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QUALITY CHARACTERIZATION OF BREAD RETAILED IN NAIROBI COUNTY, KENYA: PHYSICO-CHEMICAL AND MICROBIAL PROFILES

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Abdirizack Aftin Hussein

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ABSTRACT

Key words

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INTRODUCTION

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MATERIALS AND METHODS

Sample collection

Analytical methods

Determination of moisture content

Determination of crude fibre

Determination of protein content

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Determination of crude fat content

Determination of crude ash content

Determination of carbohydrate content

$$100 - (moisture\ content\ \% + crude\ ash\ \% + crude\ fat\ \% + crude\ protein\ \% + crude\ fibre\ \%)$$

Determination of water activity

Determination of acid insoluble ash

°

Determination of pH of aqueous extract

Analysis of Yeast and Moulds

Data analysis

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RESULTS AND DISCUSSION

Comparative evaluation of physio-chemical quality of brown and white breads in urban supermarkets

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Cluster of bread sold in urban supermarkets based on physico-chemical attributes Error! Reference source not found.

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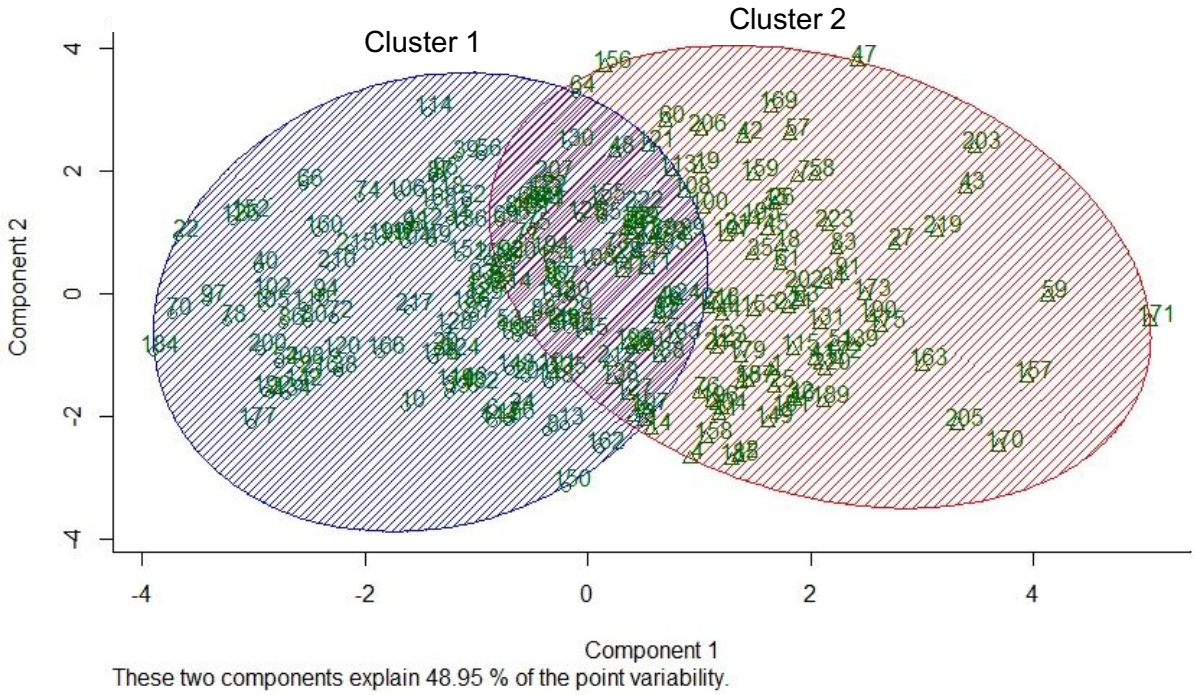

