Nutritional Composition of Some Selected Commercial Juice Made in Nigeria

Mohammed Salisu Suleiman[1], Raphael Eneji Jegede [1*], Itopa Abdulrahman Suleiman[2], Amoka Godwin Audu[1], Ele-ojo Isaac Shaibu [1], Agah Dorathy Ogohi [1]

[1] Department of Biochemistry, Prince Abubakar Audu University, Anyigba, Kogi State.

[2] Department of Science Laboratory Technology, Kogi State Polytechnic, Lokoja

Abstract: Introduction: Nutrient-fortified food play a crucial role in addressing nutritional deficiencies among infants and children, making them more appealing for consumption. Research focuses on baby foods, particularly reconstituted juice drink, which serve as significant sources of essential minerals and vitamins. However, the nutrient composition of these products varies, leading to differences in quality. The objective of this study is to assess the disparities in the nutritional content of various children's juice drink available in the Nigerian market.

Methods: Proximate analysis was carried out according to the standard procedure of Association of Official Analytical Chemists (AOAC) to evaluate the nutritional composition of the selected juice drink. Minerals content were determined using Atomic Absorption and Flame Spectroscopy Techniques. The determination of the Vitamin A content in the samples was conducted following a modified Spectrophotometric Method. For Ascorbic Acid (Vitamin C), the Vitamin C content in the samples was assessed utilizing a Spectrometric Method coupled with 2,4 Dinitrophenyl hydrazine (DNPH) procedures.

Results: Examination of the proximate and mineral analyses of ten chosen fruit juice brands revealed notable variations. Capri sonne exhibited the highest moisture content at 94.2%, while Hollandia Yogurt has the lowest at 81.3%. Chapman, Nutri Milk, and Viju Apple Flavor Milk shared the highest ash content at 0.5%, whereas Hollandia Malt, Piko Orange, and Piko Strawberry displayed the lowest at 0.01%. Nestle Malt boasted the highest crude protein concentration at 4.38%, with Capri sonne recorded the lowest at 0.18%. Hollandia Yogurt and Hollandia Malt demonstrated the highest crude fiber content, while Vitavite Multivi, Piko Orange, and Piko Strawberry showed the lowest. Regarding total carbohydrates, Hollandia Yogurt topped the list at 14.6%, while Vitavite Multivi ranked lowest at 6.57%. Nestle Millo contained the highest vitamin C content at 25.7%, whereas Piko Strawberry has the lowest at 3.82%. Caprosonne registered the highest vitamin A content at 0.6%. In terms of mineral analysis, Hollandia Yogurt exhibited the highest sodium percentage at 22.6mg/g, while Nestle led in calcium, iron, and magnesium content at 120.4mg/g, 1.7mg/g, and 25.5mg/g, respectively. It can

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* Corresponding Author: jegederaphael@gmail.com

therefore be inferred from the outcome of this study that, Milo Nestle is the best drink for children due to its higher protein, carbohydrate, vitamins (A and C) and minerals (Ca, Mg, Fe, Na) contents, followed by Hollandia Malt as compared to other juice studied.

Keywords: Juice, Proximate, Nutrition, Mineral, Vitamin

Background of the Study

Healthy dietary habits established during childhood not only yield immediate health advantages but also shape future behaviors and preferences, impacting adult health outcomes [1]. For instance, exclusive breastfeeding during the initial six months is endorsed as a public health intervention [2]. Furthermore, the introduction of complementary foods following this period, alongside sustained breastfeeding until at least 2 years of age, is recommended [3]. Additionally, it is advised to discourage the consumption of processed foods during the early years of life [4].

Despite the undeniable advantages of implementing such guidelines, numerous studies have revealed that modern society gravitates towards subpar dietary habits, leading to the premature inclusion of processed and ultra-processed foods in children's [5][6]. This trend is a direct result of women's increased participation in the workforce, resulting in limited time for meal preparation, coupled with a reliance on media-promoted products, particularly those targeted at children [7].

