

Developing a framework of food choice determinants among construction workers in South Africa

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Abstract - A plethora of factors are known to influence an individual's food choice and overall nutrition, which in turn, influences their health and safety performance. However, it appears that little research has been conducted in South Africa, on the factors which influence the food choices and intake of construction workers in particular. The paper develops a framework of food choice determinants from literature review and tests the framework using principal components analysis of empirical data from a field questionnaire survey. Results evinced that food choices among South African construction workers are determinable by seven factors as opposed to six theorized factors. The study provides evidence which defines the factors that influence construction workers' food choice. The study will be useful to construction managers and stakeholders in planning for nutrition improvement in the construction industry. Improving nutrition will contribute to improvement in health and safety performance on construction sites.

Index Terms:-Construction workers, food choice determinants, health and safety performance, South Africa.

I. INTRODUCTION

Due to its invaluable role in productivity and H&S performance improvements, the little attention given to nutrition has been a major concern for employers and organizations for decades. According to [17], the International Labour Organisation (ILO) has been concerned with adequate nourishment of workers, food safety and education for general health, safety and work productivity since its establishment. The benefits of healthy eating and overall workers' health and well-being, including inter alia, improved morale, sense of well-being, and productivity as well as reduced absenteeism, health care costs, stress, and staff turn-over, are greater for low-paid workers in high risk occupations and settings, such as the construction industry [18].

Improving nutrition is even more important in the construction industry given the physically demanding and dangerous nature of construction work and the ever-increasing demand to improve the execrable image of the construction industry with regard to its H&S performance. Improving nutrition of a particular group requires an understanding of the factors which determine their food choice decisions. Food choices, eating behaviours and resulting nutritional health are

influenced by a number of complex and inter-related individual, collective and policy-related determinants [4].

A multitude of studies have dwelt on food choice determinants, for instance, [16], which had a broad scope and employed qualitative methods; [1], [5] and [15], which only reviewed existing literature. However, it appears that there is little empirical research investigating the structure and relativity of these determinants. In addition, there is no evidence of a study conducted amongst construction workers in South Africa. The current study therefore investigates and models the determinants of food choices amongst site workers in the South African construction industry. The model will enable identification of related individual factors which determine construction workers' food choices and uptake. The study will inform effectual planning for nutrition improvement which will invariably contribute to improvements in health and safety performance on construction sites.

II. FOOD CHOICE DETERMINANTS

A. Review

[16] developed a model of food choice integrating social (including family and co-workers), cultural and economic, personal (including gender, genetic predispositions to diseases, taste, personality and preferences) determinants as well as equipment, skill, knowledge, relationships, values and traditions, mass media, climate and physical structures. [16] employed qualitative methods to explore the perceptions of the participants. The study had a very broad scope incorporating factors relating to life course events and experiences such as changes in family through marriage, changes in residence through migration, etc.

In a related study by [15], it was found that environmental influences (including location and accessibility to shops) determine food choice and consumption. Other factors were indicated to be social acceptability, promotional or advertising effects, cost and availability of foods. This study reviewed existing research conducted on food access, and developed a model which depicted relationship between food choice and neighbourhood food access.

In a review of previous studies, [1] indicated that the choices

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people make about food determine which nutrients enter their body and these choices are influenced by many interrelating factors including biological mechanisms, genetic profiles, knowledge, social and cultural factors. Other factors were indicated to be psychological, economic, religious and demographic factors. Gender was also noted to be a primary factor underlying many decisions made about food. Gender differences and stereotyping influence habits, health consciousness, weight control, degree of resistance to nutrition education, body self-perception and so on [1]. For instance, based on the degree of health consciousness or desire to lose or add weight, women consume more fruits, vegetables and dairy products, while men consume more meat (especially red meat), alcohol and hearty portion sizes. In the same study, context, in terms of time, place or location and company, was indicated to influence food decisions. This study was a review which dwelt on the influence of gender in determining food choices.

In another review, [8] indicated that food choice decisions are based on economic factors (including cost, income and availability), physical factors (such as access, skill (for cooking), education and time), biological determinants (including hunger, taste and appetite), social factors, including culture, family, peers and meal patterns), psychological factors (such as mood, stress and guilt) as well as attitudes, beliefs and knowledge about food. Cultural influences lead to the differences in the habitual consumption of certain foods and in traditions of preparation, and in certain cases can lead to restrictions such as exclusion of meat and milk from the diet but they are amenable to change.

A mixed methods research study by [3] revealed that knowledge of value to health influence what is eaten. The study also indicated that variations existed amongst generations since older people preferred traditional foods which were healthier than conventional foods. This seemed to indicate that some food choices depend on preference and health consciousness. Other factors were found to be taste, cost and availability of food. This study, which used 24-hour dietary recall, was conducted among women in a remote settlement in Canada.