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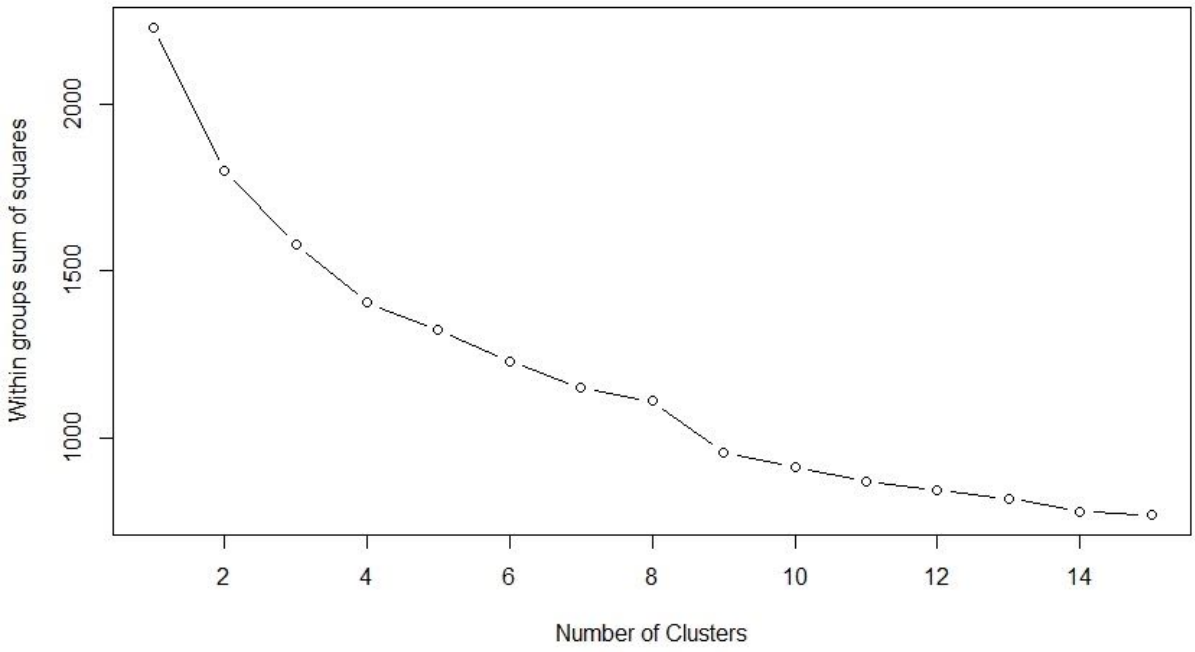

Figure 1: WSS plot for K means clusters for bread sold in Nairobi Kenya

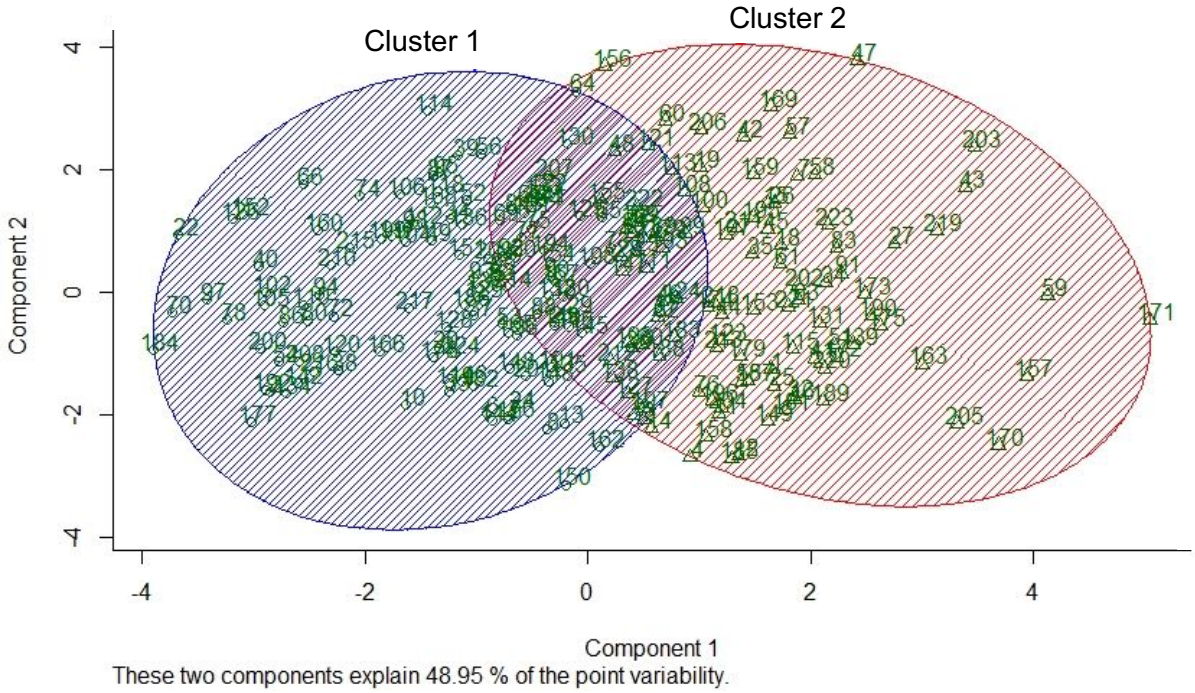

Figure 2: K means clustering of physico-chemical attributes of bread traded in urban supermarkets

