

A Balanced Diet for Construction workers to Improve Safety and productivity

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Abstract:

The United Nations (UN) under its Sustainable Development Goals (SDGs) aims to protect labour rights and promote safe and secure working environments for all workers around the world. Although the deadline to achieve the UN SDGs is approaching faster, construction workers around the world are still affected from a number of factors that highly influence their safety and productivity. Some of these factors are directly linked with the workers' daily food. This paper considers the healthy food and relates it to the productivity and safety performance of construction workers. A qualitative research strategy consisting of a systematic literature review and a semi-structured interview was adopted to accomplish the aims and objectives of this research. A healthy diet from the literature review was identified considering the construction workers' physical activities and energy requirements. The results of face-to-face interviews held with mess managers and construction workers from reputed construction organizations in Oman are reported. The selected workers (50%) consider that their daily food has an impact on their productivity and safety performance. Only 30% of the mess managers reported that they consider health-related factors to make their weekly food menu. 50% of the current food menu of the selected construction organizations in Oman is not balanced for construction workers. The result further reveals that food such as grain, vegetable, fruit, dairy product, lean meat, nuts, seed, fats, oil, and sweets should be part of the daily food to maintain the construction workers in a healthier condition. Construction workers are part of the society, thus any efforts which will improve their well-being need to be done. A healthier worker will not only be more productive but will be useful for the society. As a result of investment in workers' wellbeing, construction organizations will have the benefits of improved productivity and safety.

Keywords: UN Sustainable Development Goals, Management, Project management, Health & Safety, Safety & hazards, Workers performance, Productivity, Diet, Construction Economics.

1. Introduction:

Statistics published by the International Labour Organization (ILO) reveals that construction workers in different developed countries are 3~4 times more likely to die from accidents at the site compared to workers in other industries. In the developing world, There are higher risks (3~6 times more) of death linked with construction work in developing countries (ILO, 2015). Many construction workers suffer and die from work-related diseases developed from past influences to risky materials, such as asbestos and other chemicals. The construction industry is known as one of the world's major industrial sectors, which include sub-sectors such as building, civil engineering, demolition, and maintenance. The construction industry is further reported for a major portion of GDP in different countries. For instance, 6.10% in the U.K., 5.50% in Japan, and 9.0% in Oman (ONS, 2017; SHJ, 2017; NCSI, 2017). Statistics reported in a daily newspaper (Times of Oman) on 9th of June, 2014, noted that a total of 723,000 residents were working in the construction industry. The construction industry is growing rapidly in different developing countries and thus recognized as the main source for providing jobs to different workers. However, at the same time, it is recognized as one of the risky industries. The job of construction workers may include a variety of tasks while they are working on different projects. These projects may be related to building, repair, and

maintenance; renovation and demolishing; transportation including the construction of highways, bridges, and airports; and projects related to docks and harbors. Construction workers are exposed to different types of risk during their works such as dust and condensation; stiff working situation; handling heavy load; hot climatic condition; working at heights; excessive noise; vibration and heavy machinery; and different chemicals. It is expected that the global construction industry will reach 14 trillion US\$ in 2025 which was 9.5 trillion US\$ in 2014, reflecting an overall growth of 67% (Statista, 2017).

In Gulf Cooperation Council (GCC) member countries, the economy is heavily reliant on oil and gas export and contributes up to 50% of the total GDP (Umar and Wamuziri, 2016; Umar, 2017-a, Umar, 2017-b). In recent years, the dip in oil and gas prices somehow affected the GCC construction industry as well (Umar and Egbu, 2018-c). A comparison of the contract awarded in the GCC countries, in the first quarter of 2017 and 2018 shows an overall decline of US \$ 5.0 Billion (Ventures, 2018). The construction contract awarded in the first three months of 2017 and 2018, in GCC countries were amounting to US\$ 34,444 billion and US\$ 29,415 billion respectively. While there is an impact on the construction industry due to the current economic situation, different studies show that construction will be growing in the near future. Umar et al., (2018) while discussing the occupational safety and health regulations, reported that the value of the construction industry in Oman will grow to 6.88 Billion Omani Rial in 2026, which was 2.26 Billion Omani Rial in 2016. Moreover, the construction GDP in Oman is forecast to grow to 15.4% of the total GDP by 2026. Overall, they reported that the construction growth rate is forecasted to be at peak in 2020. Similarly, the total value of the ongoing construction projects in Qatar, in 2018 was US\$ 117,440 Million (PQ, 2018). At the same time, the deaths of construction workers in the construction of "2022 FIFA Stadium" which is one of the main ongoing projects in Qatar have attracted the attention of media and international organizations. Some of these reports show the number of construction workers that died in the project has already reached 1,200. Several estimates predicting the number of deaths will reach 4,000 by the end of 2022 when the project will be completed (ITUC, 2014; Ganji, 2016; SM, 2018).

