ACTA SCIENTIFIC NUTRITIONAL HEALTH (ISSN:2582-1423)

Volume 6 Issue 7 July 2022

Review Article

Assessing the Correlation Between the Choice of Main Carbohydrate Staple and the Preference Ranking by Very Active Manual Workers

Mwale Mary Mabel*

Ministry of Agriculture, Livestock, Fisheries and Cooperatives, Kilimo House, Nairobi, Kenya

*Corresponding Author: Mwale Mary Mabel, Ministry of Agriculture, Livestock, Fisheries and Cooperatives, Kilimo House, Nairobi, Kenya. Received: May 02, 2022 Published: June 30, 2022 © All rights are reserved by Mwale Mary Mabel.

Abstract

Manual workers are some of the most active people in our society. Work output is driven by energy supply from the food we eat. The ability to balance energy consumption and expenditure is crucial, especially for work productivity and nutritional health. However, studies on food choice for work productivity are limited. The objective of this study was to determine the correlation between the choice of the main carbohydrate energy staple and preference ranking by Very Active Manual Workers (VAMW) in Nairobi. Questionnaires were administered to 322 respondents categorized into three groups: VAMW, and moderately active civil servants (CS) and university students (US). Respondents were asked to state their main carbohydrate staple and rank six commonly consumed carbohydrate foods from most preferred to the least preferred. Ugali was ranked first with a mean rank value of 1.134±0.492, followed by chapati with a mean rank of 2.588±0.976, and the third was rice with a mean rank of 3.247±1.242. Irish potato came fourth with a mean rank of 4.299±0.970, and bananas had a mean rank of 4.588±1.068. The "others" mixed category was least preferred, ranked sixth with a mean rank of 5.165±1.297, 95% confidence level. Further analysis indicated a significant difference in preference ranking of carbohydrate staples by the VAMW, F (0.05, 5,576), P < .0001. The pairwise comparison of mean ranks indicated a significant difference between the rank means of all pairs, but no significant difference between mean ranks of rice versus chapati, and Irish potatoes versus bananas. Correlation analysis comparing the main carbohydrate staple versus occupation (activity level), revealed a very weak correlation; r value 0.024 for VAMW and r value 0.109 for all respondents, but a moderate correlation between the main carbohydrate staple versus preference ranking- r value 0.516 for VAMW; 0.598 for US; 0.595 for CS and r value 0.562 for combined groups. Regression analysis indicated the main staple was a good predictor of preference ranking, 32.4%, F (6, 303) = 24.167, p<.000, thereby rejecting the hypothesis that there is no correlation between the main carbohydrate staple and preference ranking by VAMW. Results suggested that approximately 29.7% of the variation in the preference ranking was predicted by the main staple of VAMW, compared to for 32.4% for all respondents combined. This indicates that activity level is a good predictor of preference ranking, and other factors contribute to preference ranking of carbohydrate energy staple by VAMW.

Keywords: "Ugali," Preference Ranking; Main Carbohydrate Staple; Very Active Manual Workers

Introduction

Human food preferences and diet have evolved over time and vary within and between ethnicities [1]. Staple foods are those that constitute the major part of a routine diet and generally supply most or all of the total energy and nutrient intake of individuals [2-4]. Some staple foods around the world were adopted during the period of transition in human history, from small hunter-gatherer

nomadic bands to larger agricultural settlements, between 10,000 to 3,500 years ago [4]. Communities around the world have therefore identified and established preferences for specific foods as their main source of energy, mainly influenced by taste, availability, cost and convenience [5]. Other attributes include ease of handling, preservation and preparation method [6].

According to the food exchange theory, foods of the same group can be interchanged to deliver an equivalent amount of energy in the body [7]. It is therefore expected that isocaloric foods from the same food group can be interchanged to deliver equivalent amount of energy to support an individual's activity level [8]. Carbohydrates are found in a wide array of foods with sugars, starches and fibers being the most common and abundant forms. They occur in fruits, vegetables and proteins, including nuts grains legumes and seeds, but in smaller quantities. Activity level is one of the factors that determine choice, but many studies have shown that a combination of factors such as carbohydrate type, load, quantity, preparation method and combination with other nutrients affect digestion, satiety and postprandial effect differently [9].

