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Nutritional Qualities and Comparative Analysis of Charcoal-Grilled Chicken and Beef Marinated with Three Different Alcoholic Beverages

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Abstract

This study examined the nutritional qualities, with a comparative assessment, of charcoal-grilled white and red meat marinated with three different alcoholic beverages. Fifty taste panelists were selected using the purposive sampling technique. A 9-point hedonic scale sensory evaluation sheet was administered to the respondents to gather data. The data were analyzed using descriptive and inferential statistic. Multivariate analysis of variance was used to determine significant mean difference between the samples. The proximate composition of the food products was determined using the model adopted by the Association of Official Applied Chemist (AOAC) 2010. Multiple Duncan range system was used to discover the significant difference of sample (5% significance level). This study reveals the effectiveness of marinade on enhancing the sensory properties of grilled meat. The wine marinade effectively enhanced the white meat while both beer and spirit enhanced the sensory qualities of the red meat. The study concluded that the choice of marinade is dependent on the preference of the marinade as the results showed a non-significant difference between the attributes of the samples. It is recommended that more studies be carried out using other alcoholic beverages in combination with marinades in seasoning various types of meat. Also, other grilling methods should be explored in the preparation of different types of marinated.

Keyword: *Food development, Food innovation, Gastronomy, Grilled meat, Marinated meat*

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Introduction

Meat is an integral and important component of nutrition in human and considered as vital for the human health due to its dietary qualities Meat has been acknowledged by the Food and Drug Administration (FDA, 2022) as a superior source of protein. The percentage daily value (DV) for proteins in beef and pork was set by the US Department of Agriculture at 40%, for lamb at 37%, and for veal and game at 36% (Cashman & Hayes, 2017). Additionally, meat appears to be a significant dietary source of fat, particularly saturated fatty acids (Ascherio, 2018).

Food preparation's primary goal is to create safe food with a low concentration of potentially dangerous ingredients. Meat can be processed in a variety of ways to enhance flavour, aroma, and other sensory aspects, such as grilling, roasting, deep frying, microwave oven cooking, normal oven cooking, and boiling (Abdulhameed et al., 2018). Grilling over charcoal is a typical way of preparing meat for consumption at home and in restaurants (Viegas et al., 2022).

By soaking, injecting, or tossing meat in an aqueous solution containing various chemicals, marinating improves the meat's functional and sensory qualities (U-chupaj et al., 2017). One of the still-useful classic culinary seasoning methods is marinating. Generally, it entails immersing meat products in a slurry or solution made up of a variety of substances, most of which are naturally bioactive. These ingredients include vinegar, wine, soy sauce, salt, herbs, and spices (Gutierrez et al., 2019). Different countries and locations use different marinating techniques, which customers and other stakeholders employ to different animal meat products primarily to improve their moistness and sensory qualities as well as to provide tenderness to the texture (Sokolowicz et. al., 2021}. In particular, the bioactive substances included in marinades have antibacterial and antioxidant properties that, when added to animal meat products, improve their overall nutritional value and sensory qualities. Frequently, marinades are used in conjunction with different seasonings to greatly impact the flavour development of animal meat products (Al-Dalali, Li & Xu, 2021).

The fact that alcoholic beverages are consumed by people of all ethnicities worldwide is among the most astounding historical discoveries. For many millennia, alcoholic beverages have been a component of human culture and were served during rites or rituals. It was thought that the gods were responsible for the effects these drinks produced. The consumption of alcoholic beverages was associated with the attributes of their gods, such as fortress, confidence, courage, wisdom, etc. This is the reason why alcohol is viewed as "spiritual drinks" by certain ethnic groups (Buglass et al., 2021). Other characteristics were found and taken into consideration as alcohol effects over time. A number of aches were eased, and food degradation was prevented. Although the goal of using alcoholic beverages in cooking is to enhance flavour, it can also alter food texture.

One popular application is as a sauce ingredient or as a cooking liquid in meat-based meals.

The purpose of this study is to find out how marinating affects white or red meat that has been charcoal grilled. Thus, the study assesses the nutritional value and conducts a comparative analysis of beef marinated in three (3) different alcoholic beverages (beer, wine, and spirit) and chicken marinated on charcoal grill.

