant increase in medical expenses and employee absenteeism. In their study, Finkelstein et al. showed that approximately 30% of the total cost of obesity is due to increased absenteeism (13). Furthermore, it has been found that the risk of work disability was increased by 5% for each unit increase in BMI (14).

Although a number of factors have been enumerated as the leading causes of employees' obesity, their diet, physical activity, and working schedule (e.g. shift workers), play major roles in the workplace. Another relevant problem in many work environments is that employees are not usually able to schedule a food plan or choose the food they consume. As a result, they mostly have to eat the food they are provided with by the company or the organization. In the Global Food Security Map published in 2008, Iran was among high-risk regions and in a national study conducted by Kolahdooz and colleagues, seven provinces (Khuzestan, Kerman, Ilam, and Bushehr) were shown to have an insecure nutritional status (15). Several studies conducted in Iran have also highlighted the levels of obesity, overweightness, and lipid disorders among the employees of different occupations (10, 16, 17).

2. Objectives

As a result, the present study attempted to investigate the relationship between the predisposing factors of obesity and overweightness and obesity status of employees of Karkheh dam and power station, according to the results of the employees' periodical examinations, to provide solutions to reduce complications of obesity, such as fatty liver.

3. Methods

This was a cross-sectional analytical study, conducted on the employees of Karkheh dam and power plant in the year 2017. The sample size was estimated by the Morgan table to be 127. Using simple random sampling from a list of 200 employees, only 78 individuals were selected due to the lack of access to all personnel. The inclusion criterion was having gone through annual medical examinations in the previous year (2015). Employees, who had at least two years of work record and did not suffer from any type of underlying diseases (adjusted for any sort of underlying diseases) were included in the study.

Exclusion criteria included lack of access to the employees due to their work schedules and locations, lack of access to the occupational health records of employees, being a temporary contractor. As a result, 49 employees were excluded from the study.

The demographic information, such as education, marital status, work schedule, static or dynamic work, anthropometric and laboratory data, including cholesterol, triglyceride, low density lipoprotein (LDL) and high density lipoprotein (HDL) levels were obtained from the employees' health records. The subjects' weight and height were measured using a calibrated scale with a stadiometer (1 to 300 kg) and a precision of 20 g.

Body Mass Index was calculated by dividing the weight (kg) by the squared height (m). The nutritional style of the subjects was determined by the frequency food questionnaire (FFQ) in terms of the unit of consumption during one week. The questionnaire included nine types of food

items (bread and cereals, dairy, protein, fruit, vegetable, sugar, chocolate, pastries and cookies, fat and oil, soda, and fast food (pizza and sandwiches)). Validity and reliability of the Persian version of this questionnaire has been reported in previous studies (12). The variable of work schedule was defined in two levels of fixed day work and ordinary shift work. The ordinary shift workers had two night shifts, two morning shifts, and two evening shifts, whereas the employees with fixed day work, worked from Saturday to Wednesday from morning to the afternoon.

Chi-square statistical test was used to examine the relationship between BMI, work shift, dynamic work, triglyceride, cholesterol, and LDL and HDL levels. The nonparametric Kruskal-Wallis test was used to measure the association between BMI and food intake.

4. Results

Of the entire sample size (78 people), only one was female; 95% were married and 94% held BA degree, while the rest had either associate degree, diploma or no degree at all. The results showed that based on the guidelines of the World Health Organization (WHO) (18), out of the total sample size, 22 (28.20%) were normal, 38 (48.7%) were overweight, and 18 (23.10%) were obese.

Furthermore, 25.60% of the subjects were shift workers and 34.60% had static or sedentary jobs. According to the IDL index, 62.8% of the studied population was healthy, while 23.10% were at risk and 14.10% were obese.

Based on the criteria for triglyceride levels, 48.7% of the employees were healthy, 24.4% were at risk, and 26.9% were reported as ill. In terms of cholesterol levels, 60.30% of the employees were healthy, 24.4% were at risk, and 15.4% had obesity.

Out of the total sample, 58 people were fixed day workers, of which 14 were normal, 29 were overweight, and 15 were obese. Moreover, of the 20 people, who had shift work, eight were normal, nine were overweight, and three were obese. The Chi-square test showed no correlation between BMI and shift work (P value > 0.05) (Table 1).

Table 1. The Relationship Between Work Shift and Body Mass Index of the Employees[a]

BMI	Shift Work		Total
	No	Yes	
Normal	14	8	22
Overweightness	29	9	38
Obese	15	3	18
Total	58	20	78

[a] Pearson Chi-square asymptotic significance (2-sided) = 0.339.

Twenty-seven employees had static jobs, of which six were normal, ten were overweight, and eleven were obese. Also, out of 51 people with dynamic work, 16 were normal, 28 were overweight, and seven were obese. According to the Chi-square test, there was a significant relationship between the BMI of the individuals and the type of job, as either static or dynamic (P value < 0.05) Table 2.