Kenya is a land of great diversity in its people and cultures and each of the 44 ethnic tribes has a preference and attachment to a particular staple diet or cuisine. The type of staple food is a reflection and source of cultural identity and diversity [2,10-12]. The main staple diets in Kenva are based on maize, wheat, rice, Irish potatoes, bananas and beans, including millet, cassava and sorghum [13]. Maize meal locally referred to as "Ugali," has been adopted as the popular staple food consumed by over 75% of the population in Kenya [14] as a reliable source of energy, regardless of social economic status. "Ugali" is a specially prepared soft mixture of milled maize (corn) flour, locally referred to as "Unga", prepared by mixing it in boiling water overheat and baked for about 10 to 15 minutes. It basically has no additive(s), seasoning, nor sweetener. The Ugali can be based on whole milled or sifted maize flour alone, or a mixture of different proportions of maize flour and cassava flour. It can also be based on milled pure or mixtures of millet, sorghum and cassava flours [13], commonly referred to as "brown Ugali", the traditional version. The Ugali can be consumed with a wide variety of accompaniments, making it the perfect combination with a wide range of protein and vegetable foods. It is commonly eaten with meat- beef, chicken or fish, both either stewed or roasted, and with fried kale locally known as "Sukuma wiki," or cabbage (an exotic vegetable), with milk, or with any indigenous vegetables.

However, the overwhelming reliance on maize meal staple, "Ugali", has posed a major problem in Kenya socially, economically and politically, with a common slang that "when there is no 'Ugali,' there is no food". Shortfalls in supply and price hikes have caused protests and street demonstrations, calling for government interventions, especially by low income very active persons, at times crippling economic activities [6,15-17]. The wide acceptance and reliance is propelled by the general perception and stereotype that it is tastier, nutritious and has higher satiety compared to other common carbohydrate staples. Another stereotype is associated with energy, work productivity, choice of occupation and physical stature due to their main staple food [18]. (Accordingly, some staple foods are considered inferior in terms of energy, nutrients and organoleptic taste by some individuals and ethnic communities.

Work output is driven by energy supply from the food we eat. Hence, high energy foods are expected to define the staple food of very active manual workers in order to remain productive and nutritionally health [19]. This study investigated the correlation between the main carbohydrate energy staple and preference ranking; and factors that influence the choice of carbohydrate staples by Very Active Manual Workers (VAMW) in Nairobi, Kenya. The research hypothesis tested was that there is no correlation between the main carbohydrate and work productivity output of very active manual workers in Nairobi, Kenya.

Methodology

Sampling, study site and target group

A purposeful sampling method was used to identify and recruit the group of very active healthy manual workers in Nairobi, as the main focus of this study. The manual workers were drawn from four companies in Industrial Area of Nairobi, who were determined to be very active due to their nature of work. The moderately active groups, acting as control groups, were Civil servants (CS) working in the Ministry of Agriculture, Livestock, Fisheries and Cooperatives and Ministry of Health offices in Nairobi; and University students from Kenyatta University, living and studying in Nairobi. The two groups of CS and US were interviewed as control groups to validate the difference in responses made by VAMW compared to moderately active groups. The criteria for inclusion of subjects in the study was, healthy individuals aged between 18-60 years old.

The manual workers were selected from the same unit, where most of the work performed was manual and labour intensive. Con-

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ducting the interviews within the work or study environment enabled interviewers to confirm the activity level of the respondents before commencing the interview. This also minimized significant interruption of their work or study schedule for the day. Permission to interview the respondents was obtained from management prior to the visit and arrangements were made to be at the site on time. There was no discrimination between genders, as long as they were engaged in the same activity level. However, female subjects were not found among the VAMW respondent group. Interview questionnaires were administered from where they worked or studied. The respondents were informed of the purpose of the study and their consent sought before administration of questionnaires. Respondents were assured that data collected would remain confidential. Most of the interviews for the VAMW had to be conducted during lunch break period, since most workers are paid according to the accomplished work each day. Hence, taking too much of their time would affect their pay for the specific day. Sometimes resistant respondents were motivated to get their attention to be interviewed by promising to pay for their lunch meal after the interview. Each interview took an average of 15-20 minutes. A priori sample size was determined using G*power version 3.1.9.4. with small effect size 0.23 [20,21] α = 0.05. A total of 322 questionnaires were administered.

According to the theory of food exchanges Wheeler., et al. (1996), the American Diabetes Association (2003), and The National Institute of Diabetes and Digestive and Kidney Diseases (2014) on carbohydrate counting, food energy is obtained from carbohydrates, proteins, or oils/fats in the diet. This study focused on carbohydrate energy staples and used the question of "the main carbohydrate energy staple" to differentiate it from other energy giving foods. Some ethnic communities have milk, meat and pulses as staples. A selected number of foods commonly consumed by different ethnic groups in Kenya were used to limit the category of responses so that the interviewee did not have a wide range of foods to compare and respond to. The selected carbohydrate energy giving staple foods were: Ugali, rice, chapati, Irish potatoes, bananas, and the "other" category. The "other" category option represented any other food not listed among the 5 foods such as Githeri (mixed maize and beans), cassava, spaghetti, noodles, Sweet potatoes, and bread among many alternatives.