There are several factors that are directly linked with the worker's performance in terms of safety and productively. The effects of these factors are expected to be increasing with the growth of industry if necessary remedial actions that help to increase the safety and productively performance. One of the identified factors which affect the worker's safety and productivity performance is diet. For instance, a report published in the International Labour Organization states that poor diet of workers results in a 20% loss in productivity around the world (ILO, 2005). The report further highlights that the poor diet of workers also results in a number of the other issue which includes morale, safety, productivity, and the long-term health of the workers. The report indicates that only in India, the cost of the poor diet which includes low productivity, sickness, and death is estimated in the range from US\$ 10~28 billion or 3~9% of the total GDP. This paper presents the research on a balanced diet that could be suitable for construction workers to enable them to maintain good health and thus contribute effectively towards improved productivity and safety. The next section provides an overview of safety and productivity in construction.

2. Safety and Productivity in Construction:

A press release of the International Labour Organization shows an estimate of occupational safety and health-related issues cost an annual amount of 4% to the world GDP (ILO, 2013). If the same percentage is assumed for the construction industry and the forecast of the value of spending in the global construction industry is considered, the cost of occupational safety and health in 2019 will be equal to the US \$ 0.456 trillion. Similarly, Umar (2016) reported the cost of accidents in the Omani construction industry considering two criteria using the real available data which includes the number of workers in the construction industry and the value of construction projects in a financial year. He concluded that the compensation payment of accidents is about to be 3.74 million/year

based on the number of workers in the construction industry. The reported cost of accidents based on the value of construction projects was estimated at US\$ 3.237 billion. The result of another study on the basic causes of accidents conducted by Umar and Egbu (2018), in which they analyzed a total of 623 accidents in a highway construction project, shows that a considerable number of accidents (41%) are directly linked with the workers. They used different statements to reach on the main causes of the accident as “worker”.

Delay in the construction project is a usual phenomenon around the world that occurs due to several internal and external factors which include poor definition and tracking, technical barriers, inadequate resources, changing priorities, wrong project, weather, competitors, and legal barriers (Nicholas and Steyn, 2017). Assaf and Al-Hejji (2006) observed that 30% of the construction project in Saudi Arabia completed on time, the remaining 70% experienced delays. Similarly, the National Audit Office report in the UK shows that 70% of the government construction project delay (NAO, 2003). Workforce related factors such as labour productivity, labour skills, and labour availability are regarded as some of the key delaying factors by many researchers (Kaming et al., 1997; Chan and Kumaraswamy, 1997; Assaf and Al-Hejji, 2006; Sambasivan and Soon, 2007; Umar, 2018).

Many researchers have linked the productivity and safety performance of construction workers with their physical health (Yi and Chan, 2016; Yi and Chan, 2016; Umar and Egbu, 2018-a; Umar and Egbu, 2018-b). There have been several research studies on the physical examination which were carried out among different occupations and industries. Body Mass Index (BMI) and body blood pressure were some of the common factors which were considered in these studies. For instance, BMI was considered in a research study conducted by Kawai et al. (1995) to assess the health profile of 816 white-collar workers in Japan. Umar and Egbu (2018-a) while discussing the heat stress as the main cause of accidents in construction, observed that based on the BMI results “80%” of the participants in their selected sample were overweight or obese. According to Dua et al. (2014), increased BMI being linked with prehypertension may advise that such persons are at high risk of progressing to frank hypertension. A research conducted in Denmark by Gupta et al., (2018) reported the BMI of 147 blue-collar workers from a variety of professions including construction and observed that BMI of 59% of the participants was more than 25. The mean value of the BMI of the selected participants was 26.4+4.80. Similarly, the mean BMI of 932 construction workers in Hong Kong reported by Yi and Chan (2016) was 24.3+3.70. Their reported BMI results further reveal that 2.8% of the participants were underweight, 36.1% were overweight and 6.5% were obese. The finding of similar research conducted on 314 male construction workers in the Netherland shows that based on the BMI results, 70% of the participants were classified as overweight and 22.7% as obese. (Viester et al., 2017). The BMI results of different studies, however, clearly reflect that the majority of construction workers are not in their healthy range of BMI, which will have different consequences”. A research study on the relationship of over-weight and hypertension conducted by Julius et al. (2010) suggest that weight gain may pathophysiologically contribute to an elevation of blood pressure. They further noted that the reverse of their findings is also true which means that a person with normal weight with high blood pressure will gain weight in the future.