In recent years, there has been a notable rise in the consumption of artificial beverages, particularly in the realm of liquid nourishment, such as soft drinks and processed juices. This phenomenon has been investigated by researchers, who examined the trends in the acquisition of soft drinks in both low- and middle-income countries, including Nigeria, and high-income countries [8]. Their findings revealed a significant annual increase in per capita volume consumed from 1997 to 2023, with a growth rate of 5.2% in low- and middle-income countries and 2.4% in high-income countries. These results underscore the global nature of the issue, indicating that it is not contingent upon socioeconomic or cultural factors.

It is important to highlight that besides the immediate harms associated with the consumption of such beverages, including compromised intake of breast milk and other nutritious foods, as well as deficiencies in essential micronutrients, their inclusion in the regular diet can also lead to medium- and long-term consequences such as increased risks of overweight, obesity, and related chronic diseases [9]. This impact has been demonstrated by Boynton and colleagues in their study involving 548 children in Massachusetts, where they observed a direct correlation between the consumption of sugary beverages and elevated body mass index (BMI) as well as a higher prevalence of obesity [9].

In light of the preceding information, the current research sought to investigate the nutritional profiles, specifically focusing on proximate analysis, vitamin content, and mineral composition, of soft drinks and processed juices consumed by infants.

Materials and Methods

Reagents

Throughout the analysis, solely reagents of analytical grade were utilized. These reagents were obtained from the Biochemistry Laboratory of Prince Abubakar Audu University, Anyigba.

Sample Collection

Ten (10) different fruit juice were purchased from Okura market in Dekina Local Government Area of Kogi State. All the samples were purchased at random not based on preference and they were all reconstituted in Nigeria. The samples obtained include Nutri-milk, Viju milk Apple flavor, Hollandia Yourghurt, Piko strawberry flavor, Nestle millo, Piko Apple Juice, Vitavite multivi, Hollandia malt, Chapman, and capri-sonne

Proximate Analysis

The proximate composition of the samples was evaluated following the procedures outlined in the Association of Official Analytical Chemists (AOAC) guidelines **[10]**.

Mineral Analysis

The mineral content, including Sodium (Na), Calcium (Ca), Iron (Fe), and Magnesium (Mg), of each sample was determined using Atomic Absorption and Flame Spectroscopy Techniques as outlined in the AOAC guidelines [10].

Vitamin A and C Content of Samples

The determination of the Vitamin A content in the samples was conducted following a modified spectrophotometric method [11]. For Ascorbic Acid (Vitamin C), the Vitamin C content in the samples was assessed utilizing a spectrometric method coupled with DNPH procedures **[12]**.

Statistical Analysis

The data are presented as the mean of three replicates ± standard error of the mean (SEM). Statistical analysis was conducted using SPSS version 23, employing one-way analysis of variance (ANOVA), followed by Duncan's post hoc test for multiple comparisons. Statistical significance was considered at $p < 0.05$ (95% confidence level).

Results and Discussion

TABLE 1: Proximate Composition of the Various Juice

Sample	Moisture Content (%)	Ash content (%)	Crude Fiber (%)	Fat content (%)	Crude Protein (%)	Carbohydrate (%)
A	89.13±0.09[a]	0.50±0.01[a]	0.05±0.01[a]	0.27±0.01[a]	1.18±0.03[a]	9.29±0.10[a]
B	90.50±0.00[b]	0.05±0.00[a]	0.04±0.00[a]	0.20±0.00[b]	1.05±0.00[b]	8.16±0.00[b]
C	93.77±0.09[c]	0.01±0.00[b]	0.02±0.00[b]	0.14±0.11[c]	0.24±0.01[c]	6.17±0.23[c]
D	92.53±0.09[c]	0.04±0.01[c]	0.02±0.00[b]	0.14±0.00[c]	0.49±0.03[d]	6.78±0.11[c]
E	94.23±0.03[c]	0.01±0.00[b]	ND	0.11±0.01[d]	0.13±0.03[e]	5.54±0.03[d]
F	16.27±0.15[d]	0.10±0.01[d]	0.23±0.01[c]	1.18±0.01[e]	2.61±0.02[f]	14.36±0.15[e]
G	84.67±2.57[e]	0.12±0.02[d]	0.17±0.01[d]	1.80±0.06[f]	4.46±0.05[g]	13.32±0.10[f]
H	90.40±0.06[b]	0.05±0.01[a]	0.08±0.00[e]	0.22±0.00[b]	0.61±0.00[h]	8.64±0.06[b]
I	92.52±0.07[c]	0.01±0.00[b]	0.02±0.00[b]	0.15±0.01[c]	0.35±0.00[i]	6.84±0.00[c]
J	84.11±0.05[e]	0.01±0.00[a]	0.21±0.01[c]	1.11±0.01[g]	3.79±0.04[j]	10.59±0.10[g]