The Objectives of the Study is to determine the nutritional qualities of the marinated meat samples,assess the level of acceptability of each of the marinated samples,ascertain the proximate values of the samples and evaluate the sensory qualities of the marinated meat samples.

Methodology

The was study was done at Fedsral Polytechnic, Ilaro, Ogun state,Nigeria at the Department of Hospitality Management and Technology.The Institution was established by Decree 33 of 1979.

Research Population

The study population were the academic staff of Federal Polytechnic, Ilaro, Ogun state who were in food-related department were purposively selected as taste panelists for the samples in the Hospitality Management kitchen.

Sampling size and Techniques

The sample size for this study was fifty taste panelists who were selected through a purposive sampling technique.

Material for the Study and Source

The materials used for the study were purchased locally at *Sayedero market*, that is, the red and white meat, charcoal, wine, beer, spirit, black pepper, Soy sauce, milled ginger and garlic,lemon and others while the majority of the equipment used were sourced from department uf hospitality management and technology kitchen and the few ones remaining were sourced domestically from home. The equipment include grill, tongs, brush, spoon, spatula, mixing bowl, e.t.c.

Method of Preparation

Charcoal Grill Operating Instructions:

The charcoal starter was filled with 1000g/1kg of charcoal and ignited.The charcoal grate was adjusted to the lowest position.Charcoal was dump into the bottom of the charcoal grill on to the grate.The damper was adjusted between 1/4 to 1/3 openAnother 1000g of charcoal was carefully place on the burning charcoal on the charcoal grate.The meat was then place on the cooking grates when the temperature increased to the desired level.

The adjustable charcoal grate in the charcoal grill helps moving in moving the charcoal closer to the cooking grate to help lock in juices. Searing takes only a few minutes on each side. After searing, the charcoal grate was moved to the chamber's bottom and cooking continued.

SAMPLE A - White meat (chicken) marinated with beer

Item & Quantity

Milled pepper	1tablespoon (tbsp)
Salt	1tbsp
Black pepper	1tbsp
Soy sauce	1tbsp
Milled ginger and garlic	1tbsp each
Lemon juice	1tbsp

Procedure:

The meat was washed thoroughly and arranged in a clean bowl. One teaspoonful each of milled pepper, salt, black pepper, soy sauce, lemon juice, milled ginger and garlic was added.

Flowchart for the preparation of charcoal-grilled white meat marinated with beer

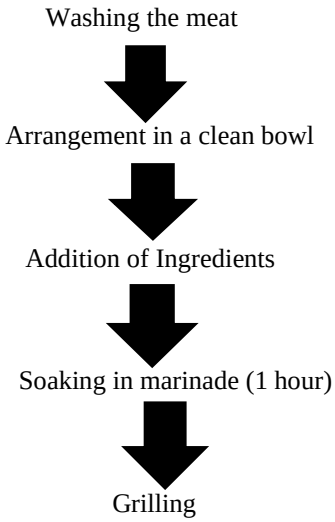


Fig 5: Flowchart for the preparation of charcoal-grilled white meat marinated with beer

SAMPLE B - White meat (chicken) marinated with wine

Item & Quantity

Milled pepper	1tablespoon (tbsp)
Salt	1tbsp
Black pepper	1tbsp
Soy sauce	1tbsp

Milled ginger and garlic	1tbsp each	washed the meat thoroughly and arranged them in a clean bowl, I added 1tbsp each of the milled pepper, salt, black pepper, soy sauce, lemon juice, milled ginger and garlic, I then soaked in wine for an hour. Finally, I grilled in the grill
Lemon juice	1tbsp	

Procedure:

Flowchart for the preparation of charcoal-grilled white meat marinated with wine

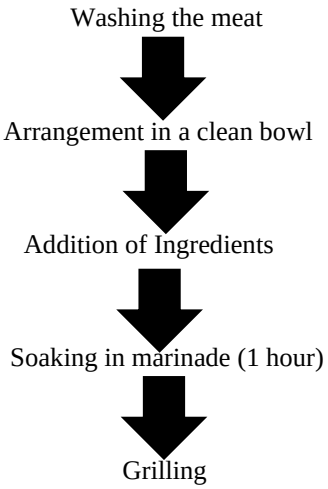


Fig 6: Flowchart for the preparation of charcoal-grilled white meat marinated with wine

