A CORRELATION STUDY OF NUTRITION AND FACTORS INFLUENCING FOOD CHOICES AMONG CONSTRUCTION WORKERS

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ABSTRACT

Nutrition is known to be linked with worker health and safety (H&S) performance. Literature suggests that construction workers have poor nutrition and this adversely affects their health, wellbeing and safety on construction sites. Strategies to improve their nutrition warrant considerable attention. This paper aims to identify significant relationships between factors influencing nutrition and the food choices of construction workers. Empirical data for the correlational study were collected through a field questionnaire survey on site construction workers in the Gauteng Province of South Africa. Principal components analysis and Pearson's correlation analysis were conducted. Findings revealed that food context, nutritional knowledge, resources and personal ideas and systems were significantly associated with choice of foods. By highlighting the factors which are correlated with nutritional choices amongst construction workers, the study provides valuable evidence which will allow for the development and implementation of efficient and successful intervention programs geared towards improving construction workers' nutrition and thus site safety performance.

Keywords: *Construction workers, factors, health and safety, nutrition, South Africa*

Introduction

The construction sector is notorious for being one of the most dangerous industries along with transportation, mining and agricultural sectors. It accounts for 30 – 40% percent of the world's fatal injuries (Murie, 2007). This is in spite of its importance in economic development through employment provision and infrastructure development (Oladinrin et al., 2012). The construction sector accounts for 7% of global employment and contributes 10% to global Gross Domestic Product (GDP) (Women in Informal Employment, Globalizing and Organizing (WIEGO), 2014). The construction industry contributes approximately 4% to the GDP of South Africa

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(Statistics South Africa, 2014). The notoriety of the construction industry in terms of its poor H&S performance underscores the need for increased focus on ways to improve H&S performance in the industry. One of such ways is through improving the nutrition of its workers (Luckhaupt and Calvert, 2014).

Construction workers' nutrition is paramount in producing high-quality work and reducing the risks of accidents, injuries and illnesses (Luckhaupt and Calvert, ibid.). Adequate nourishment, through consumption of a variety of foods from different classes of food, including proteins, carbohydrates, vitamins, minerals, fats and oil, can raise national productivity by 20% (WHO, 2015). It is therefore imperative to conduct research on the nutrition of construction workers who have fundamental roles in construction processes. Additionally, it is important to dwell on the factors which determine the food choices of construction works in particular because improving nutrition requires an understanding of the factors which either constrain or encourage particular food choices (European Food Information Council (EUFIC), 2005).

Extant literature suggests that construction workers have poor nutrition (Groeneveld et al., 2011; English & Bowen, 2011; Tiwary et al., 2012; Okoro et al., 2014). There is also a plethora of literature on the factors which influence food choices (Sobal and Bisogni, 2009; Rose et al., 2010; Arganini et al., 2012; Bruner and Chad, 2014). However, it appears that there is a dearth of empirical studies focusing on the relationship between food choices and the factors which influence food choices. The objective of the present paper is to evaluate this relationship. Knowledge of the factors which are significantly related to food choices could inform the design and implementation of future nutrition interventions for construction workers. The objective of the present study is to identify significant relationships between food choices and factors influencing food choices.

Literature Review

Construction Workers' Nutrition

Research has shown that construction workers have a habit of eating unhealthily (Men's Health Forum (MHF, 2009). According to the MHF in the United Kingdom (UK) (ibid.), the food choices of construction workers consist mainly of fatty foods which they consume with the belief that they will be enabled to perform their physically-demanding tasks. The UK study conducted interviews with construction workers and industry stakeholders and reported that male workers were more likely to make unhealthy food choices due to poor nutritional knowledge.

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In a similar study, Tiwary et al. (2012) found that construction workers in India were poorly paid and this lead to regular, but sometimes inadequate consumption of staple foods including rice, beans and potatoes. Meat consumption was rare amongst these workers because they could not afford meat.

According to Murie (2007), malnutrition is wide-spread among construction workers, partly because basic on-site amenities, including inter alia, facilities for cooking and eating, are typically not provided. This view is supported by Wanjek (2005) who found that construction workers had no secluded areas to eat or facilities on site for food preservation (refrigeration) and this resulted in consumption of food contaminated by dust and debris and/or street foods, which are, sometimes, of questionable nutrition and safety.

A similar study agreed that male workers, especially younger ones, had poor nutrition (Du Plessis, 2011). This study dwelt on young construction apprentices. On the contrary, English and Bowen (2011) reported that older construction workers had a lifetime of inadequate nutrition. The study by English and Bowen focused on factors in personal H&S, including inter alia, nutrition, of women in the South African construction industry. Another South African study concurred that construction workers, especially men consume a lot of fatty foods, sugar-sweetened beverages and fizzy drinks (Tugendhaft and Hofman, 2014).