The mean of three (3) replicates ± SEM (Standard Error of Mean) represents the values. Statistically significant differences ($p < 0.05$) are indicated by different superscripts within the columns. A= Nutri-milk, B= Viju Apple Flavoured juice, C= Piko Orange juice, D= Vita Vite Multivi Juice, E= Capri – Sonne, F = Hollandia Yogurt, G= Milo Nestle, H= Chapman, I= Piko strawberry juice, J = Hollandia malt, ND= Not Detected
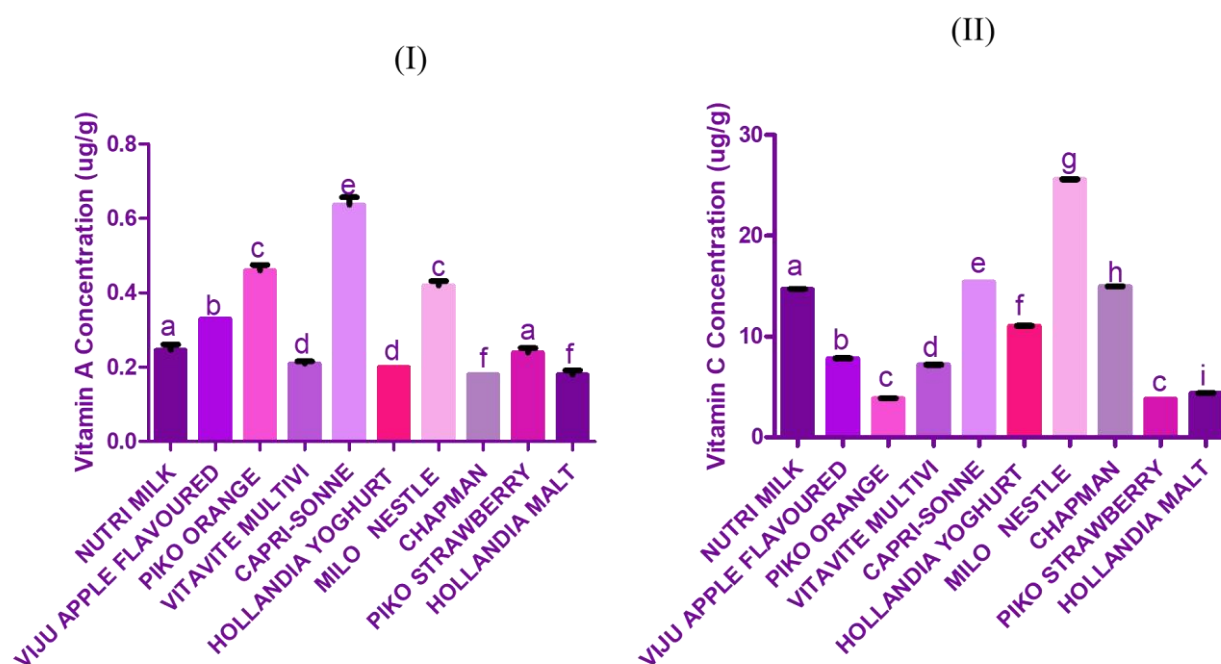

FIGURE 1: Vitamin A and C Composition of the Various Juice.