SAMPLE C - White meat (chicken) marinated with spirit

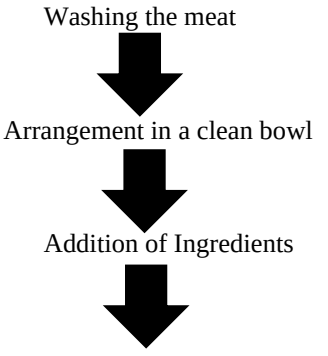
Item & Quantity

Milled pepper	1tbsp
Salt	1tbsp
Black pepper	1tbsp
Soy sauce	1tbsp
Milled ginger and garlic	1tbsp each
Lemon juice	1tbsp

Procedure:

I washed the meat thoroughly, I arranged them in a clean bowl and added 1tbsp each of the milled pepper, salt, black pepper, soy sauce, lemon juice, milled ginger and garlic;I then soaked in spirit for an hour.Finally, I grilled in the grill.

Flowchart for the preparation of charcoal-grilled white meat marinated with spirit



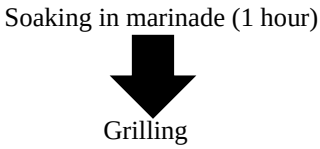


Fig 7: Flowchart for the preparation of charcoal-grilled white meat marinated with spirit

SAMPLE D - Red meat (beef) marinated with beer

Item & Quantity		**Procedure:**
Milled pepper	1tbsp	The meat was thoroughly washed and arranged in a clean bowl,I added 1tbsp each of the milled pepper, salt, blackpepper, Soy sauce, lemon juice, milled ginder and garlic. And the beer was then poured on it to soak it for an hour. Finally, this was grilled in the grill.
Salt	1tbsp	
Black pepper	1tbsp	
Soy sauce	1tbsp	
Milled ginger and garlic	1tbsp each	
Lemon juice	1tbsp	

Flowchart for the preparation of charcoal-grilled red meat marinated with beer

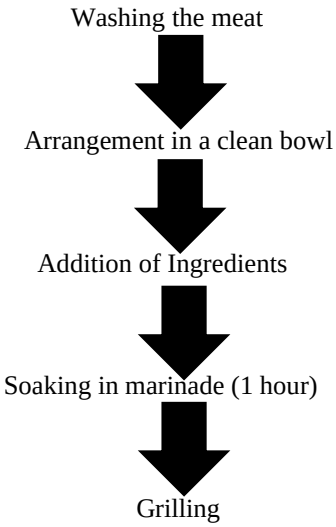


Fig 8: Flowchart for the preparation of charcoal-grilled red meat marinated with beer

SAMPLE E - Red meat (beef) marinated with wine

Item & Quantity		**Procedure:**
Milled pepper	1tbsp	The meat was thoroughly washed and arranged in a clean bowl,I added 1tbsp each of the milled pepper, salt, blackpepper, Soy sauce, lemon juice, milled ginder and garlic. And the wine was then poured on it to soak it for an hour. Finally, this was grilled in the grill.
Salt	1tbsp	
Black pepper	1tbsp	
Soy sauce	1tbsp	
Milled ginger and garlic	1tbsp each	
Lemon juice	1tbsp	

Flowchart for the preparation of charcoal-grilled red meat marinated with wine

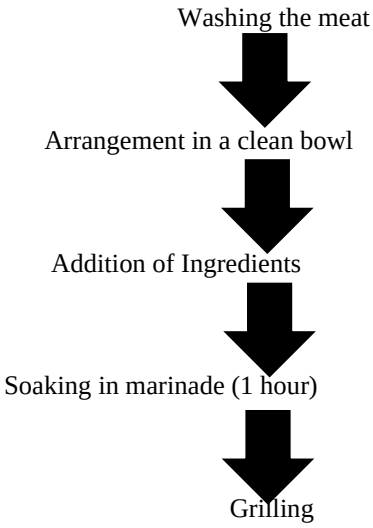


Fig 9: Flowchart for the preparation of charcoal-grilled red meat marinated with wine

SAMPLE F - Red meat (beef) marinated with spirit

Item & Quantity	
Milled pepper	1tbsp
Salt	1tbsp
Black pepper	1tbsp
Soy sauce	1tbsp
Milled ginger and garlic	1tbsp each
Lemon juice	1tbsp

Procedure:

The meat was thoroughly washed and arranged in a clean bowl,I added 1tbsp each of the milled pepper, salt, blackpepper, Soy sauce, lemon juice, milled ginder and garlic.And the spirit was then poured on it to soak it for an hour. Finally, this was grilled in the grill.

