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The Comparative Studies of the Phytochemical and Physico-Chemical Analyses of Aqueous and Methanol Extracts of Yellow and White Maize (*Zea Mays*) for Industrial Use

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ABSTRACT

Maize (Zea mays L.) is an important annual cereal crop belonging to the family Poaceae, it is an ancient Greek word which means ‘’Sustaining life’’. and Mays is a word from Taino language meaning “life giver”. Maize was the main staple food of people worldwide for many centuries. This study analyzed the phyto-chemicals (both quantitative and qualitative) and physico-chemical parameters present in aqueous and methanolic extract of yellow and white maize. The results for phytochemicals (quantitative) analysis in distilled water extract of yellow and white maize showed that yellow maize had highest percentage value of alkaloid(0.236 ± 0.002%) and white maize had (0.191 ± 0.002%), while in Methanolic extract, yellow maize also had highest percentage of alkaloid (0.341 ± 0.002%) and (0.312 ± 0.001%) for white maize. The result of physico-chemical properties of distilled water extract showed that yellow maize extract had highest value of total solid (1.440 ± 0.010%) and white maize (3.265 ± 0.015). In methanolic extract, yellow maize extract had highest value of total solid (4.330 ± 0.010) while the white maize was (3.265 ± 0.015). In conclusion, almost all the parameters of phytochemicals and physico-chemical analysis done in yellow maize extract are higher than that of white maize in distilled water and methanolic extract, yellow maize contain carotenoids(yellow colour) while white maize does not contain carotenoids, therefore yellow maize is more nutritious and more presentable (colour) than white maize.

Keywords: Phytochemicals, Physico-chemical, Analyses, Extract, Maize

INTRODUCTION

Maize or corn (Zea mays L.) is an important annual cereal crop of the world belonging to family Poaceae.. (Galinat, 2007). According to FAO (2016a), 885.3 million tons were produced in 2011. The main producer was the United States with 313.9 million tons, accounting for 35.5% of world production (Hamel and Dorff, 2016). Maize is the main staple food of people in developing countries, especially African populations (Grah *et al*., 2014). This food product is consumed by not less than 50% of the sub-Saharan populations and therefore represents the most important cereal crop in this part of the world (Grah *et al*., 2014). However, maize production remains very low in Cameroon, with about 700,000 families, artisanal and modern farms producing about 1.1 tons per farmer and a national consumption of 700,000 tons; maize is therefore the third foodstuff produced in Cameroon after cassava and plantain. It also contributes more than 150 billion FCFA to the gross domestic product (GDP).

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Most of the world's people affected by hunger and extreme poverty live in rural areas. According to FAO (2016b), achieving the Sustainable Development Goals (SDGS) requires moving to more productive and sustainable agriculture where everyone has a place, which strengthens rural livelihoods and ensures security for all while drawing less on natural resources and improving resilience to climate change. According to the New Partnership for Africa's Development (2015), maize is thus a potential source for improving food security and raising incomes for producers. Concerning the consumption and use of maize, the Conference of Ministers of Agriculture of West and Central Africa (2015) states that most of the produced corn is used for animal feed. It also shows that total maize uses are estimated at 583 million tons divided between human consumption (20%), animal consumption (67%) and other uses (13%), Several products are carried and preserved as flours, because they are susceptible to attack by pests of cereals. Their role in the feed and in the food industry is very important (Nip, 2010).A number of maize types exist on the basis of endosperm, color and kernel compositio, they are; Sweet Maize, pod maize, flour maize and dent maize (Purseglove J.W (2012); Paliwal R.L., *et al.* (2010); Darrah L., *et al.* (2013)).

MATERIALS AND METHOD

Yellow Maize, White Maize, Distilled Water and Methanol.

Collection of Sample

Maize was purchased from Bodija market, Ibadan, Oyo State, Nigeria.

RESULTS AND DISCUSSION

Table 1: Qualitative Phytochemicals Constituents of Distilled Water Extract of Yellow and White Maize.

PHYTOCHEMICAL CONSTITUENTS	DISTILLED WATER YELLOW MAIZE EXTRACT	DISTILLED WATER WHITE MAIZE EXTRACT
ALKALOIDS	+++	++
TANNIN	++	+
PHLOBOTANNIN	+	+
SAPONIN	+++	+++
FLAVONOIDS	-	-
ANTHRAQUINONES	++	++
STEROIDS	+	-
TERPENE	-	-
CARDENOLIDES	-	-
PHENOL	+++	+++
CHALCONE	-	-
CARDIAC GLYCOSIDE	+++	+++

Keys:

+++ = Present in an appreciable amount

++= Present in a moderate amount

+= Present in a trace amount

+= Completely absent

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Table 2: Quantitative phytochemical constituents of methanolic yellow maize Extract and Methanolic White Maize Extract.