Factors Influencing Food Choice

Some of the factors which influence construction workers food choices have been highlighted above. However, other studies revealed that the list is far from exhausted. For instance, Arganini et al. (2012) reviewed previous studies and reported that factors such as biological mechanisms, genetic profiles, gender differences, as well as socio-cultural, demographic, economic, religious and psychological factors influence food choices.

In Rose et al. (2010), environmental influences (including location and accessibility to shops), social acceptability, promotional and advertising effects, cost and availability of foods were indicated to be influential on food choices. Additionally, Nie and Zepada (2011) found that demography, income, marketing strategies, practices, beliefs and attitudes influence food choices. According to Nie and Zepada (ibid.), individuals choose foods which have functional and psychological benefits to them.

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A similar study by Wandel and Roos (2005) supported that food choices are influenced by notions about food, whether as fuel for immediate functioning of the body, in relation to body image or future health. The authors also opined that work schedules, knowledge, as well as social and cultural factors influence food decisions.

Summarizing the views expressed in extant literature, the factors which influence food choices are theorized to be nutritional knowledge (indicated by knowledge of what healthy food means, knowledge of the health consequences of eating or avoiding certain foods, ability to cook, and knowledge of nutritional requirements in relation to body size, age, gender and existing health status), economic factors (indicated by income, marketing strategies, discounts, cost and availability of healthy foods), environmental or physical factors (indicated by work schedules, time and seasonality), social factors (indicated by family needs, colleagues' influence, social values attached to food, media and social belonging) (Puoane et al., 2006), psychological factors (indicated by attitudes, beliefs, motives, habits, perceptions and personality) and physiological or biological factors (indicated by genetic dispositions, hunger, taste, appetite and satiety) (EUFIC, 2005).

Methods

In order to achieve the current study's objective, certain techniques were adopted. A likert-scale survey questionnaire was developed from an extensive literature review of relevant literature. The first part of the questionnaire consisted of 14 items asking about the frequency of consumption of a list of food items in a working week. The 14 questions were adapted from a study by Amare et al. (2012) which validated a Food Frequency Questionnaire (FFQ) for the purpose of collecting data on food consumption. The second part of the questionnaire comprised 42 items relating to factors influencing food choices. The questionnaire was pilot-tested, reviewed and revised by experts before the final study. The final questionnaire was administered to construction workers chosen through heterogeneity and convenience sampling. Participants included workers who were actively engaged in the physical construction activities as opposed to the site managers and supervisors. This group was chosen since they were the most susceptible to poor safety performance on construction sites in Johannesburg, Midrand, Centurion and Samrand (in Gauteng Province). Out of a total of 220 questionnaires, 183 were completed.

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 22 software. Principal components analysis (PCA) was initially conducted to reduce

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the large number of variables and refine the structures (Pallant, 2013). Preliminary considerations for PCA were assessed. The sample size requirement of 150+ was met; the Kaiser-Meyer-Olkin (KMO) values for the measure of sampling adequacy exceeded the recommended value of 0.6; and the Bartlett's spericity tests reached statistical significance at p = .000 (<.05), supporting suitability of data for factor analysis (Pallant, 2013). Outputs from the PCA (principal components), which contributed to the variance in the data sets were then adopted, retained, interpreted and used for correlation analysis. Decisions on which factors to retain were made using the Kaiser's criterion (retaining eigenvalues above 1) and scree test (retaining factors above the "breaking point"). Pearson's correlation analysis was subsequently conducted in order to assess the strength of the relationships between the food choices and influencing factors. Pearson's correlation was thought to be suitable because the distribution of data was normal (Pallant, ibid.). Cronbach's alpha *a* test and inter-item correlations were used to assess internal consistency reliability before and after PCA. Before PCA,*a* indices of the constructs ranged from 0.71 to 0.84, indicating good internal consistency. After PCA, *a* values ranged from 0.43 to 0.85. One of the food choice components had 0.43 but was still retained becauseit had a mean inter-item correlation of 0.27. Where *a values* are low, it is more appropriate to report mean inter-item correlations (Pallant, 2013). Mean inter-item correlation values ranging from 0.2 to 0.4 indicate good internal consistency (Pallant, ibid.).