The mean of three (3) replicates ± SEM (Standard Error of Mean) represents the values. Statistically significant differences ($p < 0.05$) are indicated by different superscripts on the bars
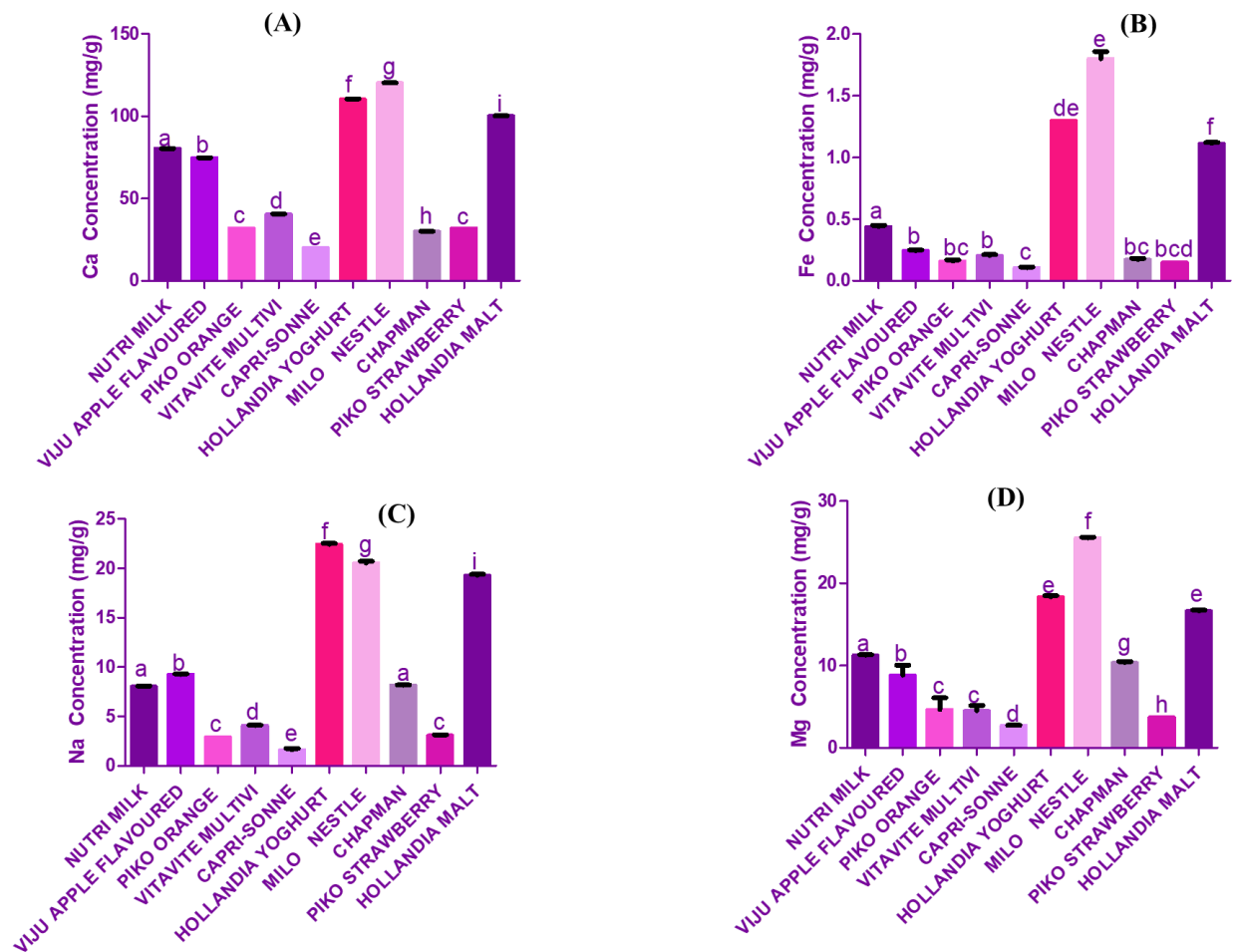
FIGURE 2: Mineral Element Composition of the Various Juice

