Assessment of Nutrient Content of Soy Bean and Bambara Nut Enriched Cassava Flour Blends

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ABSTRACT

The purpose of this work is to improve the nutrient content of cassava flour by the addition of soy bean and bambara nut flours and to assess its impact on the nutrient quality and admissibility of the flour. It also compared the nutrient content of soy bean enhanced cassava flour with the bambara nut enhanced cassava flour. *20% soybean (Sy20), 30% soy bean (Sy30),20% bambara nut (Bn20) and 30% Bambara (Bn30)* flours were incorporated into the cassava blend. Moisture, Ash, crude fibre, crude lipid, protein, carbohydrate, calcium, iron, potassium, magnesium, sodium, selenium, zinc and iodine concentrations were examined. 500 questionnaires were distributed to examine respondent's acceptability of the enhance products from the blend. There is a significant increase in the protein content of cassava from less than 1% without augmentation to 10.26 in SY20 and 12.76 in SY30 augmented cassava floor respectively. The crude lipids, crude fibre and ash contents were also increased. The observed differences were significant ($P < 0.05$). A similar trend was observe with both the BN20, BN30 though the nutrient content was higher in the SY blends. 98% of respondents positively accepted the enhanced blends in terms of flavour, texture, taste and colour.

Keywords: Enhancement, incorporated, nutrients, flour, blend, admissibility.

INTRODUCTION

Manihot esculenta, commonly called cassava, manioc, or yuca, is a perennial woody shrub with an edible root of the spurge family, *Euphorbiaceae*, native to South America and cultivated in tropical and subtropical areas of the world (Shackelford et al., 2018;Otekunrin et al., 2021). It has become the staple diet that supports the livelihood of over 300 million people living in Africa and the diaspora (Lividini & Fiedler,2015; Okwuonu et al., 2021).

It is an excellent source of vitamin C, manganese, potassium, thiamin, folic acid dietary fibres and especially carbohydrates but not a good source of proteins (Chandrasekara & Josheph Kumar, 2016; Shackelford et al., 2018).

The ratio of carbohydrate to protein is about 27:1(Okafor, J. I.; Umeh, 2021), which makes cassava a highly carbohydrate diet. It is relatively cheaper than rice, wheat, maize (Shikuku et al., 2019; Okudu &, Patricia Chidinma Okudu, 2022). Due to its relative affordability, it has become a staple food eaten by over 300 million people especially in sub–Saharan Africa (El-Ramady et al., 2021; Oluwafemi Ayodeji et al., 2022). Because of the dependence on cassava as the chief food source by majority of the population, the risk of development of protein energy malnutrition (PEM) becomes eminent(Otondi et al., 2020). These problems

of malnutrition have been observed amidst populations that rely predominantly on cassava as their chief food source devoid of other food sources that are rich in proteins to serve as compliments (Okoye & Oni, 2017; Oluwafemi Ayodeji et al., 2022),

Because these complimentary protein rich food sources are beyond the low-income earners who incidentally are the greater majority, the need for incorporating protein into cassava becomes absolutely imperative.

MATERIALS AND METHODS

Study Area:

The study was carried out in the Nutrition and Dietetics Department, Federal University of Health Sciences, Azare. Bauchi State. Samples will be collected in Bauchi, Liman katagum and Azare towns, all located in the North-Eastern region of Northern Nigeria.

Experimental details

Cassava root (*Manihot esculenta* Crantz), Soy bean seeds and Bambara nuts was procured from markets around Bauchi and Azare towns.

Preparation of Soybean into flour (Sya): The soybean seed was sorted to get rid of any litter and crushed using an electric miller. The first few kgs of the crushed flour were discarded to ascertain contaminants from the mill are eradicated from the flour. The flour was kept in a clean container for use in the study.

Preparation of Bambara nuts (Bna)

The Bambara nuts were sorted to get rid of any litter and crushed using an electric miller. The first few kgs of the crushed flour were discarded to ascertain contaminants from the mill are eradicated from the flour. The flour was kept in a clean container for use in the study.

Preparation of cassava flour (C1): The cassava roots after purchase were thoroughly cleaned to ensure all the dirt were removed. The dirt-free roots were peeled and kept under water to avoid discolouration. The roots were cut into small pieces(chips) and fermented in water for 60 h. After 60 h the fermented cassava were drained and sun dried in a clean environment free from dust. The dried cassava was then be milled using an electric miller. First few kgs of the milled cassava were discarded to avoid contamination. The flour was kept in a clean container for use in the study.