Questionnaires design, interviews and data analysis

The respondents were asked to indicate the main energy staple food consumed most regularly from six listed foods, then rank the foods according to the most preferred to the least preferred using numerical values 1 to 6. The rank of numeric value 1 indicated the most preferred and the numeric value 6 indicated the least preferred. There was no rank tying allowed in the responses. The assumptions were that all the responses were independent; there were no biases; and all respondents were familiar with or understood the description of the foods listed in the study questionnaire. Data analysis was done using Excel data analysis tools and G*power version 3.1.9.4.

Results and Discussion

Basic data

The basic data showed that the minimum age for VAMW ranged from 35 to 53 years; with a mode of 30 years and the median age of 31 years. The minimum age for US ranged from 19 years to 66 years; with a mode of 24 years and a median age of 23 years. The age range for CS was from 20 to 60 years, with a mode of 26 years and a median age of 35 years. The combined groups' median age was 28 years with a mode was 24 years. Analysis indicated that 81% of the respondents were males, while 19 % were females. Respondents who had completed secondary education, high school or had a Certificate/Diploma were 43%; and 57% had either a first degree or Postgraduate degree (Figure 1). Respondents were asked to indicate their terms of employment-whether temporary, permanently employed, or students. Analysis of the data indicated that 44% of the respondents were permanently employed, whereas 33% were on temporary employment. Students constituted 23% of the respondents, as some reported they were employed.

Figure 1: Education level of respondents.

Preference ranking results for carbohydrate energy staples Preference ranking results for Very Active Manual Workers (VAMW)

The descriptive analysis of the data indicated that Ugali was ranked first and most preferred among the listed carbohydrate foods by VAMW, 95% confidence level (Table 1). The rank for "Ugali" ranged from 1 to 3, with a mean rank value of 1.134 ± 0.492. The second preference was chapati with a mean rank 2.588 ± 0.976 . The third rank was rice with a mean rank of 3.247 ± 1.242 followed by Irish potato with a mean rank value of 4.299 ± 0.970, and fifth was banana with a mean rank value of 4.588 ± 1.068. The least preferred, ranked sixth, was the mixed category "others" with a mean rank value of 5.165 ± 1.297. The range for rice and chapati was 1 to 5, while that of Irish potatoes bananas and others ranged from 2 to 4. The results suggested that "Ugali" was the most preferred carbohydrate energy staple among VAMW (Table 1 and Table 2). Analysis of Variance suggested a significant difference in preference ranking for different carbohydrate staples by the VAMW, F (0.05, 5,576), P < .0001. Therefore, the Null hypothesis that there was no significant difference in the preference ranking of the carbohydrate energy staples by the VAMW was rejected.

Statistic	Ugali	Rice	Chapati	Irish Potatoes	Bananas	Others
Mean	1.134	3.247	2.588	4.299	4.588	5.165
Standard	0.050	0.126	0.099	0.099	0.108	0.132
Error						
Median	1	3	2	4	5	6
Mode	1	2	2	5	5	6
Standard	0.492	1.242	0.976	0.970	1.068	1.297
Deviation						
Sample	0.242	1.542	0.953	0.941	1.141	1.681
Variance						
Range	3	5	5	4	4	4
Minimum	1	1	1	2	2	2
Maximum	4	6	6	6	6	6
Sum	110	315	251	417	445	501
Count	97	97	97	97	97	97

Table 1: Preference ranking	of the car	bohyd	lrate stap	le food	s by
VAMV	W in Nairo	bi.			

Α	Analysis of Variance (ANOVA) Single Factor:										
		Sun	nmary sta	tistics							
Groups	Count	Sum	Average	Variance							
Ugali	97	110	1.134	0.242							
Rice	97	315	3.247	1.542							
Chapati	97	251	2.588	0.953							
Irish Potatoes	97	417	4.299	0.941							
Bananas	97	445	4.588	1.141							
Others	97	501	5.165	1.681							
ANOVA											
Source of Variation	SS	df	MS	F	P-value	F crit					
Between Groups	1075.473	5	215.095	198.542	0.000	2.230					
Within Groups	624.021	576	1.083								
Total	1699.493	581									

Table 2: Variance in Preference Ranking of energy staples by

 VAMW.