Flowchart for the preparation of charcoal-grilled red meat marinated with spirit

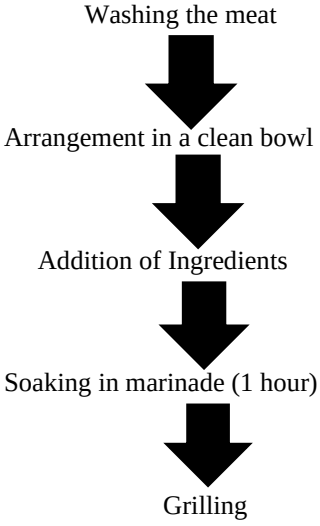


Fig 10: Flowchart for the preparation of charcoal-grilled red meat marinated with spirit

Instrument for Data Collection

The instruments used for this study are sensory evaluation assessment form which was given to the taste panelists after assessing the sensory attributes of the products. The sample's sensory attributes (appearance, crispness, aroma, taste, texture, flavor, crunchiness and overall acceptability) were evaluated using a 9-point hedonic scale, where a score of 1 is "dislike extremely", 2 is "dislike very much", 3 is "dislike moderately", 4 is "dislike slightly", 5 is "neither like nor dislike", 6 is "like slightly", 7 is "like moderately", 8 is "like very much" and a score of 9 is 'like extremely".

The panelists were given a glass of water to rinse their mouth before tasting each samples. The panelists assessed the sensory attributes of the all the meat samples to compare their attributes.

Data Collection Process

The data collected for this study were both primary and secondary data. The primary data was collected by administering the sensory evaluation form to the panelists which was analyzed statistically. The secondary data was obtained from journals, websites and textbooks.

Research Design

The design for this study was a cross-sectional design, as it involved the collection of data at a specific point in time. The study was conducted in a single phase, involving the evaluation of the sensory attributes, nutritional qualities and comparative analysis of charcoal grilled meat marinated with three (3) different alcoholic beverages (beer, wine and spirit). The panelists were selected from the members of academic and non-academic staff of Federal Polytechnic Ilaro, Ilaro, Ogun State, Nigeria. The study focused on assessing the sensory attributes of the charcoal grilled white and red meat samples using the sensory evaluation form and analyzing the nutritional composition through proximate analysis.

Data Analysis Techniques

Data were analyzed using descriptive and inferential analysis and statistical package for social sciences (SPSS) version 23.0 The proximate analysis was carried out using the Analysis of Association of Official Analytical Chemist (2010). The significance differences were determined using the Duncan multiple range test, and level of significance was determined at $p<0.05$.

Proximate Analysis

Proximate analysis was carried out according to the procedure of Association of Official Analytical Chemist for moisture, ash, crude fibre and crude protein content. The carbohydrate was calculated by difference method by subtracting the sum (g/100g dry matter) of crude protein, crude fat, ash and fibre from 100g. The caloric value was determined based on the At water factor.

Carbohydrate was calculated by difference:

$Carbohydrate$ (%) = 100% − ($Protein$ (%) + $Moisture$ (%) + Ash (%) +Fat (%) +$Fibre$ (%))

The energy value was calculated using the formula:

$EnergyValue$ = ($Protein$×4+Fat×9+$Carbohydrate$×4)kcal/100g.

Results and Discussion

Sensory Evaluation of the Marinated Samples

The table 1 below shows the sensory evaluation of meat samples prepared. 50 panelist were used for the research study. A 9-point hedonic scale was designed to measure the degree of preference of the samples. The like scale are Dislike extremely(1), Dislike very much (2), Dislike moderately (3), Dislike slightly (4), Neither like or dislike (5),Like slightly (6), Like moderately (7), Like very much (8),Like extremely (9).