Preparation of the fortified cassava flour

20% soybean concentration (Sy20): 1500g of the cassava flour and 300g of the soy bean flour were thoroughly mixed together and the mixture was divided into three equal parts.

30% soy bean concentration (Sy30): 1500g of the cassava flour and 450g of the soy bean flour were thoroughly mixed together and the mixture divided into three equal parts.

20% bambara nut concentration (Bn20): 1500g of the cassava flour and 300g of the bambara nut flour were thoroughly mixed together and the mixture will be divided into three equal parts.

30% Bambara nut concentration (Bn30): 1500g of the cassava flour and 450g of the Bambara nut flour were thoroughly mixed together and the mixture was divided into three equal parts.

30% Bambara nut and 30% soy concentration: 3000g of the cassava flour and 450g of the Bambara nut

and 450g soy bean flours were thoroughly mixed together and the mixture was divided into three equal parts.

RESULTS

Table 1: Proximate Composition Of Cassava-Soya Floor Blend Concentration (%)

PARAMETERS	SY20	SY30
MOISTURE	9.65	10.25
ASH CONTENT	5.28	4.74
CRUDE FIBRE	4.78	4.02
CRUDE LIPID	7.81	9.07
PROTEIN	10.26	12.76
CARBOHYDRATE	62.22	59.16

KEY: SY20 = 20% soy bean/ Cassava blend

       SY30 = 30% soy bean/ Cassava blend

The proximate composition of cassava-soya bean floor blend is presented in Table 1. There is a significant increase in the protein content of cassava from less than 1% without augmentation to 10.26 in SY20 and 12.76 in SY30 augmented cassava floor respectively. This is as a result of increasing the concentration of soy beans from 20 to 30%. The crude lipids, crude fibre and ash contents were also increased.

Table 2: Proximate Composition Of Bambara Nut / Cassava Blend Concentration (%)

PARAMETERS	BnN20	BN30
MOISTURE	8.80	9.35
ASH CONTENT	4.53	4.96
CRUDE FIBRE	3.31	3.87
CRUDE LIPID	6.42	7.53
PROTEIN	6.84	8.25
CARBOHYDRATE	70.10	66.04

KEY: BN20 = 20% Bambara nut/ Cassava blend

       BN30 = 30% Bambara nut/ Cassava blend

Table 2 presents the results of augmenting cassava floor with bambara nuts at 20 and 30% (BY20 and BY30) respectively. The protein content rose from 6.84 to 8.25 % for BN20 and BN30 respectively. Similar increases were observed in Ash, Crude fibre and lipid respectively.

Table 3: Mineral Composition Of Cassava-Soya Floor Blend Concentration (%)

ELEMENTS	SY20	SY30
Ca	14.10±0.008	11.70±0.009
Fe	4.30±0.001	2.80±0.001
K	9.10±0.003	7.50±0.003
Mg	8.30±0.001	6.90±0.002

Na	6.30±0.001	13.20±0.002
Se	6.30±0.002	4.30±0.001
Zn	11.70±0.002	3.90±0.001

Values are mean (n=3) ± standard deviation

KEY: SY20 = 20% soy bean/ Cassava blend

        SY30 = 30% soy bean/ Cassava blend

Table 4: Mineral Composition Of Bambara Nut Floor Blend Concentration (%)

ELEMENTS	BN20	BN30
Ca	5.80±0.001	23.90±0.001
Fe	2.80±0.001	5.60±0.001
K	10.20±0.002	13.40±0.002
Mg	9.50±0.001	9.40±0.002
Na	9.30±0.001	10.00±0.002
Se	5.00±0.002	4.90±0.002
Zn	6.10±0.001	5.50±0.002

Values are mean (n=3) ± standard deviation

KEY: BN20 = 20% Bambara nut/ Cassava blend

        BN30 = 30% Bambara Nut/ Cassava Blend

Table 5: Vitamin Composition Of Cassava-Soya And Cassava -Bambara Nut Floor Blend Concentration (Mg/100g)

Sample	vitamin A	vitaminB12
SY20	19.25	5.31
SY30	18.03	5.23
BN20	3.54	4.35
BN30	6.15	4.71