Preference ranking results for university students (US)

University students (US) were interviewed as control groups to determine whether the ranking very active manual workers was by chance due to their nature of work. Results of descriptive analysis showed that the mean rank for Ugali was 1.629 ± 1.067 , indicating wider variation in ranking among this group. The second rank was chapati with a mean rank of 2.564 ± 1.083, very close to the ranking of rice that came third with a mean rank value of 2.500 ± 1.085 . The fourth was Irish potatoes with a mean rank of 4.053 ± 0.943 . Bananas are ranked fifth with a mean rank value of 4.394 ± 0.918 . The mean rank for the "others" group was 5.872 ± 0.421, ranked sixth by this group. The results of the US respondents showed that the preference rank for "Ugali" rice and chapati ranged from 1 to 5, 95% confidence level, while that for Irish potatoes and banana ranged from 2 to 4, suggesting that Irish potatoes and bananas do not fall among the top preference by this group, for carbohydrate energy staples. The ranking of "others" category was from 4 to 6, suggesting that they are not among the top three preferred staples

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foods, and are generally least preferred by the US. To determine whether the preference ranking was by chance the data was analyzed for variance between individual rankings for different carbohydrate staples. Results suggested a very significant difference in preference ranking for different carbohydrate staples by the US, F (0.05, 5, 558), P < .0001 (Table 3 and 4).

Statistic	Ugali	Rice	Chapati	Irish Potatoes	Bananas	Others
Mean	1.628	2.500	2.564	4.053	4.394	5.872
Standard Error	0.110	0.112	0.112	0.097	0.095	0.043
Median	1	2.5	2	4	5	6
Mode	1	3	2	4	5	6
Standard Deviation	1.067	1.085	1.083	0.943	0.918	0.421
Sample Variance	1.139	1.177	1.173	0.890	0.843	0.177
Range	4	4	4	4	4	2
Minimum	1	1	1	2	2	4
Maximum	5	5	5	6	6	6
Sum	153	235	241	381	413	552
Count	94	94	94	94	94	94

Table 3: Preference Ranking results of the carbohydrate staple foods by university students.

Analysis of Variance (ANOVA) Single Factor: Summary statistics										
Groups	Count	Sum	Average	Variance						
Ugali	94	153	1.628	1.139						
Rice	94	235	2.500	1.177						
Chapati	94	241	2.564	1.173						
Irish potatoes	94	381	4.053	0.890						
Bananas	94	413	4.394	0.843						
Others	94	552	5.872	0.177						
ANOVA										
Source of Variation	SS	df	MS	F	P-value	F crit				
Between Groups	1138.775	5	227.755	253.049	0.000	2.230				
Within Groups	502.223	558	0.900							
Total	1640.998	563								

Table 4: Variance in Preference ranking of energy staples by US.

Preference Ranking results for Civil servants (CS)

Descriptive analysis of the data by civil servants showed that the rank for "Ugali" ranged from 1 to 5, compared to others 1 to 6, 95% confidence level. The mean rank for Ugali was 1.471 ± 0.930 , indicating the second widest variation after the US. The second ranking in this group was rice with a mean rank 2.608 \pm 1.101. Chapati was ranked third with a mean rank of 3.078 \pm 1.264; Banana preference had a mean rank of 4.029 ± 1.173 ; whereas Irish potatoes was ranked fifth with a mean rank of 4.510 ± 0.972 . The "others" group was least preferred with a mean rank of 5.284 ± 1.396 . The results also suggest that "Ugali" was ranked the most preferred carbohydrate staple by CS. Results indicate a significant difference in mean ranks for different carbohydrate energy staples by the CS, F (0.05, 5,606), P < .0001. (Table 5 and 6).

	Ugali	Rice	Chapati	Irish Potatoes	Banana	Others	
Mean	1.471	2.608	3.078	4.510	4.029	5.284	
Standard	0.000	0.100	0.125	0.000	0.11.6	0.120	
Error	0.092	0.109	0.125	0.096	0.116	0.138	
Median	1	2	3	5	4	6	
Mode	1	2	3	5	4	6	
Standard	0.020	1 1 0 1	1.2(4	0.070	1 1 7 0	1.207	
Deviation	0.930	1.101	1.264	0.972	1.1/3	1.396	
Sample	0.000	1 011	1 500	0.045	1 275	1.0.40	
Variance	0.866	1.211	1.598	0.945	1.375	1.948	
Range	4	5	5	4	5	5	
Minimum	1	1	1	2	1	1	
Maximum	5	6	6	6	6	6	
Sum	150	266	314	460	411	539	
Count	102	102	102	102	102	102	

Table 5: Preference Ranking results of the carbohydrate staple foods by Civil Servants.

Analysis of Variance (ANOVA) Single Factor: Summary										
statistics										
Groups	Count	Sum	Average	Variance						
Ugali	102	150	1.471	0.866						
Rice	102	266	2.608	1.211						
Chapati	102	314	3.078	1.598						
Irish Potatoes	102	460	4.510	0.945						
Banana	102	411	4.029	1.375						
Others	102	539	5.284	1.948						
ANOVA										
Source of Variation	SS	df	MS	F	P- value	F crit				
Between Groups	976.739	5	195.348	147.560	0.000	2.229				
Within Groups	802.255	606	1.324							
Total	1778.994	611								

Table 6: Testing for Variance in Preference Ranking of energy staples by CS.