Findings and Discussion

Results from PCA

With regard to the food choices, four components, accounting for 61.45% of the total variance, were extracted and retained. Interpretation of the four factors revealed strong item-loadings on the first two components and weak loadings on the 3rd and 4th components (shown in Table 1). Components 3 and 4 were still retained because they had good and fairly acceptable Cronbach's alpha values, respectively. In addition, the fourth component contained important, universal and core foods usually consumed together (Carmona, 2004). The four components were named *alternative foods***(**dairy, eggs, nuts, fish, cereals), *traditional core foods*(extra salt, sugary food, fried food, pasta, grains), *secondary core foods* **(**vegetables, fruits) and *core foods*(meat, corn meal), respectively. The components were named based on their nature, importance and universality amongst the study participants (Carmona, ibid.).

With regard to the factors influencing nutrition, seven components accounting for 60.09% of the total variance were retained, after repeated analysis. Interpretation

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(Appendix) revealed that items loaded evenly on each component. The seven factors were thereafter renamed based on the nature of their structure and with support from literature. The seven components were retained for further analysis. They are as follows: *food context* (including brand name, food in season, time constraints, location, cooking skills and marketing strategies); *biological factors* (including taste of the food, appetite, appearance, quality, hunger and satiety); *nutritional knowledge* (including knowledge about food sources of energy, about sources of food nutrients, about health implications of consuming or not consuming particular foods, and about the daily dietary requirements); *personal ideas and systems* (including eating habits, cynical attitude towards nutrition promotion, mood, the fact that healthy food help to enhance concentration, peers/colleagues' influence, the need to belong to a social group, social media and networking, belief that avoiding meat will keep one healthier, belief that killing animals for food is not good, and belief about adequacy of current diet); *economic factors* (including cost/price of food, availability of food, wages/income and food discounts); *resources* (including on-site facilities for food storage and preservation, and heating up food, eating facilities such as benches, washing bowls, etc., knowledge of nutritional requirements for existing health conditions, for age and body size, the fact that healthy food will help to increase productivity and the fact that one will lose or add weight with certain foods); and *cultural background* (including knowledge of what to eat as a man or woman, and what to eat for the type of work engaged in, belief that one should only eat food from their culture and belief that avoiding meat will save money).

Table 1: Loading Matrix of Food Choice Components

Item	Component			
	1 (alternative foods)	2 (traditional core foods)	3 (secondary core foods)	4 (core foods)
Dairy products	**.702**	-.137	.029	.042
Eggs	**.683**	-.099	.014	.471
Nuts	**.680**	.105	.088	-.105
Fish	**.590**	.136	-.005	-.034
Cereals	**.405**	.353	.183	-.231
Extra salt	-.026	**.725**	-.281	.071
A lot of sugary foods	.014	**.666**	-.036	.167
A lot of fried foods	-.172	**.609**	.248	-.009

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Pasta	.268	**.466**	.206	-.141
Grains like rice	.127	**.420**	-.018	-.036
Vegetables	-.002	-.083	**.795**	.166
Fruits	.120	-.018	**.793**	.052
Meat	.078	.010	.044	**.597**
Corn meal	-.049	.085	.075	**.336**

Results from Correlation Analysis

A correlation matrix was constructed in order to discover important relationships between the nutrition variables (food choices) and factors influencing food choices, using Pearson's correlation. Table 2 presents the results of the analysis.

There was a statistically significant small positive relationship between *food context* and *alternative foods* (r = .228, N = 179, p = <.01), as well as between *food context* and *traditional core foods* (r = .277, N = 180, p = <.01). These findings seem to suggest that the more time available to prepare certain foods, a higher ability to prepare such foods are associated with more choice of alternative and traditional core foods. These findings support the views of the EUFIC (2005).

The relationship between *biological factors* and *core foods* was small, but significant (r = .218, N = 177, p = <.01). This seems to suggest that higher rates of consumption of meat and corn meal may be associated with a higher appetite and level of satisfaction, as well as better taste, appearance and quality of the foods. This finding is in line with the views of the EUFFIC (2005).

A small significant correlation was indicated between *nutritional knowledge* and *alternative foods* (r = .284, N = 178, p = <.01), as well as between *nutritional knowledge* and *secondary core foods* (r = .203, N = 179, p = <.01), with higher rates of consumption of dairy, fish, eggs, cereals, fruits and vegetables, associated with increased knowledge about nutrition and an awareness of the health benefits of consuming healthful foods. This finding is consistent with findings from a study by Soederberg-Miller and Cassidy (2012) which indicated that knowledge and understanding about nutrition enhances dietary modifications and enables better decision-making with regard to choosing healthy foods.

There was a medium positive correlation between *personal ideas and systems* and *traditional core foods* (r = .321, N = 178, p = <.01). This seems to suggest that higher consumption of pasta, grains, as well as fried, salty and sugary foods is associated

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with higher inclination to personal views and social ties. This finding aligns with findings from Sobal and Bisogni (2009) which indicated that personality, personal pREFERNCES, family, co-workers and other relationships influences consumption of foods in this category.