KEY: SY20 = 20% soy bean/ Cassava blend

        SY30 = 30% soy bean/ Cassava blend

        BN20 = 20% Bambara nut/ Cassava blend
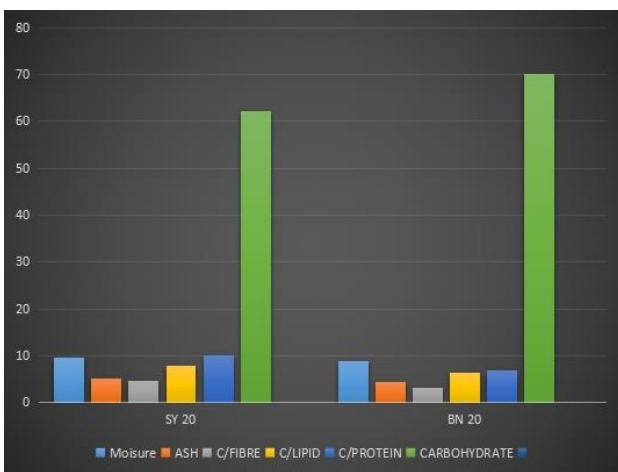
        BN30 = 30% Bambara nut/ Cassava blend

Table 6: Iodine Composition Of Cassava-Soya And Cassava -Bambara Nut Floor Blend (Mg/Kg)

sample	CONCENTRATION
SY20	0.85

SY30	1.33
BN20	2.35
BN30	2.92

KEY: SY20 = 20% soy bean/ Cassava blend

SY30 = 30% soy bean/ Cassava blend

BN20 = 20% Bambara nut/ Cassava blend

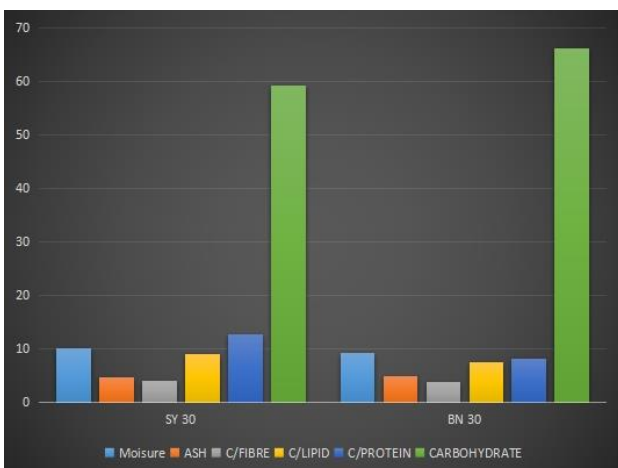BN30 = 30% Bambara nut/ Cassava blend

Figure 1: Comparison of proximate composition of SY20 and BN 20 concentration (%).

KEY: SY20 = 20% soy bean/ Cassava blend

BN20 = 20% Bambara nut/ Cassava blend

There was a significant difference (P <005) in the protein, lipids, fibre and ash concentrations of the augmented cassava floor between the SY20 and BN20, SY30 and BN30 as shown in figures 1 and 2 respectively. With SY blends having higher concentrations.

Figure 2: Comparison of proximate composition of SY30 and BN30 concentration (%).