Comparison of Preference rank mean results for all three group categories combined

Comparison of combined rank means of the three group categories was done to compare the variance between the groups in ranking of selected carbohydrate energy staples. Ugali had a mean rank was 1.411 with a variance of 0.064, ranked first by all the respondent groups. The combined mean ranking for rice was 2.785 with a variance of 0.163, almost tying with the mean rank of chapati with 2.743 and a variance of 0.084, the third most preferred carbohydrate staple. The fourth was Irish potatoes with a mean rank of 4.287 and a variance of 0.052. The mean rank for banana was 4.337 with a variance of 0.080, making it fifth most preferred staple, followed by the "others" group, least preferred with a combined mean rank of 5.441 and a variance of 0.143. The overall ranking by all respondents for the different types of carbohydrates was significantly different. (Table 7). Although "Ugali" was ranked first by all the respondent groups, the analysis of the combined rank means suggests a significant difference in ranking of all carbohydrate staples, F (0.05, 5, 12), P < .0001. The null hypothesis tested that there was no significant difference in preference ranking of carbohydrate energy staple foods was rejected. Results indicated at least one significant difference between the preference ranking of Ugali compared to other carbohydrate energy staples.

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ANOVA: Single Factor:										
Summary										
Groups	Count	Sum	Average	Variance						
Ugali	3	4.232	1.411	0.064						
Rice	3	8.355	2.785	0.163						
Chapati	3	8.230	2.743	0.084						
Irish Pota- toes	3	12.862	4.287	0.052						
Bananas	3	13.011	4.337	0.080						
Others	3	16.322	5.441	0.143						
ANOVA										
Source of Variation	SS	df	MS	F	P-value	F crit				
Between Groups	31.603	5	6.321	64.590	0.000	3.106				
Within Groups	1.174	12	0.0979							
Total	32.778	17								

Table 7: Comparison of rank means for all the threegroup categories.

Post hoc analysis

A Post hoc analysis of the results to determine which of the rank means were significantly different from others was conducted using the Scheffe' test. Pairwise comparison indicated there was a significant difference in the rank means for all other carbohydrate staples except for rice versus chapati, and Irish potatoes versus banana, where there was no significant difference. (Table 8).

Further Post hoc analysis revealed the effect size for the sample groups to be 0.23, with a final Power of 0.949. The test statistic was 3.027 with a non-centrality parameter of 15.4997 (Figure 2).

Overall, 79% of the all respondents selected "Ugali" as their most preferred carbohydrate energy staple. The second most preferred was chapati with 11%, followed by rice at 6% of the respondents. Respondents who preferred banana as their main energy source were 2%. The least preferred were Irish potatoes and the "others", 1% each, However, compared 90% of VAMW respondents pre-

Pair	Difference between means	Fs calculated value
Ugali and Rice	1.374	21.057
Ugali and Chapati	1.333	20.416
Ugali and Irish potatoes	2.877	44.073
Ugali and Banana	2.926	44.833
Ugali and Others	4.030	61.742
Rice and chapati	0.042	0.640
Rice and I/Potato	1.502	23.016
Rice and Bananas	1.552	23.776
Rice and Others	2.655	40.685
Chapati and Irish potato	1.544	23.657
Chapati and Banana	1.594	24.417
Chapati and Others	2.697	41.326
I/Potato and Banana	0.050	0.760
Irish Potatoes and Banana	1.153	17.669
Irish potatoes and others	1.104	16.909

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Table 8: Pairwise comparison of means using Scheffe's testFs crit = 15.53.

Figure 2: The Distribution graph for the combined mean ranks.

ferred Ugali. The Null hypothesis tested that there is no significant difference between the mean rank of Ugali by VAMW compared to other groups, moderately active CS and US was rejected. This indicates that Ugali is the most preferred staple among the VAMW, but also among US and CS in Nairobi, (Figure 3). staple in Nairobi

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very weak correlation between the preference ranking and occupation (activity level/work productivity), r value 0.109; but r value was 0.024 for VAMW (Table 9, 10 1nd 11). However, the correlation analysis of the combined results indicated a moderate relationship between the main carbohydrate energy staple (Ugali) and the preference ranking by the groups, r value 0.562. The hypothesis tested was that there is no correlation between the main carbohydrate energy staple and preference ranking of VAMW. The Analysis showed moderate correlation with r values of 0.516 for VAMW, 0.598 for US and 0.595 for CS.

Simple linear regression analysis: the carbohydrate energy main staple and the preference ranking (ugali) - combined groups

A simple linear regression analysis was conducted to test the Null hypothesis that the regression coefficient (slope) was equal to 0. The results suggest that a significant proportion of the variation in the preference ranking by activity level was predicted by the main staple. Results indicate that the main carbohydrate staple was a good predictor of the preference ranking by all the groups, F (6, 303) = 24.167, p < .000 (Table 12).