3. Research Methodology:

The research strategy adopted to achieve the goal of this research was qualitative in nature. Data related to a healthy diet has been extracted from the existing literature using specific keywords such as “healthy diet”, “balanced diet” and “calories requirement”. This exercise aimed to find the characteristics of a healthy diet and then compare it with a healthy diet with the diet of construction workers through a semi-structured interview. The interview was also used as a tool to explore how such a healthy diet can be adopted for construction workers. Similarly, a research study conducted by Umar and Egbu (2018-a) related to the construction workers' health profile found that 80% of the participants in their selected sample were overweight or obese. They further classified 40% of the workers from the selected samples as hypertension based on the result of measured blood pressure.

One of the reasons for this could be the diet of these workers. To investigate this, a sample of 20 respondents (10 mess managers/ supervisors and 10 construction workers) from construction organizations registered in Oman in grade I and above and were executing major construction projects, were selected for a face to face interview. Since the purpose of this exercise was exploratory in nature and was aiming to determine the facts around the diet of construction workers in Oman, thus a qualitative approach was considered to be the best fit in this research. Umar and Egbu (2018-c) explained in detail the advantages of face to face interview techniques for data collection. All the participants were asked the interview questions in the same way, so that more accurate and reliable data could be collected.

4. Result and Discussion:

Considering the two research approaches adopted to deliver the aims and objectives of this research, the results and discussion are divided into two main categories aligned to the research methodology. Thus results and discussion from the arising from the existing literature are presented in section 4.1, while the results and discussion of the face-to-face interview are presented in section 4.2.

4.1. Results and Discussion (Literature Review):

The results and analysis of the existing literature review suggest that foods which are rich in potassium, magnesium, and fiber can help to control the high blood pressure (Cassidy et al., 2010; Tabassum and Ahmad, 2011; Coleman, 2012; Lynn et al., 2012; West et al., 2012; Chiu et al., 2015). Morgan et al. (1984) regarded potassium as a useful mineral for the human body. Potassium and magnesium are also known as electrolyte substances which produce electrical impulses throughout the human body and help the body to perform some of the important functions such as keeping normal blood pressure, balancing water, nerve impulses, digestion, heartbeat and keeping body pH normal (Robinson and Stokes, 2002). Different types of foods that have a major quantity of potassium, magnesium, and fiber are listed in table 1.

Table 1: Foods Rich in potassium, magnesium, and fiber (Joe, 2017; Goldman, 2017; Men's Journal, 2018).

S.No.	Potassium	Magnesium	Fiber
1	Bananas	Whole Wheat	Raspberries
2	Avocados	Spinach	Avocado
3	White Potato	Quinoa	Chia seeds
4	Sweet Potato	Almonds	Flaxseed meal
5	Tomato	Cashews	Oatmeal
6	Beans	Black Beans	Lentils
7	Dried Apricots	Edamame	Broccoli
8	Yogurt	Peanuts	Cabbage
9	Salmon	Tofu	Apples
10	Spinach	Sesame Seeds	Brussels sprouts

During an online search around a balanced diet using the keyword “balanced diet for construction workers”, the researcher came across the Dietary Approaches to Stop Hypertension (DASH) diet (DASH, 2018). The DASH diet plan recommends a variety of foods that are rich in potassium, calcium, and magnesium thus it helps to reduce the blood pressure. The studies conducted by the National Heart, Lung, and Blood Institute concluded that the DASH diet plan help to increase human physical activities reduces blood pressure and cholesterol (NIH, 2018). In the daily DASH plan, foods such as grain, meat, poultry, and fish, vegetables, fruit, low-fat or fat-free dairy products, fats and oil, and sodium are included. There are two different types of DASH diet plans which are developed for men

and women linked to their age and activity levels. The DASH plan for men is reported here assuming that the construction industry is highly populated by men workers. The three levels of activities indicated in table 2 are described here.