According to [2], the physical environment determines the choices of food made at a workplace. These include facilities provided on-site for food storage and preparation, as well as eating locations.

A cross-sectional study using focus groups and clinical measures indicated that insufficient time to prepare healthier meals at home and seasonality influenced dietary behaviours amongst South African employees [10]. Participants in this study felt that they generally followed healthier diets during summer when their intake of salads was higher and there was a greater variety of fruits and vegetables. Availability of healthy foods, a determinant also noted by [6] and [17], on construction sites depends on the season. [10] evaluated the effectiveness of an on-going workplace wellness programme which was conducted on South African employees, but not specifically on construction workers.

Other studies conducted in the construction industry concur that the nutrition of construction workers is influenced by a host of factors including knowledge about food and nutrition, social factors, economic factors, etc. [17] noted that construction workers' nutrition is influenced by availability and cost of healthy food alternatives on site or nearby, wages, work schedules (including length of meal breaks, since people generally do not make healthy food choices when they are rushed), work-related and welfare facilities (such as provision of eating areas) and economic environment. In his opinion, construction workers sometimes have no place to eat or money to purchase food; local and nearby restaurants can be expensive or in short supply and street foods are bacteria laden. In addition, the lackadaisical attitude of employers and unions towards nutrition was indicated to exacerbate the situation. Workers' access to food at construction sites was not a top union concern. Main concerns included wages, distribution of working time and non-unionized migrant workers. Construction employers on their part are usually more interested in maximizing productivity and profits and meeting tight deadlines, with little regard to their workers' wellbeing and health pursuits [14]. [17] had a broad scope, including workers in general and focusing on food quality and quantity.

Work schedules, regular travel between worksites due to the transient nature of construction, and limited on-site catering facilities (e.g. a kitchen and/or healthy food) were also indicated to be environmental determinants on a typical construction worksite which can determine workers' eating lifestyle [13]. However, this study focused on the environmental factors and excludes personal factors which could influence nutritional intake on a construction site.

According to [5], construction apprentices' food choices are determined by nutritional knowledge and cooking skills, familial factors (socio-economic status of parents and parental influence), peer influence, food supply and acquisition (e.g., at home, work or through fast-food outlets) demographic factors (age and gender differences, income, ethnicity and cultural variables); dietary restraint (conscious choice to regulate body weight), work and financial responsibilities, unhealthy childhood and adolescent food practices which endure into adulthood. The other factors were found to be media and stereotypical views about nutrition (since men generally view nutrition and cooking as socially prescribed for women and are relatively unconcerned about health and diet). In a related study, which explored these factors using focus groups and thematic analysis, found that apprentices' dietary practices were moderated by convenience, availability and cost of foods, nutritional beliefs, significant others, colleagues in the workplace and body image[6]. However, [5] and [6] only focused on apprentices in the construction industry and therefore their results may not be generalized.

Literature reviewed in this section, seemed to suggest that there are a multitude of factors which determine food choices and uptake. The studies which dwelt on construction workers' nutrition also identified the factors which influence the

nutrition of construction workers in particular. Some nutrition factors were indicated to be economic, social and environmental elements. Other factors were indicated to be physiological, cultural, and religious in nature. Summarizing the classifications and views expressed in the above-discussed studies, the food choice determinants are theorized to be nutritional knowledge, economic factors, environmental factors, social factors, psychological factors and physiological factors. These are presented in Table I.

B. Theoretical framework

Taking into consideration the views expressed in the review section above, a theoretical framework (Figure I) was developed. It was thought that:

- some of the studies had a broader focus (for instance, [17], which incorporated workers in general; and [16], which incorporated life course events and experiences.
- some focused on young construction workers only [5] and [6] and therefore cannot really be generalized.
- the methods used in some of the studies were different. For instance, [3] studied the influences on diet intake, but employed a mixed methods design and used 24 hour dietary recall to obtain information on intake among women only. The results of the study by [3] cannot really be generalized since the construction industry is male-dominated and the nutrition-influencers might differ when males are studied. [1] and [5] reviewed previous literature, while [6] used focus groups and questionnaires.
- there was little evidence of research conducted in South Africa, amongst construction workers.

The theoretical framework therefore incorporates factors which were thought to determine food choices and uptake amongst construction workers in South Africa. The rectangles represent the measurable variables, whereas the ovals represent the observed variables. The identified determinants are defined and summarized in Table I.