Chapati	Ugali	Rice	Chapati	Irish Potatoes	Banana	Others	Occupation
Ugali	1						
Rice	-0.410	1					
Chapati	-0.241	-0.161	1				
Irish Potatoes	-0.130	-0.087	-0.149	1			
Banana	-0.075	-0.177	-0.335	-0.190	1		
Others	0.030	-0.299	-0.182	-0.311	-0.241	1	
Occupation	0.109	-0.109	-0.156	-0.147	0.087	0.224	1

Table 9: Correlation Analysis occupation and preference ranking of staples.

	Ugali	Rice	Chapati	Irish potatoes	Bananas	Others	Occupation
Ugali	1						
Rice	-0.293	1					
Chapati	-0.317	-0.267	1				
Irish potatoes	-0.063	-0.174	-0.088	1			
Bananas	0.185	-0.197	-0.285	-0.121	1		
Others	0.030	-0.343	-0.086	-0.379	-0.394	1	
Occupation	0.024	-0.148	0.123	0.035	-0.023	0.017	1

Table 10: Manual workers: Correlation analysis for the main staple and preference ranking.

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Figure 3: The distribution graph for the mean ranks by the groups.

Determination of correlation between the main staple and the preference ranking

Correlation and linear regression analysis for combined data-All groups

A correlation analysis for main staple versus preference ranking of carbohydrate staples was done for all three groups combined. The Null hypothesis tested was that there was no correlation between main carbohydrate energy staple and occupation (activity level/work productivity). Analysis of combined data revealed a

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	Combine	d: All groups	Manual workers		University students		Civil servants	
	Main staple	Ugali	Main staple	Ugali	Main staple	Ugali	Main staple	Ugali
Main staple	1		1		1		1	
Ugali	0.562	1	0.516	1	0.598	1	0.595	1
Mean	1.432	1.429	1.426	1.426	1.429	1.426	1.429	1.426
Standard Deviation	0.982	0.903	0.982	0.903	0.982	0.903	0.982	0.903
Count	310	310	310	310	310	310	310	310

Table 11: Correlation table.

SUMMARY OUTPUT: All group categories									
Regression Stat	istics								
Multiple R	0.569								
R Square	0.324								
Adjusted R Square	0.310								
Standard Error	0.816			Fcrit	2.129				
Observations	310								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	6	96.477	16.079	24.167	0.000				
Residual	303	201.601	0.665						
Total	309	298.077							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%	
Intercept	2.012	5.283	0.381	0.704	-8.384	12.409	-8.384	12.409	
Ugali	0.576	0.264	2.183	0.030	0.057	1.096	0.057	1.096	
Rice	-0.014	0.253	-0.057	0.955	-0.512	0.483	-0.512	0.483	
Chapati	-0.054	0.259	-0.207	0.836	-0.563	0.456	-0.563	0.456	
Irish Potatoes	-0.072	0.255	-0.284	0.777	-0.574	0.429	-0.574	0.429	
Banana	-0.076	0.255	-0.298	0.766	-0.577	0.426	-0.577	0.426	
Others	-0.106	0.249	-0.425	0.671	-0.595	0.384	-0.595	0.384	

 Table 12: Linear Regression Analysis: between the main staple and ranking of the foods- All groups combined.

Citation: Mwale Mary Mabel. "Assessing the Correlation Between the Choice of Main Carbohydrate Staple and the Preference Ranking by Very Active Manual Workers". *Acta Scientific Nutritional Health* 6.7 (2022): 107-122.

Additionally, the unstandardized slope of 0.576 and standardized slope of 0.569 are statistically significant from 0 (t = 2.183, df = 6, p < 0.0001); the confidence interval does not include 0 (0.057, 1.096) further confirming that the combined groups' carbohydrate energy main staple statistical significance; the intercept (mean rank score) when the pretest is 0) was 2.012.

Multiple R Squared indicates approximately 32.4% of the variation in the preference ranking was predicted by the main carbohydrate energy staple of the groups combined, suggesting a small effect (Cohen, 1988). Other factors also contribute to the preference ranking, 67.6%. The power achieved in the test was 1.0000, showing a strong level of confidence to reject the null hypothesis if it is in fact false.

Figure 4.4.7.1: Regression line graph for combined groups for main Staple (Ugali) versus preference ranking



Figure 4: Distribution plot for the combined data results - main carbohydatre staple (Ugali) versus preference ranking.

Figure 5: Correlation analysis: Very Active Manual Workers.

Correlation analysis for main carbohydrate energy staple (Ugali) versus the preference ranking by Very Active Manual workers (VAMW)



Figure 6: Correlation Analysis: main staple (Ugali) versus Preference ranking by Very Active Manual Workers .