Phytochemical Result on Methanolic Extract

PHYTOCHEMICAL CONSTITUENTS	METHANOLIC YELLOW MAIZE EXTRACT	METHANOLIC WHITE MAIZE EXTRACT
ALKALOIDS	+++	+++
TANNIN	+++	++
PHLOBOTANNIN	++	+
SAPONIN	+++	+++
FLAVONOIDS	+++	++
ANTHRAQUINONES	+++	+
STEROIDS	++	+
TERPENE	++	+
CARDENOLIDES	+	-
PHENOL	+++	+++
CHALCONE	+	+
CARDIAC GLYCOSIDE	+++	++

Keys:

+++ = Present in an appreciable amount

++ = Present in a moderate amount

+ = Present in a trace amount

- = Completely absent

Table 3: Qualitative Phytochemicals Constituents of Distilled Water Yellow Maize Extract and Distilled Water White Maize Extract.

PHYTOCHEMICAL CONSTITUENTS	**DISTILLED WATER YELLOW MAIZE EXTRACT**	**DISTILLED WATER WHITE MAIZE EXTRACT**
ALKALOIDS%	0.236 ± 0.002	0.191 ± 0.002
TANNIN%	0.002 ± 0.000	0.002 ± 0.000
PHLOBOTANNIN%	0.001 ± 0.000	0.001 ± 0.000
SAPONIN%	0.120 ± 0.002	0.108 ± 0.001
FLAVONOIDS%	0.000 ± 0.000	0.000 ± 0.000
ANTHRAQUINONES%	0.006 ± 0.000	0.004 ± 0.000
STEROIDS%	0.002 ± 0.000	0.000 ± 0.000
TERPENE%	0.000 ± 0.000	0.000 ± 0.000
CARDENOLIDES%	0.000 ± 0.000	0.000 ± 0.000
PHENOL%	0.158 ± 0.001	0.125 ± 0.002
CHALCONE%	0.000 ± 0.000	0.000 ± 0.000
CARDIAC GLYCOSIDE%	0.010 ± 0.001	0.088 ± 0.001

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Table 4: Qualitative Phytochemicals Constituents of Methanolic Yellow Maize Extract and Methanolic White Maize Extract.

PHYTOCHEMICAL CONSTITUENTS	METHANOLIC YELLOW MAIZE EXTRACT	METHANOLIC WHITE MAIZE EXTRACT
ALKALOIDS%	0.341 ± 0.002	0.312 ± 0.001
TANNIN%	0.027 ± 0.001	0.021 ± 0.002
PHLOBOTANNIN%	0.016 ± 0.001	0.010 ± 0.002
SAPONIN%	0.228 ± 0.001	0.216 ± 0.002
FLAVONOIDS%	0.008 ± 0.000	0.006 ± 0.000
ANTHRAQUINONES%	0.010 ± 0.000	0.007 ± 0.000
STEROIDS%	0.003 ± 0.001	0.002 ± 0.000
TERPENE%	0.002 ± 0.000	0.001 ± 0.000
CARDENOLIDES%	0.001 ± 0.000	0.000 ± 0.000
PHENOL%	0.259 ± 0.002	0.239 ± 0.002
CHALCONE%	0.002 ± 0.000	0.002 ± 0.000
CARDIAC GLYCOSIDE%	0.146 ± 0.001	0.136 ± 0.002

Table 5: Physiochemical Constituents of Distilled Water Yellow Maize Extract and Distilled Water White Maize Extract.

PHYSICOCHEMICAL CONSTITUENTS	DISTILLED WATER YELLOW MAIZE EXTRACT	DISTILLED WATER WHITE MAIZE EXTRACT
pH%	5.050 ± 0.050	5.900 ± 0.100
PROTEIN%	0.862 ± 0.006	0.684 ± 0.006
FAT%	0.007 ± 0.000	0.005 ± 0.000
FIBRE%	0.001 ± 0.000	0.002 ± 0.000
ASH%	0.012 ± 0.001	0.029 ± 0.001
MOISTURE%	98.560 ± 0.010	98.800 ± 0.020
TOTAL SOLID%	1.440 ± 0.010	1.200 ± 0.020
TTA%	0.313 ± 0.002	0.292 ± 0.001

Table 6: Physicochemical Constituents of Methanolic Yellow Maize Extract and Methanolic White Maize Extract.