Table1 displays the average panelist responses, along with their corresponding standard deviations, for the appearance, crispness, aroma, texture, taste, flavour, crunchiness, and overall acceptability of the samples.

The samples' mean values range from 7.90 to 8.34, 7.88 to 7.90, 7.56-7.86, 7.60 to 7.66, 7.84 to 7.88, 7.98 to 7.52, 7.90 to 7.74, and 8.04 to 8.18.

The taste panelist found sample A to have the most pleasing appearance (8.34 ± 0.939^{a} mean value), while samples D (7.90 ± 0.974^{b}) and F (7.90 ± 1.074^{b}), both with the same mean value, are the least pleasing.Cooking method affects the color pigments (myoglobin) and appearance, which are directly related to heating time and temperature. This reason agreed with the findings of (Abdulhameed et al., 2018) which says The color of meat degrades at the higher heating temperature.

Regarding crispness, samples C (7.94 ± 1.114^{a}) and D (7.94 ± 1.038^{a}) had the same mean response, suggesting that both samples were highly valued by the taste panelists, while sample E (7.84 ± 1.017^{b}) had the lowest mean response.As chicken fries, liquid evaporates and the breading dehydrates. After that, proteins in the marinade and flour will set and start to brown, giving the crust flavor. The more surface area you have, the crunchier the crust and the more flavorful the bird. (Kenji Lopez-Alt, 2023).

Regarding Aroma, sample B, with a mean value of 7.94 ± 0.956^{b}, was the most favoured by the taste panelists, whereas sample F, with a mean value of 7.56 ± 1.402^{a}, was the least favoured.The chemical process that takes place after primary alcohol fermentation can mitigate the acidity of a wine and add complexity of aromas (Alfred Medolli 2010).

Samples A, B, C, D, E, and F have texture values of 7.66 ± 1.171^{b}, 7.80 ± 1.107^{b}, 7.66 ± 1.255^{b},7.58 ± 0.992^{a}, 7.52 ± 1.111^{a}, and 7.60 ± 1.171^{b}, respectively. Sample B (7.80 ± 1.107^{b}) has the highest value and is the most liked, while sample E (7.52 ± 1.111^{a}) has the lowest value.The texture of meat gets tougher/harder depending upon the heating mechanism and the temperature applied to meat while cooking (Abdulhameed et. al., 2018)

Sample B has the lowest mean value of 7.66 ± 1.062^{b} in terms of taste, while Sample C has the highest mean value of 8.04 ± 1.124^{b} the taste panelists' most and least favourite, respectively. The presence of lactic acid and diacetyl gives wine a full mouthfeel (Tyler Armstrong 2012).

Marinades applied alongside various seasonings will aim to significantly influence the meat product's flavor development (Al-Dalali et al., 2021). All samples have an approximate mean value of 8. Sample E has the lowest mean value (7.44 ± 1.198^{b}), and sample F has the highest (7.98 ± 1.169^{a}).

Sample F (7.90 ± 1.199^{a}) had the highest crunchiness, while sample E (7.30 ± 1.266^{b}) had the lowest.This suggests that sample F was the one that the taste panelists liked the most.Polyunsaturated fatty acids in meats or marinades are very susceptible to temperature induced oxidation which can generate new compounds that could negatively affect the aroma, flavour, crunchiness, and nutritional value of grilled meats. Together with lipid oxidation, Maillard reaction is the most important reaction that affects the sensory characteristics of meat during cooking (Khan et al., 2015). This reaction occurs between the amine group of amino acids and the carbonyl group of sugars. Maillard reaction products generation are well-known important contributors to the pleasant and desirable flavours in cooked or grilled meat (Mottram, 1998).

Descriptive statistics pertaining to overall acceptability reveal that the average mean value of all charcoal-grilled meat samples is approximately 8.Findings from the analysis of the different charcoal grilled meat samples showed that these samples were found to be acceptable since there is no significant difference in the samples with respect to the sensory attributes. In addition, results also indicated that the choice of the samples are highly influenced by appearance, aroma and taste among others as evidence from the perceived sensory characteristics.