Simple linear regression analysis: the carbohydrate main staple versus preference ranking (ugali) - very active manual workers (VAMW)

A simple linear regression was conducted to determine if the VAMWs' main staple could predict the variation in preference ranking of the group compared to that of the control groups. The Null hypothesis tested was that the regression coefficient (i.e., the slope) was 0. The results of the simple linear regression suggest that a significant proportion of the preference ranking was predicted by the main staple of the Manual workers. This implies that the activity level is a good predictor of preference ranking, F (6, 90) = 6.345, p < 0.0001 (Table 13).

Additionally, we find the following: the unstandardized slope (0.293) and standardized slope (0.545) is statistically significantly different from 0 (t = 1.811, df = 6, p < .0001); confidence interval includes 0 (-0.029, 0.615), further confirming statistical significance, the intercept average preference was 1.288.

Multiple R Squared indicates that 29.7% of the of the carbohydrate energy preference ranking was predicted by the main staple of the VAMW. These suggest that other factors (69.3%) contribute to the variation in preference ranking by the Manual workers. The power achieved in the test was 1.0000 showing a strong level of confidence to reject the null hypothesis when it is false.

Citation: Mwale Mary Mabel. "Assessing the Correlation Between the Choice of Main Carbohydrate Staple and the Preference Ranking by Very Active Manual Workers". *Acta Scientific Nutritional Health* 6.7 (2022): 107-122.

SUMMARY OUTPUT: MANUAL WORKERS									
Regression Statistics		Very Active Manual Workers							
Multiple R	0.545								
R Square	0.297								
Adjusted R	0.250								
Square	0.250								
Standard Error	0.286								
Observations	97								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	6	3.120	0.520	6.345	0.000				
Residual	90	7.375	0.082						
Total	96	10.495							
	Coefficients	Standard	t Stat	P-value	Lower 95%	Upper	Lower	Upper	
		Error	t Stat		LOWEI 93%	95%	95.0%	95.0%	
Intercept	1.288	3.048	0.422	0.674	-4.768	7.343	-4.768	7.343	
Ugali	0.293	0.162	1.811	0.074	-0.029	0.615	-0.029	0.615	
Rice	-0.029	0.146	-0.199	0.843	-0.319	0.261	-0.319	0.261	
Chapati	-0.060	0.150	-0.397	0.693	-0.359	0.239	-0.359	0.239	
Irish Potatoes	-0.006	0.146	-0.040	0.968	-0.296	0.284	-0.296	0.284	
Banana	-0.007	0.147	-0.050	0.960	-0.298	0.284	-0.298	0.284	
Others	-0.047	0.145	-0.321	0.749	-0.335	0.242	-0.335	0.242	

Table 13: Regression line Graph for Very Active Manual Workers.

Figure 7: Distribution plot for main staple (Ugali) and preference ranking results - Very Active Manual Worker.

Figure 7a: Correlation analysis for main staple (Ugali) versus preference ranking- Civil Servants.

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Simple linear regression analysis: the carbohydrate energy main staple and the preference ranking (ugali) - civil servants

The simple linear regression was done to determine if the CS (Moderate Activity level) main staple could predict the variation in preference ranking of the group compared to that of VAMW. The Null hypothesis tested was that the regression coefficient (i.e., the slope) was 0. The results of the simple linear regression suggest that a significant proportion of the preference ranking was predicted by the main staple of the CS. This implies that the activity level is a good predictor of preference ranking, F (6, 112) = 11.400, p < 0.0001 (Table 14).

		Sun	nmary Out	tput: Civil	Servant	·		·
Regression Stati	stics							
Multiple R	0.616							
R Square	0.379							
Adjusted R Square	0.346							
Standard Error	1.100							
Observations	119							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	6	82.822	13.804	11.400	0.000			
Residual	112	135.615	1.211					
Total	118	218.437						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-6.475	10.068	-0.643	0.521	-26.422	13.473	-26.422	13.473
Ugali	1.235	0.513	2.408	0.018	0.219	2.251	0.219	2.251
Rice	0.460	0.478	0.963	0.338	-0.487	1.407	-0.487	1.407
Chapati	0.372	0.496	0.751	0.454	-0.610	1.355	-0.610	1.355
Irish Potatoes	0.216	0.491	0.440	0.661	-0.757	1.190	-0.757	1.190
Banana	0.377	0.490	0.770	0.443	-0.594	1.349	-0.594	1.349
Others	0.291	0.468	0.622	0.535	-0.636	1.217	-0.636	1.217

Table 14: Regression line Graph for Civil Secrvants.

Additionally, we find the following: the unstandardized slope (1.235) and standardized slope 0.616 are statistically significantly different from 0 (t = 2.408, df = 6, p < .0001); confidence interval does not include 0(0.219, 2.251), further confirming statistical significance, the intercept average preference was -6.475.