4.1.1. Sedentary Activity Level:

Sedentary activity refers only to those light-intensity physical activities which are part of daily routine. This includes spending a lot of time on the office desk with less walking. For example, this also includes doing exercise at a low intensity which allows breathing normally.

4.1.2. Moderate-intensity activity:

This includes activities equal to the walking of 2.4 km to 4.8 km with a speed of 4.8~6.4 km/h. such activity doesn't allow to breath normally thus breathing in moderate-intensity activities is "harder" and persons in such activities are able to make a conversation easily with others.

4.1.3. Active Activity:

This activity refers to all those activities equal to walking more than 4.8 km with a speed of 4.8~6.4 km/h. This also includes light-intensity physical activities. In such activities, the heart works at its maximum efficiency. Normally such activities result in sweat after the initial few minutes. Construction workers are the best fit into this category of activity level.

Table 2: Daily Calorie Requirement for Men Based on the Types of Activities (NIH, 2018).

Age in years	Calories Required		
	Sedentary Activity	Moderate Active	Active Activity
19–30	2400	2600 – 2800	3000
31–50	2200	2400 – 2600	2800 – 3000
51+	2000	2200 – 2400	2400 – 2800

Considering the foreigner's workers population in Oman, the National Centre of Statistics and Information data shows that 1231407 male workers out of 1349443 (91.25%) are in the range of 20~49 years (NSCI, 2014). This fact was assumed to be true in the Omani construction industry as well, thus for the count calories the age of construction workers is considered to be from 20 to 49 years and the level of activity was considered as "active" which gives an average 3,000 daily calorie requirements. For such daily calorie requirements (3,100), the DASH diet plan is more appropriate for construction workers.

4.2 Result and Discussion (Face-to-face Interview):

As discussed in the methodology section, two different types of respondents were selected to participate in a face-to-face interview. These participants were the mess managers and construction workers. Since the different sets of questions were used for these groups of the interviews, the results and discussion are therefore provided in separate sections. The next section describes the results and discussion of the interviews held with the mess managers.

4.2.1. Result and Discussion (Mess Managers):

All the interviewees (100%) agreed that for the development of a weekly food menu, consultation with workers took place to allow them to show their choice, however, their choice is not guided by health factors. Three interviewees highlighted that they have a variety of workers from different countries, thus the main factor which workers report on the menu improvement is a taste of food of their choice. Some of them request Indian food; some of them request south Indian food which is

different from traditional Indian food. Even some of the workers request Arabic food. Thus in a diversity of workers, it is very difficult to consider each request. The final decision on the food menu is driven by the majority. In response to the question that interviewees as mess managers/supervisors consider the health-related factors when developing the daily food menu for their workers; 3 out of ten (30%) respondents reply as “yes” and stated that they do consider such factors and their menu is well healthy. Four interviewees (40%) reported that their organizations have already standardized the food menu considering workers' choice and health factors and now it is adopted in all of their organization projects. They reported that they have three different types of mess at their project site. One is for workers, one is for mid-level staff and one is for senior staff. There are different menus in these messes. This is somehow a normal fact that in most projects the management of the organization provides a different level of facilities to their workforce and most likely they are divided based on their ranks or seniority. However, on the same project, if there are three different messes and when it has different food, thus it indicates that the quality of food will not be the same. All of the interviewees reported that they are not using any association or organization guidelines for the development of their food menu. This however clearly indicates that if these mess managers/ supervisors are not using such guidelines, then how they summarized that their food menu is healthy. When the interviewees were asked to compare their food menu with the DASH food menu for 3100 calories, two out of 10 (20%) interviewees reported that there is a similarity of 80%. Five out of 10 (50%) reported stated that there is a difference of approximately 50% between the two menus. Three interviewees (30%) reported a similarity ranging from 60~65% between two food menus. When the interviewees were asked to compare the cost of DASH menu with their existing menu and report which one could be cheaper and which one could be expensive or there will be no cost different; four interviewees reported that it is very difficult to arrive on the cost as they don't know at the market price of some items at the moment. Two (20%) of the interviewees noted that the cost difference could be in the range of +10%. One interviewee reported that the cost of the DASH menu will be almost the same as the cost of their current menu. Two interviewees reported that the cost of the DASH menu will be higher ($\geq 20\%$) than their current menu.