Table 2. The Relationship Between Type of Job and Body Mass Index of the Employees[a]

BMI	Kind of Job		Total
	Static	Dynamic	
Normal	6	16	22
Overweightness	10	28	38
Obese	11	7	18
Total	27	51	78

[a] Pearson Chi-square asymptotic significance (2-sided) = 0.026.

The results of the LDL level indicated that of the 18 obese personnel employed in this company, six individuals were at risk (130 < LDL) and five were obese (160 < LDL).

Analysis of the triglyceride index showed that of the total number of subjects participating in this study, 19 were at high risk ($\geq$ 150) and 21 were obese (> 200). Furthermore, the Chi-square statistical test showed that there was a significant relationship between the level of triglyceride and employees' BMI (P value > 0.05) (Table 3).

Cholesterol level analysis demonstrated that seven obese employees had a dangerous levels of cholesterol ($\geq$ 200) and five were obese ($\geq$ 240).

The nonparametric Kruskal-Wallis test showed that there was no significant relationship between the different groups based on their BMI and their food consumption (P value > 0.05). In other words, the consumption of food in the three groups (normal, obese, and overweight) was the same (Table 4).

Moreover, of the different food groups, vegetables and fruits had the lowest level of consumption, respectively, and the highest consumption level was related to the fat and oil group. The results also showed that there was a relationship between BMI and consumption of fast food, soda, sugar, and fat and oil along with pastry and cake (P value > 0.05)

5. Discussion

Regarding the BMI of overweight (5, 15, 19) and obese (> 30) employees, it was found that the prevalence of overweightness and obesity among the personnel was 48.7% and 23.10%, respectively. As a result, the prevalence of overweightness and obesity in this work environment was 71.8%

Table 3. The Relationship Between the Levels of Low Density Lipoprotein, Cholesterol, Triglyceride and Body Mass Index of Employees[a]

Variables	BMI			Total
	Normal	Overweightness	Obese	
LDL				
Healthy	15	27	7	49
At risk	5	7	6	18
Obese	2	4	5	11
Total	22	38	18	78
Triglyceride level				
Healthy	14	21	3	38
At risk	6	4	9	19
Obese	2	13	6	21
Total	22	38	18	78
Cholesterol level				
Healthy	16	25	6	47
At risk	3	9	7	19
Obese	3	4	5	12
Total	22	38	12	78

[a] Pearson Chi-square test for LDL level asymptotic significance (2-sided) = 0.168, Pearson Chi-square test for triglyceride level asymptotic significance (2-sided) = 0.168, Pearson Chi-square test for cholesterol level asymptotic significance (2-sided) = 0.093.

in total, which was higher than the general statistics reported in different populations of Iran. Furthermore, the pattern of overweightness and obesity among the employees of this organization was similar to other reports from a number of workplaces (20-23).

Higher BMI and overweightness among employees are not only major risk factors for the outbreak of cardiovascular disorders, fatty liver, hypertension, diabetes, musculoskeletal disorders, etc., yet may also increase the risk of occupational accidents and injuries. Also, based on existing studies and available data, risk factors, such as work-related stress, long working hours, overwork, shift work, and the type of job, in terms of being static or dynamic, can influence the trend of overweightness and the prevalence of obesity among employees (6). These factors may indirectly influence certain behaviors of employees, such as eating habits (24). Given the fact that most employees of Karkheh dam and power plant project are day workers and have sedentary jobs, it seems that this factor has increased the levels of BMI and obesity among them. The employees of the administrative department of this company mostly work overtime and for long hours, which can also be assumed as one of the reasons for weight gain and obesity among them.

The results of this study showed that there was no correlation between the employees' BMI and shift work. Since almost no previous study provides an agreed-upon definition of shift work, the lack of correlation between work shift and BMI increase might be attributed to the longer rest time periods of the shift workers compared to day workers (25). It must be noted that although a number of sources have mentioned work shift as one of the factors leading to an increase in body mass index, blood pressure and cardiovascular complications (26-29), other studies have not confirmed such effects (30).

Another finding of the present study was the significant relationship between the employees' BMI and their level of physical activity (static or dynamic work) at work. The relationship between static and immobile lifestyle and the incidence of overweightness and cardiovascular complications have been confirmed by previous studies (31). Since ergonomic assessments of the workstation of in this company had demonstrated a significant number of sedentary jobs, involving long-term sitting at the desk, it can be concluded that low physical activity during work is the main cause of such relationship. Studies conducted by the Career Builder Job Research Company in the US, reported that 56% of the employees believed that their overweightness and obesity was due to sitting at the desk for long hours (24).