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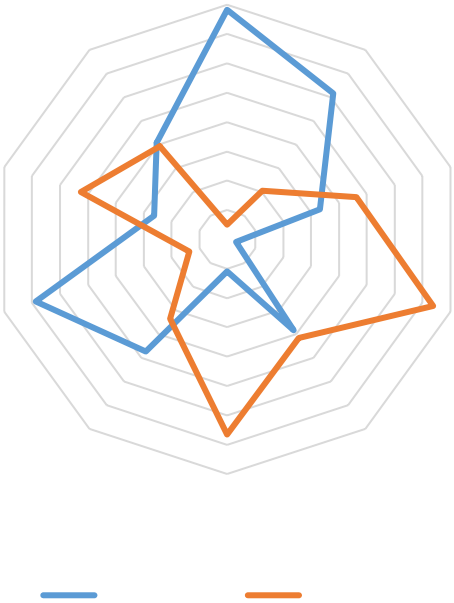

Figure 3: Physico-chemical characterization of bread retailed in the urban county of Nairobi

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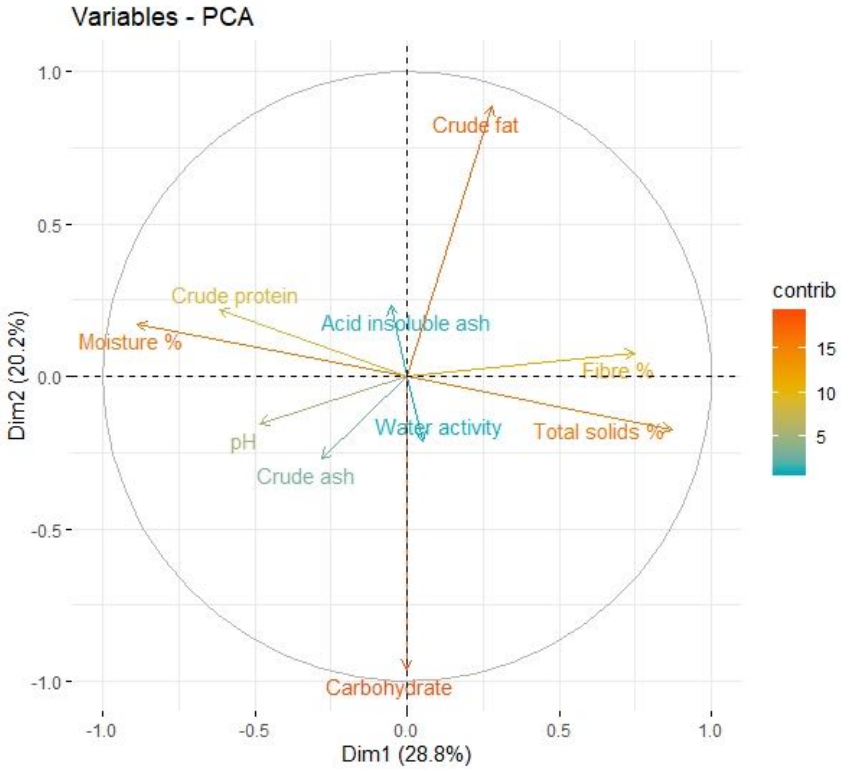

Figure 4: Principle component analysis of physico-chemical attributes of bread retailed in the urban county of Nairobi

CONCLUSION

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Conflict of Interest

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Table 1: Nutritional quality of bread in urban supermarkets

Type of bread	Moisture (%)	Total solids (%)	Crude protein (%)	Crude fat (%)	Crude fibre (%)	Crude ash (%)	Carbohydrate	Acid insoluble ash (%)
Brown	32.44±2.35a	67.02±2.39b	13.6±1.61a	7.42±3.20a	0.65±0.17b	0.68±0.29a	77.53±3.41a	0.47±0.33a
White	30.34±2.63b	68.95±2.64a	13.1±1.59b	7.53±3.56a	0.72±0.19a	0.69±0.28a	77.83±3.41a	0.36±0.25a
CV %	8.42	3.96	12.1	45.1	22.33	0.94	4.39	82.04
MSD	0.55	0.66	0.42	0.89	0.04	0.07	0.89	0.22
p-value	<0.001	<0.001	0.008	0.808	<0.001	43.1	0.483	0.343

The values are mean ± sd of all the samples analyzed in duplicates. All the variables in dry weight basis except for moisture and total solids. MSD-minimum significant difference

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Table 2: Physical and microbial quality of bread in urban supermarkets