The mean of three (3) replicates ± SEM (Standard Error of Mean) represents the values. Statistically significant differences (p<0.05) are indicated by different superscripts on the bars

The findings from both proximate **(Table 1)** and mineral elements analyses **(Figure 2)** of the ten selected fruit juice, including Nutri-milk, Viju Milk Apple flavor, Hollandia Yogurt, Piko Strawberry flavor, Nestle Millo, Piko Apple Juice, Vitavite Multivi, Hollandia Malt, Chapman, and Capri sonne, revealed significant variations in their nutritional qualities and mineral compositions. Table 1 illustrated the percentage content of moisture, ash, fiber, protein, and carbohydrates in these juice. Notably, Capri-sonne exhibited the highest moisture content at 94.2%, while Hollandia Yogurt has the lowest at 81.3%, indicated a potential susceptibility to microbial spoilage **[13]**.

In terms of ash content, Chapman, Nutri Milk, and Viju Apple flavor milk showed the highest concentration at 0.5%, while Hollandia Malt, Piko Orange, and Piko Strawberry exhibitdd the lowest

at 0.01%. Nestle Malt recorded the highest crude protein concentration at 4.38%, while Caprosonne recorded the lowest at 0.18%. Hollandia Yogurt and Hollandia Malt demonstrated the highest crude fiber content, whereas Vitavite Multivi, Piko Orange, and Piko Strawberry showed the lowest. Hollandia Yogurt has the highest total carbohydrate content at 14.6%, while Vitavite Multivi has the lowest at 6.57%.

Figure 1 displayed the vitamin content of the ten selected juice drink, revealing Nestle Millo with the highest concentration of vitamin C at 25.7% and Piko Strawberry with the lowest at 3.82%. Additionally, Caprosonne registered the highest vitamin A content at 0.6%, while Chapman has the least. These differences underscore the varied nutritional contributions of these juices, particularly in children's health.

Furthermore, mineral analysis indicated that Hollandia Yogurt has the highest percentage of sodium (Na 22.6mg/g), while Nestle Millo has the highest calcium (Ca), iron (Fe), and magnesium (Mg) content at 120.4mg/g, 1.7mg/g, and 25.5mg/g, respectively. This emphasizes the significant biochemical functions of fruits juice in the body, particularly in bone and teeth development and blood clotting. The combination of these minerals with the proximate composition of the juice likely facilitates their various functions, such as calcium's role in activating enzymes like adenylate cyclase and calcium-dependent protein kinases **[14]**.

Conclusion

The analysis underscored the presence of essential nutrients and minerals in varying quantities across the baby juice drink samples. Some products exhibited low moisture content, beneficial for preservation. However, it's evident that the mineral elements in all ten selected juice drink fall below the daily recommended intake, highlighting the need for further attention to ensure adequate nutritional provision. Making inference from the nutritional composition of the juice, Milo Nestle is recommended for children due to its higher protein, carbohydrate, vitamins (A and C) and minerals (Ca, Mg, Fe, Na) content followed by Hollandia Malt as compared to other juice studied.

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Conflict of Interest
The research has been thoroughly carried out and no conflict of interest

Authors' Contribution:
Suleiman M.S. design the research and carryout the proximate analysis of the samples
Jegede E. R did the statistical analysis and wrote the introduction of the manuscript
Audu G.A carried out the vitamin analysis of the sample and also involve in the writing of the discussion
Suleiman A.I: carried out the mineral element analysis of the samples
Shaibu I E: was involved in proximate and vitamin analysis of the samples
Ogohi D.A: collected and prepared the samples and was also involved in carrying out the proximate and mineral element analysis of the samples