Similar studies from Iran suggested that factors, such as sedentary jobs, may result in employees' overweight-

Table 4. The Relationship Between Different Food Groups (Unit/Week) and Employees' BMI

Variables	Number	Mean ± SD	Minimum	Maximum	P Value
Bread					0.39
Normal	22	47.0909 ± 16.08285	15.00	82.00	
Overweightness	38	40.7632 ± 18.19145	13.00	105.00	
Obese	18	40.7222 ± 20.77061	17.00	98.00	
Total	78	42.5385 ± 18.24985	13.00	105.00	
Dairy product					0.38
Normal	22	15.7273 ± 8.66812	3.00	35.00	
Overweightness	38	17.3684 ± 10.56875	6.50	50.00	
Obese	18	20.1944 ± 10.85349	9.00	54.00	
Total	78	17.5577 ± 10.13768	3.00	54.00	
Protein					0.083
Normal	22	32.7500 ± 14.59758	9.50	60.00	
Overweightness	38	37.6842 ± 14.40506	17.50	88.00	
Obese	18	43.6389 ± 17.07406	20.00	73.00	
Total	78	37.6667 ± 15.40886	9.50	88.00	
Fruit					0.078
Normal	22	17.1364 ± 8.79012	6.00	35.00	
Overweightness	38	12.1842 ± 8.02649	1.00	35.00	
Obese	18	12.5556 ± 8.61751	0.00	30.00	
Total	78	13.6667 ± 8.55793	0.00	35.00	
Vegetable					0.708
Normal	22	2.8864 ± 1.97564	0.50	7.00	
Overweightness	38	3.4474 ± 4.05168	0.00	21.00	
Obese	18	3.7778 ± 3.54061	0.00	14.00	
Total	78	3.3654 ± 3.43934	0.00	21.00	

ness and obesity (17, 18). According to the findings of this study, there is a correlation between BMI increase and triglyceride levels of the employees. In fact, 61% of the obese staff in the company had LDL levels of more than the recommended limits and 66% had cholesterol levels beyond the recommended level. Previous studies have shown that excessive fat accumulation (triglyceride) in liver cells is the main cause of developing fatty liver as a metabolic syndrome (32). Therefore, it can be said that the employees of this company are at higher risks of developing fatty liver (3). Analysis of the results of the FFQ questionnaire showed that employees have a tendency to eat high-calorie, fatty and oily food, as well as, very sweet types of food. Moreover, they do not have enough fruits and vegetables in their diets. This is, therefore, likely to increase indexes, such as LDL and triglycerides. Many employees also have sugary and high-calorie snacks over the course of their work, and they generally have to eat the food provided by the company and are not able to control their dietary pattern at the workplace. On the other hand, the quality and quantity of employees' nutrition at the workplace is not a priority for many managers and is usually considered as a subsidiary issue or an impediment to production. Many dining venues, such as the one that was studied in this work environment, often provide unhealthy and unvaried food and snacks. A study on the role of teaching nutritional tips to employees, concluded that there was a positive and significant correlation between the level of employees' triglyceride and their BMIs (33). According to a comprehensive study by Wanjek (34), implementing strategies to improve the status of kitchen and standard dining halls, as well as, supportive programs, such as coupons or healthy nutrition tokens for employees are extremely influential in minimizing the prevalence of obesity and malnutrition

among the workers. Furthermore, results of the FFQ questionnaire in this study showed that the consumption of vegetable and fruit and the consumption of fat comprised the lowest and the highest respectively. The successful experiences of organizations in modifying bad eating habits of the employees have shown that changing their menu, as well as, introducing foodstuff, such as fresh fruit and vegetables, processed bread, fish , dairy products, different vegetable salad and boiled food, can significantly decrease the levels of blood lipid and weight gain (34). Results of Kim et al.'s research on 75 workers showed that providing continuous and regular nutrition programs for the employees were very effective in maintaining their optimal health and reducing risk factors, such as elevated levels of triglyceride and lipid (35). As a result, enhancing the level of employees' nutritional awareness by including appropriate nutrition programs presented by nutritionists, distributing and installing leaflets and posters related to healthy and balanced diet in the workplace can prevent the prevalence of obesity among the workforce.

5.1. Conclusion

Overall, since overweightness and fatty liver disease is gaining prevalence around the world and especially in Iran, studies in this area are of high significance. As indicated in this study, a combination of educational and motivational strategies, as well as, an integration of physical exercises along with healthy diet can prevent BMI increase and incidence of fatty liver.

Acknowledgments

The authors would like to thank all the employees of the Karkheh Production and Exploitation Power Station, especially the CEO, Mr. Yazdanipoor, who cooperated with this study.

Footnotes

Authors' Contribution: Leila Jodakinia and Mohammad Faridan were involved in the development of the study design and protocol, data interpretation, manuscript drafting and were the guarantor. Seyyed Hojat Mousavi Kordmiri, Mohammadreza Yazdanipoor, and Mojtaba Haghighat contributed to the development of the study protocol, data analysis, and manuscript drafting.

Conflict of Interests: The authors declared no conflict of interests.

Ethical Considerations: All of the the subjects in this study gave voluntary informed consent to participate in this research.

Funding/Support: None declared.

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