KEY: SY30 = 30% soy bean/ Cassava blend

BN30 = 30% Bambara nut/ Cassava blend

Figures 3 and 4 compared the proximate profiles of SY30, and BN30 respectively. The crude protein of BN30 was 8.25 that of SY30 were 12.76 while the BN30 was the lowest, same observed for other parameters (fig 3). Similar trends were observed in fig 4 for proteins, lipids, and fibre, ash, carbohydrate and moisture contents. The differences were significant at ($P < 005$).
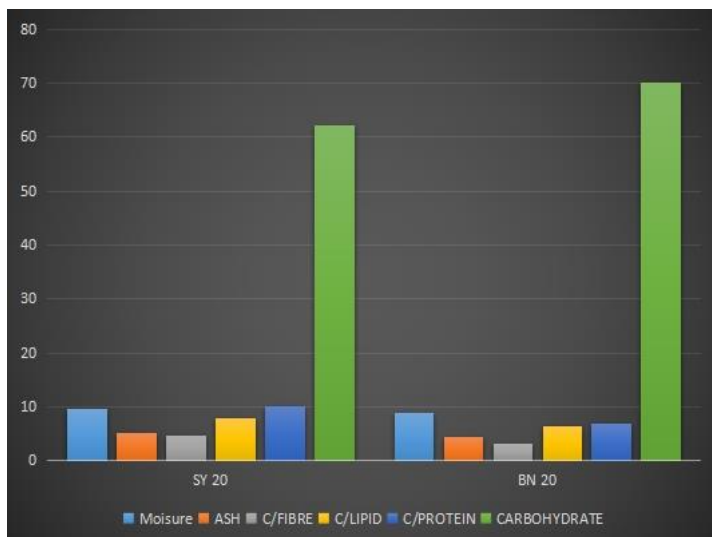
Figure 3: Comparison of proximate composition of SY30, BN 30 and BN30SY30 concentration (%).
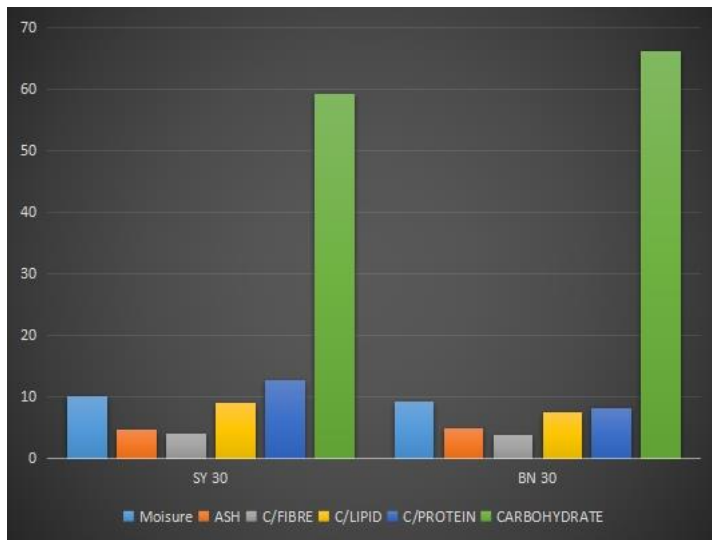
KEY: S30 = 30% soy bean/ Cassava blend

B30 = 30% Bambara nut/ Cassava blend

Figure 4: Comparison of proximate composition of SY20, BN 20 and BN30SY30 concentration (%).

KEY: SY20 = 20% soy bean/ Cassava blend

BN20 = 20% Bambara nut/ Cassava blend

The concentration of Ca, Fe, Se and Zn were higher in SY20, while K, Mg, and Na were higher in the BN20 blend, the differences were significant at ($P < 005$) (fig5); while Ca, Fe, K, Mg, Na, Se, and Zn were allhigher in the BN30 than SY30. The differences except for Se were significant at ($P < 005$) (fig 6).

Figure 5: Comparison Mineral Composition Of Sy20 And Bn20 Cassava Blend Concentration (%)
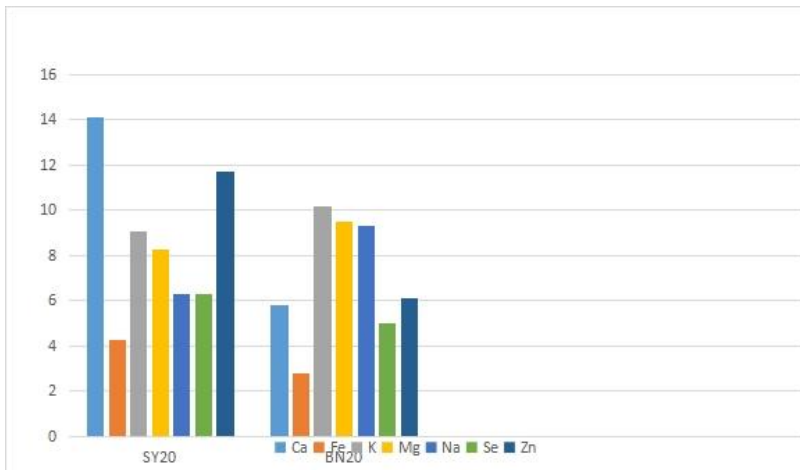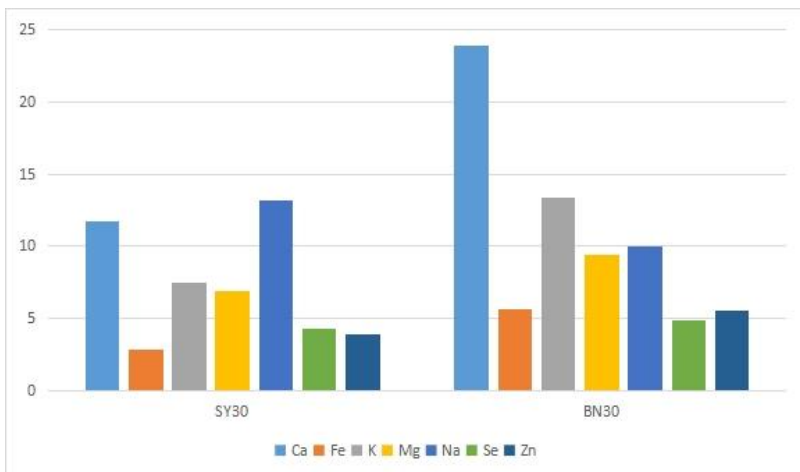