Type	Water activity*	pH	Yeast and moulds log cfu/g
Brown bread	0.87±0.16b	5.66±0.18a	nd
White bread	0.72±0.16a	5.64±0.18a	nd
CV %	13.91	3.26	na
MSD	0.07	0.05	
p-value	<0.001	0.462	na

*Significant at p<0.01. nd-not detected, na-not applicable. The values are mean ± sd of all the 56 samples analyzed in duplicates. MSD-minimum significant difference

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Table 3: Loading of individual observations of variables into clusters

Variables		Cluster 1 (Proportion %)	Cluster 2 (Proportion %)
Supermarket chain	Supermarket chain 1	56 (50.0)	56 (50.0)
	Supermarket chain 2	6 (37.5)	10 (62.5)
	Supermarket chain 3	19 (39.6)	29 (60.4)
	Supermarket chain 4	26 (54.2)	22 (45.8)
Brand	Brand 1	14 (50.0)	14 (50.0)
	Brand 2	20 (71.4)	8 (28.6)
	Brand 3	3 (50.0)	3 (50.0)
	Brand 4	2 (50.0)	2 (50.0)
	Brand 5	2 (100.0)	0 (0.0)
	Brand 6	2 (7.1)	26 (92.9)
	Brand 7	10 (35.7)	18 (64.3)
	Brand 8	1 (100.0)	0 (0.0)
	Brand 9	1 (100.0)	0 (0.0)
	Brand 10	1 (14.3)	6 (85.7)
	Brand 11	4 (57.1)	3 (42.9)
	Brand 12	19 (67.90	9 (32.1)
	Brand 13	24 (85.70	4 (14.3)
	Brand 14	3 (21.4)	11 (78.6)
	Brand 15	11 (78.6)	3 (21.4)
Individual supermarket lines	Supermarket line 1	3 (18.8)	13 (81.3)
	Supermarket line 2	8 (50.0)	8 (50.0)
	Supermarket line 3	8 (50.0)	8 (50.0)
	Supermarket line 4	6 (37.5)	10 (62.5)
	Supermarket line 5	9 (56.3)	7 (43.8)
	Supermarket line 6	8 (50.0)	8 (50.0)
	Supermarket line 7	9 (56.3)	7 (43.8)
	Supermarket line 8	10 (62.5)	6 (37.5)
	Supermarket line 9	11 (68.8)	5 (31.3)
	Supermarket line 10	10 (62.5)	6 (37.5)
	Supermarket line 11	9 (56.3)	7 (43.8)
	Supermarket line 12	4 (25.0)	12 (75.0)
	Supermarket line 13	4 (25.0)	12 (75.0)
	Supermarket line 14	8 (50.0)	8 (50.0)

REFERENCES

1. **Mason NM, Jayne TS and B Shiferaw** Africa's rising demand for wheat: Trends, drivers, and policy implications. Dev Policy Rev. 2015; **33(5)**:581–613.

2. **Ijah UJJ, Auta HS, Aduloju MO and SA Aransiola** Microbiological, nutritional, and sensory quality of bread produced from wheat and potato flour blends. Int J Food Sci. 2014.

3. **Leyvraz M, Mizéhoun-Adissoda C, Houinato D, Baldé NM, Damasceno A, Viswanathan B, Amyunzu-Nyamongo M, Owuor J, Chiolero A and P Bovet** Food consumption, knowledge, attitudes, and practices related to salt in urban areas in five sub-Saharan African countries. Nutrients. 2018; **10(8)**.

4. **Ruel MT, Garrett JL, Hawkes C and MJ Cohen** The food, fuel, and financial crises affect the urban and rural poor disproportionately: A review of the evidence. J Nutr. 2010; **140(1)**:170S–176S.

5. **Mason N, Jayne TS, Donovan C and A Chapoto** Are staple foods becoming more expensive for urban consumers in eastern and southern Africa? Trends in food prices, marketing margins, and wage rates in Kenya, Malawi, Mozambique, and Zambia. MSU International Development Working. 2009.

6. **Owade JO, Abong GO and MW Okoth** Production, utilization and nutritional benefits of Orange Fleshed Sweetpotato (OFSP) puree bread : A review. Curr Res Nutr Food Sci. 2018; **06(3)**:1–12.

7. **Wanjuu C, Abong G, Mbogo D, Heck S, Low J and T Muzhingi** The physiochemical properties and shelf-life of orange-fleshed sweet potato puree composite bread. Food Sci Nutr. 2018;(February):1555–63.

8. **Owade JO, Abong GO, Okoth MW, Heck S, Low J and T Muzhingi** Physiochemical characteristics of orange fleshed sweetpotato (Ipomoea batatas) shelf-storable puree composite bread. Acta Hortic. 2019; **1251**:189–98.