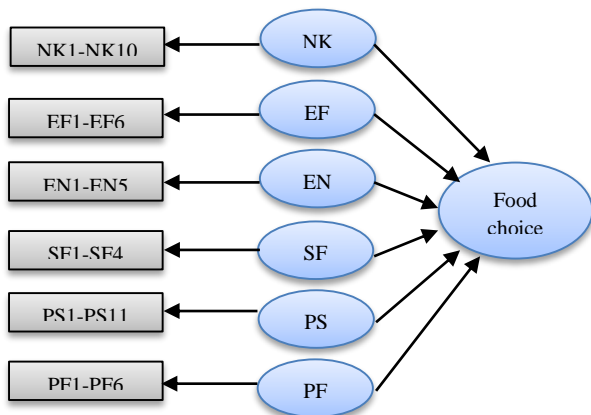


FIGURE I: THEORETICAL FRAMEWORK

TABLE I
THEORETICAL FRAMEWORK MEASURES FOR
NUTRITION DETERMINANTS

Factor	Measures	Label
Nutritional Knowledge (NK)	knowledge of what an adult should eat in a day	NK1
	knowledge of the sources of nutrients	NK2
	knowledge of the sources of energy	NK3
	knowledge of health benefits (consequences of eating or not eating particular foods)	NK4
	knowledge of nutritional requirements for body size	NK5
	knowledge of nutritional requirements for age	NK6
	knowledge of nutritional requirements for existing health status	NK7
	knowledge of nutritional requirements for the type of work engaged in	NK8
	knowledge about nutritional requirements for gender	NK9
	cooking skills	NK10
Economic Factors (EF)	wages/income	EF1
	availability of food	EF2
	cost/price of food	EF3
	marketing strategies/advertisements	EF4
	brand name	EF5
	discounts and subsidies	EF6
Environmental Factors (EN)	location	EN1
	seasonality	EN2
	time constraints	EN3
	on-site eating facilities	EN4
	facilities for food preservation on site	EN5
Social factors (SF)	friends/colleagues' influence	SF1
	familial influence (family norms and traditions)	SF2
	social media and networking	SF3
	social class	SF4
Psychological Factors (PS)	culture	PS1
	belief that killing animals for food is not good	PS2
	belief that avoiding meat keeps one healthier	PS3
	belief that avoiding meat save money	PS4
	belief about adequacy of diet	PS5
	fact that healthy eating increases productivity	PS6
	fact that healthy eating prevents accidents and injuries	PS7
	body image	PS8
	cynical attitude towards nutrition	PS9
	promotions	PS10
	mood	PS11
eating habits	PS11	
Physiological Factors (PF)	hunger	PF1
	taste	PF2
	satiety	PF3
	quality	PF4
	appetite quality of food	PF5
	palatability/appearance	PF6

III. METHODS

Extant literature regarding factors which determine food choice and uptake were reviewed and synthesized. The theoretical framework and a likert-scale questionnaire were outputs from the literature review. The questionnaire consisted of 42 questions inquiring about factors which determine food choice. The questionnaire was pilot-tested, reviewed and revised by experts before being self-administered to construction workers on construction sites. The participants, which included construction site workers comprising electricians, brick-layers, tilers, painters, carpenters, steel-fixers, plumbers, pavers and unskilled workers, were selected through heterogeneity and convenience sampling. Effort was made to include workers from different construction establishments involved in building, civil engineering and general construction projects. This was done in order to enhance generalizability of the results. Out of a total of 220 questionnaires distributed, 183 were returned. Raw data were then subjected to Principal Components Analysis (PCA) using Statistical Package for Social Sciences (SPSS) version 22 software. PCA was done in order to test the structures and composition of the theorized determinants. Principal axis factoring and direct oblimin rotation were used. Two frameworks emerged from the PCA. One was adopted as the final framework. The results are presented in the next section. Missing data were excluded using listwise deletion. Preliminary descriptive analysis of data revealed that data were normally distributed. Outliers were identified and removed before analysis. The forty-two items were then subjected to PCA. Outputs from the PCA (principal components) were thought to contribute to the variance in the data set. They were obtained using the Kaiser's criterion (retaining eigenvalues above 1), scree test (retaining factors above "breaking point") and Monte Carlo parallel analysis (retaining factors whose initial eigenvalues were larger than the criterion values from parallel analysis). Cronbach's alpha α test was used to assess internal consistency reliability before and after PCA. The theoretical framework variables had alpha values ranging from "0.71 to 0.84", indicating good internal consistency [12]. The final framework (after PCA) ranged from "0.62 to 0.85", also indicating good internal consistency.

IV. FINDINGS AND DISCUSSION

Prior to performing the PCA for the factors influencing nutrition, the suitability of data for factor analysis was assessed. Inspection of the correlation matrix revealed the presence of many coefficients with 0.3 and above. The Kaiser-Meyer-Olkin value was 0.743, exceeding the recommended value of 0.6 and the Bartlett's Test of Sphericity reached statistical significance ($p = .000$), supporting the factorability of the correlation matrix [12].