Table1: sensory qualities (organoleptic properties) of various samples of charcoal grilled meat prepared

SAMPLE	Appearance	Crispness	Aroma	Texture	Taste	Flavour	Crunchiness	Overall Acceptability
A	8.34±0.939^{a}	7.90±0.909^{a}	7.86±1.069^{a}	7.66±1.171^{b}	7.88±1.223^{b}	7.52±1.418^{b}	7.74±1.275^{a}	8.18±0.941^{a}
B	8.04±0.903^{a}	7.92±0.986^{a}	7.94±0.956^{b}	7.80±1.107^{b}	7.66±1.062^{b}	7.58±1.012^{a}	7.60±1.178^{b}	7.88±1.100^{a}
C	8.10±0.909^{a}	7.94±1.114^{a}	7.82±1.410^{a}	7.66±1.255^{b}	8.04±1.124^{b}	7.80±1.030^{a}	7.76±1.287^{a}	8.06±1.018^{a}
D	7.90±0.974^{b}	7.94±1.038^{a}	7.72±1.051^{b}	7.58±0.992^{a}	7.92±1.275^{a}	7.76±1.080^{b}	7.70±1.182^{a}	7.96±1.068^{a}
E	7.92±1.085^{b}	7.84±1.017^{b}	7.64±1.290^{b}	7.52±1.111^{a}	7.80±1.212^{a}	7.44±1.198^{b}	7.30±1.266^{b}	8.04±0.947^{a}
F	7.90±1.074^{b}	7.88±1.288^{a}	7.56±1.402^{a}	7.60±1.171^{b}	7.84±1.608^{b}	7.98±1.169^{a}	7.90±1.199^{a}	8.04±1.142^{a}
p-value	0.813	0.813	0.813	0.813	0.813	0.813	0.813	0.813

***Source**: Field Survey, 2024*

Values are mean of triplicate± standard deviation

Mean values in the column with superscripts are significantly different from each other at p>0.05

KEYS FOR SAMPLES:

SAMPLE A = White meat (chicken) marinated with beer
SAMPLE B = White meat (chicken) marinated with wine
SAMPLE C = White meat (chicken) marinated with spirit
SAMPLE D = Red meat (beef) marinated with beer
SAMPLE E = Red meat (beef) marinated with wine
SAMPLE F = Red meat (beef) marinated with spirit.

Proximate Properties of the various meat samples

The approximate values of the prepared meat samples are displayed in table2 below. The meat sample's moisture content (%) varied between 54.82 and 55.05. The following content ranges were observed: 45.33–44.93 for dry matter; 28.16–26.78 for fat; 1.21–1.10 for ash; 0.00–0.00 for crude fibre; and 15.96–17.05 for crude protein. Phytate content ranged from 0.615 to 0.591 and carbohydrate content from 0.00 to 0.00. Moisture content of all the samples showed more than (55%) ranging from 55.07-67.11 except sample A which had 54.82%. The highest moisture content was found in sample B (67.11%) and the lowest was found in sample A (54.82%).Marinating meat in red wine can improve its flavour and moisture level. In order to enhance flavour infusion and tenderness, they frequently contain

red wine, olive oil, herbs, and spices (Charles, 2023). White meat can have its shelf life extended by marinating it in beer. This is because the marinade reduces the total live count (TVC) and dry matter content, which can cause grilled meat to spoil.

The study show that the dry matter content was between 45.33%-32.89%. The highest dry matter was in sample A (45.35%) while the lowest dry matter sample was found in sample B (32.89%) which was significantly different among other samples

Fat content in all the samples were varied from each other. Sample A contain the highest fat content (28.16%) and show significance difference among other samples. Meanwhile the lowest is recorded in Sample B(20.90%).Compared to red meat, white meat has less fat when marinated in wine. The grilled red meat sample that had been marinated in wine was found to have a high crude protein content.