9. **Ayele HH, Bultosa G, Abera T and T Astatkie** Nutritional and sensory quality of wheat bread supplemented with cassava and soybean flours. Cogent Food Agric [Internet]. 2017; **3(1)**. Available from: http://doi.org/10.1080/23311932.2017.1331892

10. **Ayele HH, Bultosa G, Abera T and T Astatkie** Nutritional and sensory quality of wheat bread supplemented with cassava and soybean flours. Cogent Food Agric [Internet]. 2017; **14(1)**:1–13. Available from: http://doi.org/10.1080/23311932.2017.1331892

11. **East African Community.** East African standard: Bread- Specification. DEAS 43:20129. 2012.

12. **KEBS.** Kenya standard bread — Specification. KS EAS 43: 2012. KEBS 2012; 2012.

13. **KEBS.** Sweetpotato bread - specification. DKS2859: 2018. Kenya Bureau of Standards — Secretariat; 2018.

14. **AOAC.** Official methods of analysis, Association of official analytical chemist. 19th Editi. Washington D.C., USA; 2012.

15. **R Core Team (2019).** R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2019. 1-4 p.

16. **Grafenauer S and F Curtain** An audit of Australian bread with a focus on loaf breads and whole grain. Nutrients. 2018;**10(8)**.

17. **Ali A, Al-Nassri HAS, Al-Rasasi B, Akhtar MS and BS Al-Belushi** Glycemic index and chemical composition of traditional omani breads. Int J Food Prop. 2010; **13(1)**:198–208.

18. **Mano F, Ikeda K, Joo E, Fujita Y, Yamane S, Harada N and N Inagaki** The effect of white rice and white bread as staple foods on gut microbiota and host metabolism. Nutrients. 2018;10(9).

19. **Almeida EL, Chang YK and CJ Steel** Dietary fibre sources in bread: Influence on technological quality. LWT - Food Sci Technol [Internet]. 2013; **50(2)**:545–53. Available from: http://dx.doi.org/10.1016/j.lwt.2012.08.012

20. **Owade JO, Abong GO, Okoth MW, Heck S, Low J, Mbogo D, Malavi D and T Muzhingi** Sensory attributes of composite breads from shelf storable orange-fleshed sweetpotato puree. Open Agric. 2018; **3**:459–65.

21. **Jakubczyk E, Marzec A and P Lewicki** Relationship Between Water Activity of Crisp Bread and Its Mechanical Properties and Structure. Polish J food Nutr Sci. 2008; **58(1)**:45–51.

22. **Kim D, Kim B, Yun E, Kim J, Chae Y and S Park** Statistical quality control of total ash, acid-insoluble ash, loss on drying, and hazardous heavy metals contained in the component medicinal herbs of “ssanghwatang”, a widely used oriental formula in Korea. J Nat Med. 2013; **67(1)**:27–35.

23. **Rowan AM, Moughan PJ and MN Wilson** Acid-insoluble ash as a marker compound for use in digestibility studies with humans. J Sci Food Agric. 1991; **54(2)**:269–74.

24. **Owade JO** Physico-chemical characteristics, sensory profile and shelf-stability of bread incorporating shelf-storable orange fleshed sweetpotato puree. University of Nairobi; 2018.

25. **Scheuer PM, Mattioni B, Barreto PLM, Montenegro FM, Gomes-Ruffi CR, Biondi S**, **Kilpp M** and **A de Francisco** Effects of fat replacement on properties of whole wheat bread. Brazilian J Pharm Sci. 2014; **50(4)**:703–12.

26. **Downey AG** Proximate analysis of a selection of brown breads commercially produced in the Republic of Ireland. Irish J Food Sci Technol. 2018; **12(1)**:13–23.

27. **Owade JO, Abong GO and MW Okoth** Production, utilization and nutritional benefits of orangfleshed sweetpotato (OFSP) puree bread: A review. Curr Res Nutr Food Sci. 2018; **6(3)**.

28. **Van Jaarsveld PJ, Faber M and ME Van Stuijvenberg** Vitamin A, iron, and zinc content of fortified maize meal and bread at the household level in 4 areas of South Africa. Food Nutr Bull. 2015; **36(3)**:315–26.

29. **Olusegun TA, Olufemi OA, Olaniran O, Olusola A, Bolade KO and O Oluwatoyosi** Safety of bread for human consumption in an urban community in Southwestern Nigeria. African J Food Sci. 2015; **9(5)**:272–7.

30. **Ezenyi CB** Assessment of bread safety in Nigeria: One decade after the ban on the use of potassium bromate. J Food Process Technol. 2014; **06(01)**:1–4.