Figure 6: Comparison Mineral Composition Of Sy30 And Bn30 Cassava Blend Concentration (%)

Vitamins A and B12 of SY20. SY30, BN20 and BN30 were compared (fig 7); while the Iodine concentrations of SY20. SY30, BN20 and BN30 blends were compared (fig 8) respectively. The concentration of Vitamin A was higher than B12 in SY20, SY30 and BN30 blends, whereas it is lower than B12 in the BN20 blend (fig7). The concentration of Iodine is lowest in the SY20, followed by the SY30, BN20 and BN30 blends (fig8).

Figure 7: Comparison Of Vitamin Composition Of Sy20, Sy30, Bn20 And Bn30 Cassava Blend Concentrations (%)
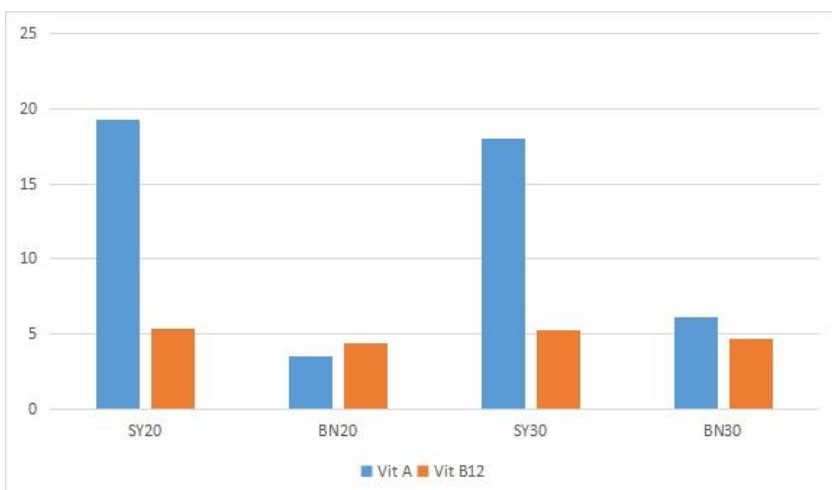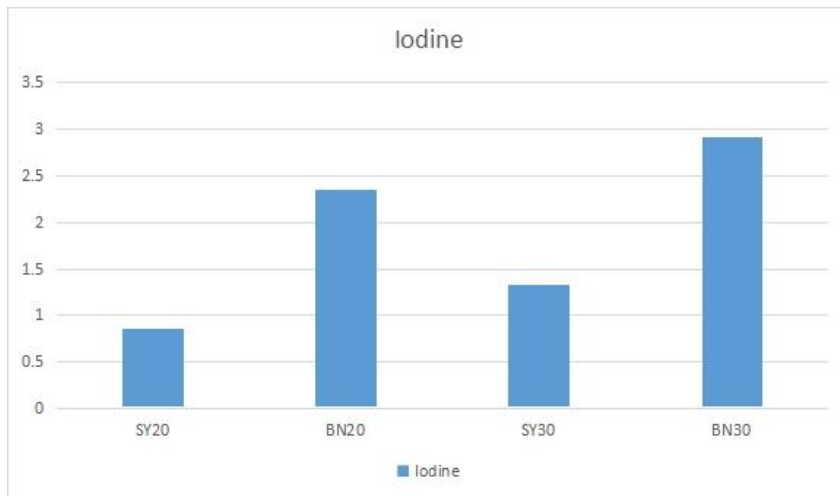
Figure 8: Comparison Iodine Composition Of Sy20, Sy30, Bn20 And Bn30 Cassava Blend Concentrations (Mg/Kg)

Figures 9 and 10 examined Consumer acceptability or otherwise of the SY20 and SY30 cassava blends. About 98% of the respondents completely like all the components of the SY20, SY30 cakes while a negligible few were dissatisfied with some components and a few remain neutral.