The relationship between *personal ideas and systems* and *alternative foods* was small, but significant (r = .244, N = 178, p = <.01). This seems to suggest that higher rates of consumption of dairy foods, eggs, nuts, fish and cereals are associated with higher inclination to one's personal beliefs and social attachment. This finding aligns with findings from Puoane et al. (2006) which stated that individuals attach social meanings and values to certain foods.

A moderate significant positive relationship was found between *resources* and *alternative foods* (r = .372, N = 180, p = <.01), with higher rates of consumption of dairy foods, eggs, nuts, fish and cereals associated with higher availability of on-site facilities for food storage and eating such as refrigerator, cupboards, microwaves etc. This finding supports the findings in Escoffery et al. (2011) which indicated that workers who had cafeterias, refrigeration and microwaves were able to prepare and store more healthful and side items such as milk, eggs and fish, whereas their counterparts who had no such facilities were unable to eat these food items.
There were also significant positive correlations, albeit small, between *resources* and *traditional core foods* (r = .295, N = 181, p = <.01), as well as between *resources* and *secondary core foods* (r = .239, N = 182, p = <.01). This seems to suggest that a higher awareness of the benefits of certain foods in increasing productivity is associated with increased choice of fried, salty and sugary foods. This is in line with findings from MHF (2009) which reported that the participants ate fatty foods in the belief that they will be enabled to perform their tasking duties. That increased awareness of nutritional requirements for current health status may be associated with increased choice of fruits and vegetables corresponds with Petrovici and Ritson's study (2006) in which health motivation and belief that healthy food can help prevent diseases were reported to influence food choices.

A medium positive correlation was found between *cultural background* and *traditional core foods* (r = .332, N = 182, p = <.01). This seems to suggest that higher inclination to one's cultural orientation is associated with higher rates of consumption of foods like pasta, grains and fried foods is associated with cultural beliefs, gender and type of work engaged in. The finding that beliefs and gender differences may be

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related to consumption of certain foods is consistent with findings from Pfeifer (2009) which found that differing norms may be imposed on men and women by the society as what type of food is perceived as masculine or feminine.

It is notable that no significant relationship was found between *economic factors* and the food choices. This result is inconsistent with findings from studies by EUFIC (2005) and Darmon and Drewnoski (2008) which indicated that consumption of certain foods like grains, fish, dairy products and vegetables are more likely to be associated with higher income groups while foods like pasta, rice and added fats are more likely to be consumed by lower income groups. This could be because foods are generally affordable, even by low-income earners, in Gauteng and thus the cost is not an object.

Table 2: Pearson's Correlations

		Alternative foods	**Traditional core foods**	**Secondary core foods**	**Core foods**
Food context	Pearson Correlation	.228	.277	.133	.043
	Sig. (2-tailed)	.002	.000	.075	.569
	N	179	180	180	179
Biological factors	Pearson Correlation	.168	.186	.007	.218
	Sig. (2-tailed)	.025	.013	.923	.004
	N	177	178	178	177
Nutritional knowledge	Pearson Correlation	.284	.076	.203	.190
	Sig. (2-tailed)	.000	.309	.007	.011
	N	178	179	179	178
Personal ideas and systems	Pearson Correlation	.244	.321	.144	-.044
	Sig. (2-tailed)	.001	.000	.056	.557
	N	178	178	178	178
Economic factors	Pearson Correlation	.069	.166	-.091	.112
	Sig. (2-tailed)	.360	.027	.232	.136
	N	177	177	176	177

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Resources	Pearson Correlation	.372	.295	.239	.000
	Sig. (2-tailed)	.000	.000	.001	.999
	N	180	181	182	180
Cultural background	Pearson Correlation	.198	.332	-.032	-.031
	Sig. (2-tailed)	.007	.000	.669	.683
	N	181	182	182	181

5.0 Conclusion and Recommendations

The study set out to evaluate the relationship between food choices and the factors influencing food choices among construction workers in the Gauteng Province of South Africa. Significant relationships were mostly found between food choices and food context, nutritional knowledge, resources and personal ideas and systems. The findings could be useful in designing, developing and implementing future nutrition intervention programmes for construction workers specifically, focusing on these significant factors. In an effort to improve the nutritional quality of their workers, construction employers and managers should provide different forums for educating and informing the workers about the importance of healthy eating. Additionally, personal ideas and views could be reformed, through nutrition education, to encourage healthy food choices. Furthermore, provision of areas and facilities for eating and storing foods could encourage bringing healthy food from home. These interventions could encourage construction workers to make better food choices, which will in turn improve their health, wellbeing and safety on sites.