PHYSICOCHEMICAL CONSTITUENTS	METHANOLIC YELLOW MAIZE EXTRACT	METHANOLIC WHITE MAIZE EXTRACT
pH%	4.300 ± 0.000	5.500 ± 0.000
PROTEIN%	2.383 ± 0.007	1.583 ± 0.006
FAT%	0.025 ± 0.000	0.018 ± 0.000
FIBRE%	0.001 ± 0.000	0.001 ± 0.001
ASH%	0.019 ± 0.001	0.022 ± 0.001
MOISTURE%	95.670 ± 0.010	96.735 ± 0.015
TOTAL SOLID%	4.330 ± 0.010	3.265 ± 0.015
TTA%	0.431 ± 0.003	0.387 ± 0.002

DISCUSSION

Table 1: showed the presence of alkaloids, tannins, phlobatannin, anthraquinones, steroids, in both yellow and white maize extract while flavonoid, terpenes, cardenolide and chaleones were absent in both yellow and white maize extract while **Table 2**: revealed the presence of alkaloids, tannins, phlobatannins, saponin, flavonoids, anthraquinones, steroid, terpenes, cardenolides, phenol, chalcones and cardiac glycosides in the yellow and white maize extract while only cardenolides is absent in only white maize extracts.**Table 3**: showed the amount of each phytochemical present in yellow maize and white maize of distilled water and methanolic

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extract.The quantity of phytochemicals present in distilled water yellow maize extract is as follows: 0.236 ± 0.002% alkaloid, 0.002 ± 0.000% tannin, 0.001 ± 0.000% phlobatannin, 0.120 ± 0.002% Saponin, 0.006 ± 0.000% anthraquinone, 0.001 ± 0.000% steroid, 0.158 ± 0.001% phenol, 0.104 ± 0.001% cardiac glycoside.The amount of each phytochemicals present in distilled water white maize extract is as follows: 0.191 ± 0.002% alkaloid, 0.002 ± 0.000% tannin, 0.001 ± 0.000% Phlobatannin, 0.108 ± 0.001% Saponin, 0.004 ± 0.000% Anthraquinone, 0.001 ± 0.000% steroid 0.125 ± 0.002% phenol, 0.088 ± 0.001% Cardiac glycoside.The amount of each phytochemicals present in methanolic yellow maize extract is as follows: 0.341 ± 0.002% alkaloid, 0.027 ± 0.001% tannins, 0.016 ± 0.001% phlobatannin, 0.228 ± 0.001% saponin, 0.008 ± 0.000% flavonoid, 0.010 ± 0.002% anthraquinone, 0.003 ± 0.001% steroid, 0.002 ± 0.000% terpenes, 0.001 ± 0.000% cardenolides, 0.239 ± 0.002% phenol, 0.002 ± 0.000% chalcones, 0.146 ± 0.001% cardiac glycoside.The amount of each phytochemicals present in methanolic white maize extract is as follows: 0.312 ± 0.001% alkaloid, 0.021 ± 0.002% tannins, 0.010 ± 0.002% phlobatannin, 0.216 ± 0.002% saponin, 0.006 ± 0.002% flavonoid, 0.007 ± 0.000% anthraquinone, 0.002 ± 0.000% steroid, 0.002 ± 0.000% terpenes, 0.001 ± 0.000% cardenolides, 0.239 ± 0.002% phenol, 0.002 ± 0.000% chalcones, 0.136 ± 0.002% cardiac glycoside.The distilled water yellow maize extract recorded the highest percentage of alkaloids which is 0.236 ± 0.002% while distilled water white maize extract recorded the least which is 0.191 ± 0.002%. This implies that yellow maize is a good source of alkaloid in distilled water than white maize.

The distilled water white maize extract and distilled water yellow maize extract has the same percentages of tannin which is 0.002 ± 0.000%. The distilled water yellow maize extracts and distilled water white maize extract has the same percentage of phlobatannin which is 0.001 ± 0.000%.The distilled water yellow maize extract recorded the highest percentage of saponin which is 0.120 ± 0.002% while distilled water white maize extract recorded the least which is 0.108 ± 0.001%. This implies that yellow maize is a better source of saponin in distilled water than white maize.Flavonoid content is absent in both distilled water yellow maize extract and distilled water white maize extract.Anthraquinone content in distilled water yellow maize extract which is 0.006 ± 0.000% is higher than the anthraquinone content in distilled water white maize extract which is 0.004 ± 0.000%.Steroid is present in distilled water yellow maize extract and the percentage is 0.001 ± 0.000% but absent in distilled water white maize extract.Terpenes content is absent in both distilled water yellow maize extract and distilled water white maize extract.Cardenolides content is absent in both distilled water yellow maize extract and distilled white maize extract.Phenol content in distilled water yellow maize extract which is 0.158 ± 0.001% is higher than the phenol content in distilled water white maize extract which is 0.125 ± 0.002%.Chalcones content is absent in both distilled water yellow maize extract and distilled water white maize extract.Cardiac glycosides content in distilled water yellow maize extract which is 0.104 ± 0.001% is higher than the cardiac glycosides content in distilled water white maize extract which is 0.088 ± 0.001%.