Figure 9: Depicting Consumer acceptability or otherwise of the SY20 cassava blend.
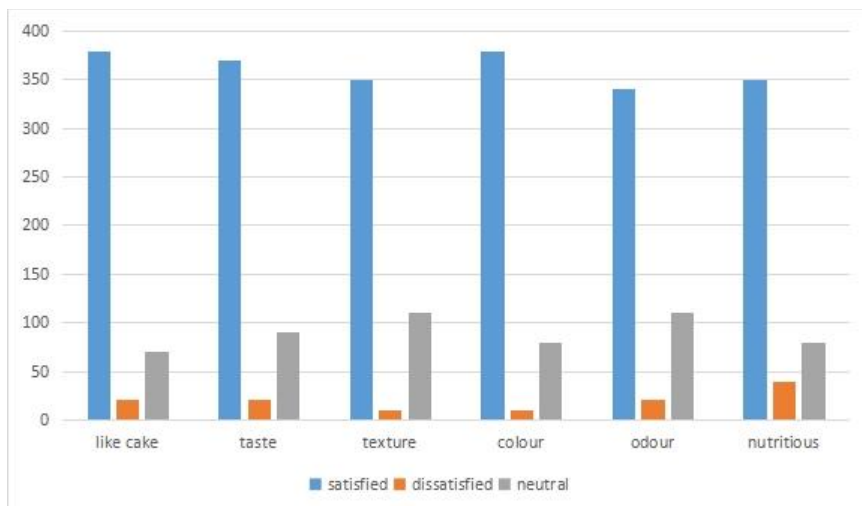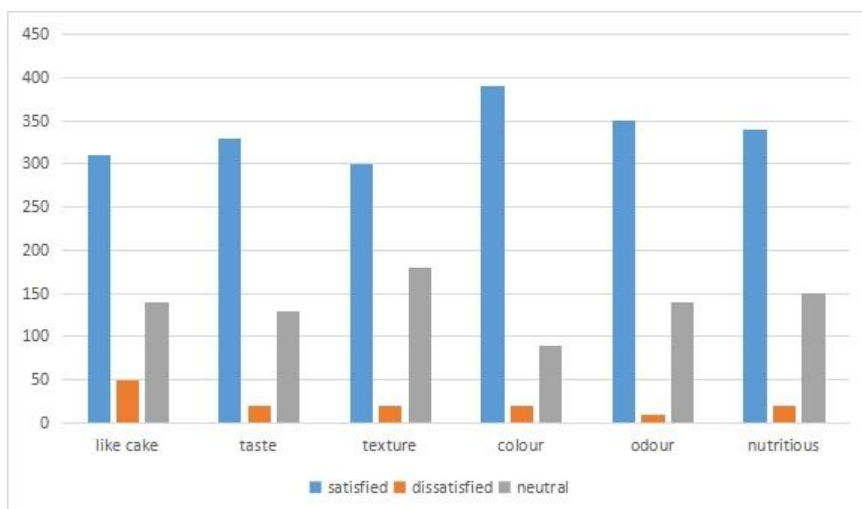

Figure 10: Depicting Consumer acceptability or otherwise of the SY30 cassava blend.

Figures 11 and 12 examined consumer acceptability or otherwise of the BN20 and B30 cassava blends. About 97% of the respondents completely like all the components of the BN20, BN30 cakes while a negligible few were dissatisfied with some components and a few remain neutral.