Sample A,E and F show the higher level of ash content among other sample with 1.21%, 1.31% and 1.10% respectively. Then followed by Sample C(0.96%)and Sample D (0.93%) while Sample B contained the lowest level of ash content (0.78%) respectively. The ash content refer to the mineral and inorganic left after the food sample has been heated to a very high temperature removing moisture, volatiles and organic (Precisa, 2023)

This study show that the crude protein was between (17.05-11.21%). The highest content of protein was in Sample F (17.05%) while the lowest was in Sample B (11.21%). The protein content varied from each samples and this maybe due to fermentation process, addition of herbs and spices and the effect of temperature during grilling. The protein quality is affected during processing as a result of heat application (Mannoj, 2018)

Beef and chicken that have been grilled have a naturally low carbohydrate content; in fact, some sources claim that they contain none at all. This is because the meat itself doesn't contain any starchy or sugary ingredients. In a similar vein, grilled meat typically has a low fibre content. Lastly, the meat usually loses fibre and carbs during the grilling process. Rather, grilling is the process of applying dry heat to the meat, which lowers its moisture content and forms a delicious crust on the outside of the meat.Therefore, neither carbohydrates nor fibre are present in any of the samples being studied.

The proximate analysis shows that there is no significant difference between the samples with respect to their proximate compositions such as the Moisture content, Dry Matter content, Fat content, Ash content, Crude protein content and Phytate content. However, It was observed that the choice of a sample is been influenced by the high level of moisture content, moderate level of phytate content, moderate level of dry matter content, low level of fat content, low level of ash content, low level of crude protein content, no carbohydrate and fibre content.

Table2: proximate composition of various samples of Charcoal Grilled Meat prepared

SAMPLE	Moisture Content	Dry Matter Content	Fat Content	Ash Content	Crude Fibre Content	Crude Protein Content	Carbohydrate Content	Phytate
A	54.82±0.02^{a}	45.33±0.10^{b}	28.16±0.01^{b}	1.21±0.22^{a}	0.00	15.96±0.10^{a}	0.00	0.615±0.001^{a}
B	67.11±0.01^{b}	32.89±0.22^{b}	20.90±0.01^{b}	0.78±0.01^{b}	0.00	11.21±0.22^{a}	0.00	0.522±0.204^{a}
C	62.04±0.2	37.96±0.1	24.11±0.0	0.96±0.1	0.00	12.83±0.0	0.00	0.682±0.00

	2^b	0^a	2^a	0^b		2^b		1^b
D	62.31±0.02^b	37.69±0.01^b	24.08±0.10^b	0.93±0.01^a	0.00	12.68±0.12^b	0.00	0.688±0.12^b
E	55.02±0.01^b	44.98±0.01^b	26.81±0.01^b	1.13±0.22^a	0.00	17.04±0.01^b	0.00	0.589±0.00^b
F	55.07±0.02^a	44.93±0.22^a	26.78±0.01^b	1.10±0.02^a	0.00	17.05±0.01^b	0.00	0.591±0.12^b
p-value	0.753	0.753	0.753	0.753	0.00	0.753	0.00	0.753

***Source**: Field Survey, 2024*
Values are mean of triplicate± standard deviation
Mean values in the column with superscripts are significantly different from each other at p>0.05

Conclusion

The result of the study revealed the sensory qualities and proximate composition of charcoal grilled meat (both white and red) with respect to the type of marinade used. This study serves as a preliminary investigation on and confirmed how different types of marinades influence the sensory properties and proximate composition of charcoal grilled meat, and the impact made depending on the type of meat (either white or red meat). This study also establish that the choice of marinade is dependent on individual preference as all marinades used in this research were all good choices. In this research, wine marinade tends to be more effective at enhancing sensory qualities and proximate composition of white meat than red meat while both beer and spirit marinades are more effective at enhancing sensory qualities and proximate composition of red meat.

The sensory evaluation and proximate composition results analyzed showed a non-significant difference between the charcoal grilled meat marinated with beer, wine and spirit with respect to the type of meat used (white or red).

The type of marinade used (beer, wine and spirit) has an impact on the sensory qualities (appearance, crispness, aroma, taste, texture, crunchiness etc.) and proximate composition (moisture content, dry matter content, fat content, ash content, crude protein content) of the charcoal grilled meat, therefore, the hypothesis which says that "there is no significant relationship between alcoholic beverages (beer, wine and spirit) used as a marinade and both the sensory qualities and proximate composition of the charcoal grilled meat" was rejected.

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