Table 4: shows that various phytochemical present in methanolic yellow maize extract and methanolic white maize extract.Alkaloid content in methanolic yellow maize extract which is 0.341 ± 0.002% is higher than the alkaloid content in methanolic white maize extract which is 0.312 ± 0.001%.Tannin content in methanolic yellow maize extract which is 0.027 ± 0.001% is higher than the tannin content in methanolic white maize extract which is 0.021 ± 0.002%.Phlobatannin content in methanolic yellow maize extract which is 0.016 ± 0.001% is higher than the phlobatannin content in methanolic white maize extract which is 0.010 ± 0.002%.Saponin content in methanolic yellow maize extract which is 0.228 ± 0.001% is higher than the saponin content in methanolic white maize extract which is 0.216 ± 0.002%.

Flavonoid content in methanolic yellow maize extract which is 0.008 ± 0.000% is higher than the flavonoid content in methanolic white maize extract which is 0.006 ± 0.002%.Anthraquinone content in methanolic yellow maize extract which is 0.010 ± 0.002% is higher than the anthraquinone content in methanolic white maize extract which is 0.007 ± 0.000%.Steroid content in methanolic yellow maize extract which is 0.003 ± 0.001% is higher than the steroid content in methanolic white maize extract which is 0.002 ± 0.000%.

Terpenes content in methanolic yellow maize extract and methanolic white maize extract is the same percentage which is 0.002 ± 0.000%.Cardenolide is present in methanolic yellow maize extract and the percentage is 0.001 ± 0.000% but absent in methanolic white maize extract.Phenol content in methanolic yellow maize extract which is 0.259 ± 0.002% is higher than the phenol content in methanolic white maize extract which is 0.239 ± 0.002%.

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Chalcones content in methanolic yellow maize extract and methanolic white maize extract is the same percentage which is 0.002 ± 0.000%.Cardiac glycoside content in methanolic yellow maize extract which is 0.146 ± 0.001% is higher than the cardiac glycoside content in methanolic white maize extract which is 0.136 ± 0.002%.

Table 5: This result shows the various physicochemical present in distilled water of yellow maize extract and white maize extract.The pH content of distilled water white maize extract which percentage is 5.900 ± 0.100% is higher than the distilled water yellow maize extract which percentage is 5.050 ± 0.050%.Protein content of distilled water yellow maize extract in percentage of 0.862 ± 0.006% is higher than the distilled water white maize extract which is 0.684 ± 0.006%.

Fat content of distilled water yellow maize extract in percentage of 0.007 ± 0.000% is higher than the distilled water white maize extract which is 0.005 ± 0.000%.Fibre content of distilled water white maize extract which percentage is 0.002 ± 0.000% is higher than the distilled water yellow maize extract which is 0.001 ± 0.000%.Ash content of distilled water white maize extract which percentage is 0.029 ± 0.001% is higher than the distilled water yellow maize extract which is 0.012 ± 0.001%.Moisture content of distilled water white maize extract which is 98.800 ± 0.020% is higher than the distilled water yellow maize extract which is 98.500 ± 0.010%.Total solid content of distilled water yellow maize extract which percentage is 1.440 ± 0.010% is higher than the distilled water white maize extract which is 1.200 ± 0.020%.TTA content of distilled water yellow maize extract which percentage is 0.313 ± 0.002% is higher than the distilled water white maize extract which is 0.292 ± 0.001%.This result shows the various physicochemical present in methanolic yellow maize extract and white maize extract.Methanolic white maize extract has the highest pH which is 5.500 ± 0.000% while the pH of methanolic yellow maize extract is low which is 4.300 ± 0.000%.The protein content in methanolic yellow maize extract which is 2.383+0.007% is higher than the protein content in white maize extract which is 1.583 ± 0.000%.There is a slight difference in the fat content of methanolic white maize extract which is 0.018 ± 0.000% and methanolic yellow maize extract which is 0.025 ± 0.000%.The fibre content of methanolic vellow maize extract and methanolic white maize extract is the same which is 0.001 ± 0.000%.The ash content of methanolic yellow maize extract is slightly different from methanolic white maize extract which are 0.019 ± 0.001% and 0.022 ± 0.001%.The moisture of white maize extract which is 96.734 ± 0.015% is higher than the moisture content of yellow maize extract which is 95.670 ± 0.010%.The total solid of yellow maize extract which is 4.330 ± 0.010% is higher than white maize extract which is 3.265 ± 0.016%.There is a slight difference in the TTA of methanolic yellow maize extract which is 0.431 ± 0.003% while the TTA of methanolic white maize extract is 0.387 ± 0.002%.

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