Figure 11: Depicting Consumer acceptability or otherwise of the BN20 cassava blend.
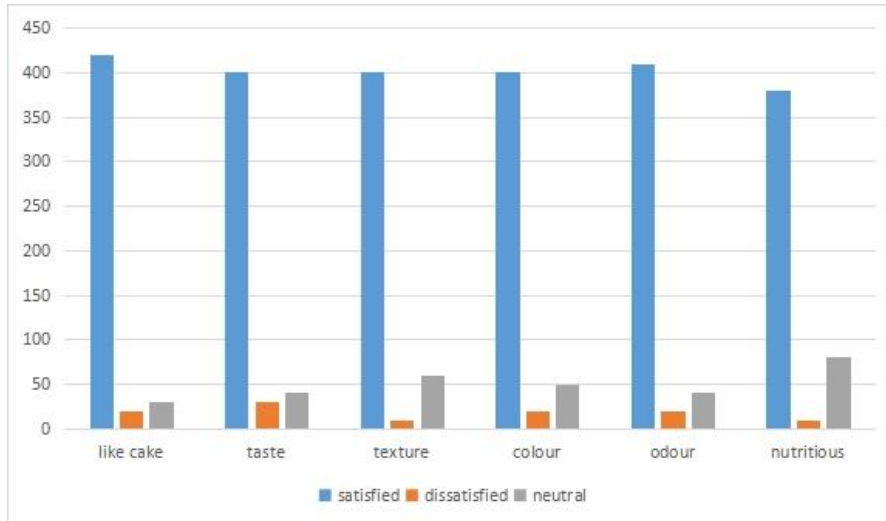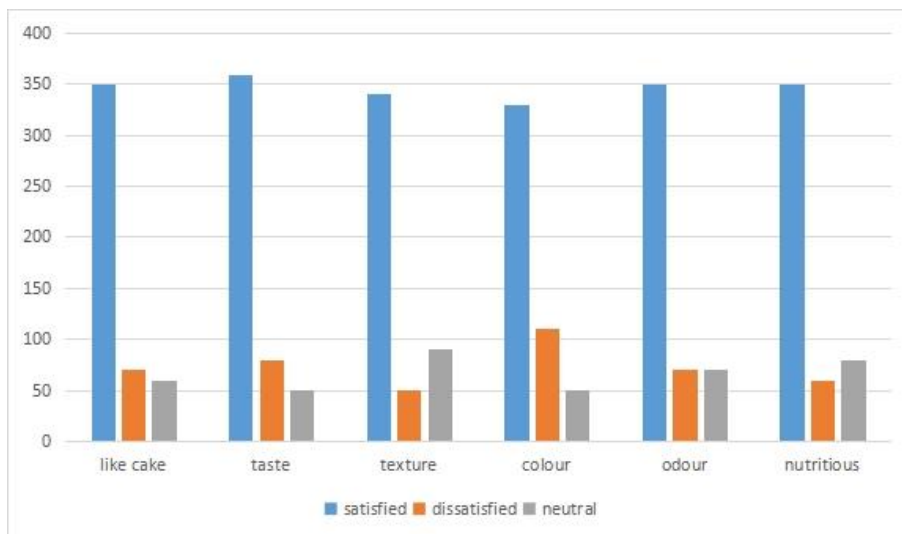

Figure 12: Depicting Consumer acceptability or otherwise of the BN30 cassava blend.

DISCUSSIONS

Results from the study showed a remarkable increase in both all the macro-nutrients assessed. The percentage increases as the concentration were increased from 20 to 30%. The SY blends had higher protein, carbohydrate, crude fats and fibre than the BN blends. A similar report by Okafor and Umeh (2021) in a study that compared the proximate composition of malted and un malted seeds of some flours observed similar trends. The concentration of Ca, Fe, Se and Zn were higher in SY20, while K, Mg, and Na were higher in the BN20 blend, the differences were significant at ($P <005$) which also in tandem with the work of Okudu and Patricia (2022). The concentration of Vitamin A was higher than B12 in SY20, SY30 and BN30 blends, whereas it is lower than B12 in the BN20 blend. The concentration of Iodine is lowest in the SY20, followed by the SY30, BN20 and BN30 blends, this trend was observed in a study carried out by Isah et al. (2020). About 98% of the respondents completely like all the components of the SY20, SY30 cakes while a negligible few were dissatisfied with some components and a few remain neutral. While 89% of the

respondents completely like all the components of the BN20 and BN30 cakes.

CONCLUSION

Soy bean and bambara nut cassava enhanced flour has shown a tremendous nutrient quality improvement and can be used to combat malnutrition and its consequences in low income communities whose staple diet is carbohydrate rich , protein deficient cassava.

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