All the forty-two items theorized to be nutrition determinants were then subjected to PCA. Results from repeated PCA revealed that food choices could be determined by eleven or seven components. In the first analysis, eleven components exceeded eigenvalues above 1 (10.679, 4.145,

2.879, 2.241, 1.883, 1.818, 1.592, 1.432, 1.377, 1.300 and 1.117), explaining 25.43%, 9.87%, 6.85%, 5.34%, 4.48%, 4.33%, 3.79%, 3.41%, 3.28%, 3.10% and 2.66%, respectively of the variance, and accounting for a total variance of 72.53%. The results of the scree test also revealed a break after the eleventh component. This was further supported by the results of the pattern matrix, which also shows the labeling of the components extracted and the items loading evenly on all the components extracted.

However, due to the large number of the components extracted, the difficulty in naming them and the low internal consistency reliability of some of the components, a decision was made to re-run the rotation with a number closer to the expected number or to the originally theorized framework to increase internal consistency reliability of the components. Cronbach's alpha values for the eleven-item structure ranged from "0.54 to 0.84".

The second rotation was done with the first seven components, which accounted for 60.09% of the total variance. Interpretation of these seven revealed that items loaded more on each component and the structure was similar to the theoretical framework (Appendix). In addition, the internal consistency reliability of the components improved, ranging from 0.62 to 0.85. The seven components were then adopted. In other words, the seven-factor model was preferred because of its closeness to the theoretical framework, sufficient number of primary loadings, ease of interpretation and increased reliability of components. The components were named food context, biological factors, knowledge, personal ideas and systems, economic factors, resources and cultural distinctions.

Food context was used to define brand name, seasonality, time constraints, location, cooking skills and advertisements/marketing strategies. This is in line with findings from studies by [1] and [16], which indicated that food context is determined by time, place or location and company. The authors contended that food context defines the environment and specific setting in which food choices occur, encompassing the physical surroundings, social climate of the choice setting, specific food supply factors in the environment such as types of food, food sources and availability of foods in the food system, including seasonal and market factors.

Biological factors were found to include physiological needs and sensory aspects of the body such as hunger, satiety, palatability, taste and quality and appearance of food, as viewed by [1] and [8].

Nutritional knowledge consisted of four basic aspects of knowledge which influence food decisions. These included knowledge about food sources of energy, knowledge about sources of different food nutrients, knowledge about the health implications or consequences of consuming or not consuming particular foods, and knowledge about the recommended daily dietary requirements. This is consistent with what [9] indicated as being the essentials of nutritional knowledge.

The term *personal ideas and systems* was used to denote nutrition determinants comprising eating habits, attitude

toward advertisements and advertisers, 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, and belief that avoiding meat will keep one healthier, belief that killing animals for food is not good, and belief about adequacy of current diet. This was consistent with findings from [7] who contended that decisions on food choices were based on previously resolved deliberations and values which may stem from consideration of health status, managing relationships, society's food ideology, family environments, media and personal experiences, and which become habitual over time.

Economic factors comprised cost/price of food, availability of food, wages/income and foods on special offers and discounts, as viewed by [8].

Resources comprised 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 through consumption of certain foods. This aligns with findings from [16] which indicated that individuals consider assets which could be tangible or intangible, such as equipment (freezer, pantry space), space, knowledge, values, relationships, etc., in making food decisions.

Cultural distinctions comprised knowledge of what to eat as a man or woman; knowledge of what to eat for the type of work; belief that I should only eat food from my culture; and belief that avoiding meat will save money. This is consistent with findings from [11] which contended that culture encompasses knowledge, beliefs, customs and habits which a group of people share.

V. CONCLUSION

The study set out to establish a model of food choice determinants among construction workers. A framework was developed from literature and tested using PCA. The resulting framework had seven factors as opposed to the six factors theorized from literature.

The findings have practical implications for construction managers, employers and stakeholders who want to improve nutritional uptake of their workers. Awareness of the factors which influence their site workers' nutrition is valuable in planning for nutrition improvement. In addition, knowledge of the structure of these determinants will be helpful in collectively designing for the related individual factors. Improving nutrition, by targeting the identified nutrition determinants, will invariably result in improvement in health and safety performance on construction sites.

Although the study was conducted among construction workers, the model could be applicable to workers in general, especially low-income workers since working conditions and circumstances are similar. Future research could attempt to validate the model using more sophisticated analytical technique such as the structural equation modeling.

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LOADING MATRIX OF THE SEVEN COMPONENTS OF NUTRITION DETERMINANTS AFTER ROTATION

Measures		Component							
		1	2	3	4	5	6	7	
Food context	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	
Biological factors	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	
Nutritional knowledge	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	
Personal ideas and systems	my eating habits, eg. adding salt no matter what, having my food with beer or juice instead of water, eating something sweet after a meal, eating the same cereal everyday	-.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	
	Economic factors	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	
Resources	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	
	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	
Cultural distinctions	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	