4.2.2 Result and Discussion (Construction Workers):

All the construction workers selected for the interview respondents that their daily food has a major contribution to keep them fit and perform their job effectively. One of the interviewees noted that apart from healthy food, it is also important to have a daily meal on time. He stated that due to the nature of his job, in most cases he is not able to take his daily meal on time especially his lunch. This appears to be an issue on most of the construction sites, especially on highway construction projects. Umar et al (2018), while discussing the occupational safety and health regulation related to the construction industry, highlighted a similar point and stated that afternoon break in summer is made mandatory by the government in Oman. 70% of the interviewees reported that the first choice of selecting their daily food as the food should be healthy and tasty. Two interviewees responded that the food should be healthy, however cooking style some time makes it un-tasty. One of the interviewees stated that he doesn't use such criteria for selecting the food. When the interviewees were asked about the consultation for making a daily or weekly food menu in their organization; 60% of the respondents replied as yes. 40% of the respondents stated that they have not been part of such consultation in their organization. Three interviewees accepted that daily food had an impact on their daily performance related to productivity and safety. Two Interviewees stated that good food provides us better energy to perform our daily activities. 50% of the interviewees were not sure that the food may have a positive or negative impact on their work and safety-related performance. When interviewees were asked to match their daily food menu with the DASH menu; 20% of the respondents reported that their menu is roughly (90%) the same as the DASH menu. 80% of the respondents noted that there is less similarity (less than 50%) among the items in their menu and

the DASH menu. Nine out of 10 (90%) respondents classified the DASH menu as the best food menu for construction workers.

5. Conclusion:

Construction worker's health-related factors such as BMI and hypertension have attracted the attention of many researchers because these factors directly affect the worker's productivity and safety performance. The literature review presented in this paper suggests that the causes of most of the accidents (41%) are directly related to the workers where the health factors have a major contribution to these accidents. Similarly, most of the construction projects encounter delays due to the productivity performance of workers. Most of the studies around human health found that overweight and hypertension is very common among construction workers. In light of these issues, this paper considers the intervention of healthy food that helps workers to maintain their health and could contribute to their safety and productivity. From the literature review, foods that help to reduce blood pressure and maintain a healthy weight are identified considering construction workers' energy requirement to effectively perform their daily activities. These foods include grain, vegetable, fruit, fat-free or low-fat dairy products, lean meat, poultry, and fish, nuts, seed, and legumes, fats and oil, and sweet and added sugar.

The result of face to face interviews with mess managers from reputed construction organizations in Oman reveals that they consider the choice of the workers in making their daily or weekly food menu. They reported that the workers' choice of food is not guided by health-related factors. Only 30% of the mess managers/ supervisors replied that they considered health-related factors when they are deciding the food menu for their workers. 50% of the workers reported that the food they take has an impact on their safety and productivity performance. The DASH daily food menu suitable for construction workers was compared with their organizational food menu. All the comparison shows that similarity between their food menu and DASH food menu is less than 50%. Similarly, 80% of the workers reported that the similarity between their food menu and the DASH menu is less than 50%. It is important to note that both samples (mess managers and workers) were from the same organizations. Two mess managers reported that the difference between their food menu and the DASH food menu could be in the range of + 10%. The other two mess managers reported the cost of the DASH menu is more than ($\geq 20\%$) from their existing food menu. Although this study provides an insight into food intervention to improve both safety and productivity in construction, the longitudinal study needs to be conducted to reach an actual improvement when a specific food menu is adopted for such construction workers. Overall construction workers are part of the society, thus any efforts which will improve their well-being need to be done. A healthier worker will not only be more productive but will be useful for the society. As a result of investment in workers' wellbeing, construction organizations will have the benefits of improved productivity and safety.

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