The findings in this paper are subject to one limitation. The study was conducted in only one province of South Africa and may not be generalizable to other geographical regions. Future research could evaluate the relationship between food choices and the factors which are known to influence food choices using workers in another location or using a different sample of workers.

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APPENDIX

Loading matrix of the components of nutrition determinants after rotation

Measures	Component						
	1	2	3	4	5	6	7
Brand name	*.726*	.180	.065	.074	-.013	-.153	-.147
Food in season	*.694*	-.027	-.024	.084	.056	.024	.123
Time I have before work and during breaks	*.551*	.051	.017	-.067	.027	-.134	.373
Location of where the food is sold	*.540*	.046	-.065	.118	-.073	-.123	.064
Cooking skills	*.482*	-.029	.038	-.061	.078	.013	.369
The way the food is advertised or marketed	*.469*	.178	.020	.133	-.010	-.158	.121
What I am used to from home and family traditions	*.279*	.113	-.016	.129	.201	-.137	.106
The taste of the food	.156	*.765*	.283	-.093	-.030	.139	.110
My appetite for particular foods	.186	*.623*	-.007	.020	-.081	-.086	.054
How presentable the food is	-.002	*.612*	-.323	.067	-.043	-.243	.122
The feeling of fullness I get from the food	.015	*.576*	-.046	.005	.346	.060	.012
The quality of the food	-.096	*.564*	.009	.115	.031	-.142	-.061
How hungry I am	-.016	*.507*	.108	.149	.307	.158	.057
What I know will give me energy	-.177	.046	*.786*	.085	.172	.149	.074
What I know would give me different nutrients, eg., proteins, carbohydrates, vitamins and minerals	-.123	.105	*.721*	.069	-.094	-.163	-.091
What I know can happen to my health if I eat or don't eat particular foods	.228	.206	*.427*	-.128	.178	-.270	-.099
What I know an adult should eat in a day	.180	-.138	*.404*	-.043	-.030	-.086	.122
My eating habits	-.058	.256	-.124	*.610*	.023	-.010	.038
My idea that particular foods are advertised for the benefit of the sellers or advertisers	.142	-.206	.084	*.574*	.165	-.021	-.088
My mood, eg. happy, sad, stressed, etc.	.196	.226	.018	*.538*	.110	.027	-.075
The fact that healthy food will help me concentrate on my work and avoid accidents and injuries	-.331	.020	.064	*.521*	.104	-.182	-.092
What my friends choose for us to eat	.104	.276	.011	*.483*	-.036	.075	.213
The need to belong to a particular social group	.002	.114	-.068	*.471*	.013	-.112	.248
Social media and networking	.315	.277	.032	*.471*	-.102	-.034	.005
My belief that avoiding meat will keep me healthier	.204	-.163	.080	*.448*	-.278	-.188	.313
My belief that killing animals for food is not good	.328	-.047	.159	*.429*	-.106	.043	.268
My belief that my current diet is adequate	.072	-.066	.258	*.358*	-.114	-.081	.093
The cost/price of the food	.049	-.168	.074	.118	*.845*	.051	-.127
The foods available	.062	.074	-.014	-.249	*.729*	-.198	.100
The wages I am paid/income I make	-.254	.069	.005	.079	*.636*	-.154	.233
The foods on special offers or discounts	.333	.122	.006	.204	*.464*	.190	.011
The facilities on site for storing and heating up my food	.466	.034	-.100	.106	.041	*-.633*	-.065
The eating facilities provided on site, eg. benches, tables, washing bowls/sinks, etc.	.355	.033	.074	.120	.042	*-.616*	-.026
What I know my body needs for my current health status	.174	.036	.237	-.080	-.071	*-.564*	.138
What I know my body needs at my age	-.114	-.048	.151	.100	-.062	*-.558*	.300

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The fact that healthy food will help increase my productivity at work	-.188	.131	.055	.073	.232	-.*525*	-.112
What I know my body size needs	.144	-.175	.212	-.059	.074	-.*413*	.263
My idea that I will add or lose weight with particular foods	.047	.173	-.131	.298	.110	-.*318*	.020
What I know I should eat as a man or woman	.202	.035	-.002	-.011	.014	.003	.*652*
What I know my body needs for the type of work I do	-.222	.232	.109	-.059	.091	-.062	.*560*
My belief that I should only eat food from my culture	.109	.027	.049	.396	.015	.022	.*515*
My belief that avoiding meat will save money	.251	-.206	-.252	.367	-.097	-.138	.*427*

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