Multiple R Squared indicates that 37.9% of the of the carbohydrate energy preference ranking was predicted by the main staple (of the moderate activity level group). These suggest that factors (62%) contribute to the variation in preference ranking by the Civil servants' group. The power achieved in the test was 1.0000 showing a strong level of confidence to reject the null hypothesis when it is false.

Assessing the Correlation Between the Choice of Main Carbohydrate Staple and the Preference Ranking by Very Active Manual Workers

Figure 8: Distribution plot for Civil Servants main staple (Ugali) versus Preference ranking- University students.

Simple linear regression analysis: the carbohydrate energy main staple (ugali) and the preference ranking (ugali) - university students

A simple linear regression was conducted to determine if the US (Moderate activity level) main staple could predict the variation in preference ranking of the group compared to that of VAMW. The Null hypothesis tested was that the regression coefficient (i.e., the





slope) was 0. The results of the simple linear regression suggest that a significant proportion of the preference ranking was predicted by the main staple of the University students. This implies that the activity level is a good predictor of preference ranking, F (6, 87) = 12.303, p < 0.0001 (Table 15).

SUMMARY OUTPUT: UNIVERSITY STUDENTS									
Regression Stat	istics								
Multiple R	0.678								
R Square	0.459								
Adjusted R Square	0.422								
Standard Error	0.527								
Observations	94								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	6	20.490	3.415	12.303	0.000				
Residual	87	24.149	0.278						
Total	93	44.638							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%	
Intercept	8.908	11.230	0.793	0.430	-13.412	31.228	-13.412	31.228	
Ugali	-0.069	0.536	-0.130	0.897	-1.134	0.996	-1.134	0.996	
Rice	-0.392	0.539	-0.727	0.469	-1.462	0.679	-1.462	0.679	
Chapati	-0.590	0.534	-1.105	0.272	-1.651	0.471	-1.651	0.471	
Irish Potatoes	-0.433	0.531	-0.814	0.418	-1.489	0.623	-1.489	0.623	
Banana	-0.329	0.539	-0.610	0.543	-1.401	0.743	-1.401	0.743	
Others	-0.289	0.549	-0.528	0.599	-1.380	0.801	-1.380	0.801	

Table 15: Regression line Graph- University students.

Additionally, we find the following: the unstandardized slope (-0.069) and standardized slope (0.078) is statistically significantly different from 0 (t = -0.130, df = 6, p < .0001); confidence interval includes 0 (-1.134, 0.996), further confirming statistical significance, the intercept average preference was 8.908.

Multiple R Squared indicates that 45.9% of the of the carbohydrate energy preference ranking was predicted by the main staple of the US (moderate activity level). These suggest that other factors (64%) contribute to the variation in preference ranking by the University students. The power achieved in the test was 0.99999 showing a strong level of confidence to reject the null hypothesis when it is false.

Figure 10: Distribution plot for University students main staple and Ranking.

Conclusion

In this study, Ugali stands out as the undisputed preferred main carbohydrate energy staple food for very VAMW in Nairobi. This implies a correlation between the choice of main carbohydrate energy staple and level of productivity for very active manual workers. Energy supply affects concentration span, endurance and duration of intensive strenuous work or activities. The Kenya National Food Composition Tables food composition indicate the nutrient values of the selected foods. This study indicates that choice of main carbohydrate staple is driven by other factors that are intrinsic or extrinsic to the staple food itself.

The ability to balance individual energy consumption and expenditure is important for very active individuals. Most epidemiological studies have focused on hunger, satiety, obesity, weight management, glycemic index, exercise, and malnutrition; but not so much has been done on the choice of energy foods by very active individuals. The energy requirements for the VAMWs group is very high and heavy work output is driven by energy supply from the food they eat. VAMW also need to stay healthy as they work and earn an income based on their strength and endurance. This study confirms the claim that Ugali is preferred and may have higher energy and satiety, although not necessarily superior to other carbohydrate staples. This study may not immediately contribute to changing the existing stereotypes about other carbohydrate energy staples, but could influence policy measures to support access to preferred staples fir very active individuals to remain productive at work. Adequate nutrition education and information is needed to enable individuals make the best choices among the alternative staples and combinations that can enhance satiety, and support activity level and desired work performance. In most developed countries technology has been embraced to carry out heavy work, but labour in developing countries is mainly manual making the choice of energy staple important.

The results of this study contributes to empirical evidence regarding the claims made by individuals and communities about the postprandial effect of different carbohydrate energy staples with regard to manual labour work and work productivity or activity level. This study may also contribute to changing some negative perceptions about certain ethnic foods or diets, which they consider exotic and of inferior quality. Correcting the perception of various staple foods will improve utilization and demand, leading to increased production and food security and economic development. Providing accurate information will also influence staple food choices by activity level.

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