RUGIPO Research & Technical Journal; Vol. 3, Issue 1: Issues in Science & Agricultural Technology; Sept, 2024 Edition
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PHYSICO-CHEMICAL AND ANTIOXIDANT PROPERTIES OF GOLDEN MELON-CUCUMBER JUICE

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Abstract
Despite the numerous studies to encourage the consumption of functional diets, the population diet tends to fall short of the target due to so many reasons which include over processing of foods, busy lifestyles, and increased dependence on convenience foods. For those seeking a more adequate diet, consuming fruits and vegetables regularly is an excellent solution. The objective of this research is to evaluate the physico-chemical and antioxidant properties of golden cucumber juice**.** The raw material was procured and processed into five samples, samples A (100% Golden Melon), B (100% Cucumber), C (50% Golden Melon + 50% Cucumber), D (70% Golden Melon + 30% Cucumber) And E (30% Golden Melon + 70% Cucumber). The antioxidant and physio-chemical properties of the samples were determined using standard methods. Data obtained were statistically analyzed using ANOVA to test for the level of significance. Findings showed that value ranged from 0.032% - 0.222% for PH, 0.027% -.0256% for Brix and 0.298% - 2.224% for Colour. The result also shows that vitamin A ranged from 3.160% - 6.621%, Polyphenol14.289% - 20.120%, vitamin C (Ascorbic acid) 18.590% - 33.192%), phenol 4.160% - 6.864%) and flavonoid 1.236% - 1.813%. Sample D possessed the most desirable physico-chemical and antioxidant composition compared to other samples. Therefore, Golden melon-cucumber juice can be consumed as juice due to its higher antioxidant contents which could offer protection against inflammation, free radicals, microbes and tumor formation.

Keywords: Physicochemical, antioxidant, free radicals, golden melon, cucumber

Introduction

Fruit juice is a combination of one or more fruits obtained from the edible portion of healthy, ripe fruit, fresh or frozen or preserved, giving the juice its unique colour and aroma (Oladipo et al., 2022). The Golden Melon (*Cucumis melo*) fruit is considered an underutilized fruit due to its limited reach in Western Nigeria (Vaughn & Geissler, 2009; Sodipo et al., 2019). **1**). It is low in energy, highly perishable, and has an exceptional capacity for micronutrients, particularly vitamin C and carotenoid, a precursor to vitamin A (Lester, 2006). Golden melon fruit (*Cucumis melo*) are very high in minerals such as potassium, calcium, phosphorus, magnesium, and iron and they are an ideal choice for weight control (Edwards, 2003; Quek, 2007). Cucumber (*Cucumis sativus*) is a widely cultivated plant a member of the Cucurbitaceae family in the gourd family, along with squash and different kinds of melon (Vivek et al., 2017, Agatemor et al., 2018). It is a primary source of vitamins and minerals in the human diet, but it has a very low caloric and nutritional value. Cucumbers have a high water capacity with the highest water content of any vegetable, about 96% water, low fat, low cholesterol, and low sodium. They taste pleasant and refreshing, and they contain a lot of water. Due to their cooling qualities, Cucumbers are extremely good for bringing relief to

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the eyes in summer (Shrivastava & Roy, 2013).

Knowing that eating a wide variety of fruits and vegetables frequently in a week can provide optimal nutrition, boost immunity, and general health, and provide all the disease-prevention and antioxidant benefits required to thrive is important (Van Duyn & Pivonka, 2000). Fruits and vegetables are among the most important foods for humans since they are not only nutrient-dense but also essential for good health maintenance and function (Wong et al., 2003). They contribute colour, taste, and diversity to the diet in addition to providing necessary minerals and vitamins (Ragaert et al., 2004). Numerous studies have demonstrated that a diet rich in fruits and vegetables is essential to maintaining a healthy weight and that a low intake of these foods increases the risk of developing chronic illnesses like cancer, heart disease, stroke, and cataract development. Fruit and vegetable consumption also boosts immunity (Van Duyn & Pivonka, 2000)). Unbalanced diets with insufficient fruit and dietary fibre intake are among the top 10 risk factors contributing to mortality and are predicted to cause 2.7 million deaths annually, according to the 2007 World Health Report (Dias, 2011). Therefore, this study tends to evaluate the physico-chemical and antioxidant properties of golden melon-cucumber juice.

Materials and method

Source of Materials and Equipment

Golden melon (*Cucumis melo*) was purchased from Gwagwalada market, Abuja and Cucumber (*Cucumis sativus)* was purchased from Oja Oba, Owo Ondo State, Nigeria. All equipment was obtained from the departmental store, this equipment includes knives, spoons, a grater, a sieve, a blender, a kitchen weighing scale, and cups.

Preparation of golden melon Juice: Golden melon was washed in clean running water to remove dust, dirt and other foreign materials with a plain stainless knife. The golden melon was peeled and the seeds were removed. After that, it was chopped into smaller pieces and blended using a blending machine/blender. The juice was extracted using a sieving cloth. The extracted juice was filled in a pet bottle and then kept in a refrigerator for further analysis.

Preparation of Cucumber Juice: Cucumber was washed in clean running water to remove dust, dirt and other foreign materials with a plain stainless knife. The cucumber was peeled and the seeds were removed. After that, it was chopped into smaller pieces and blended using a blending machine/blender. The juice was extracted using a sieving cloth. The extracted juice was filled in a pet bottle and then kept in a refrigerator for further analysis.

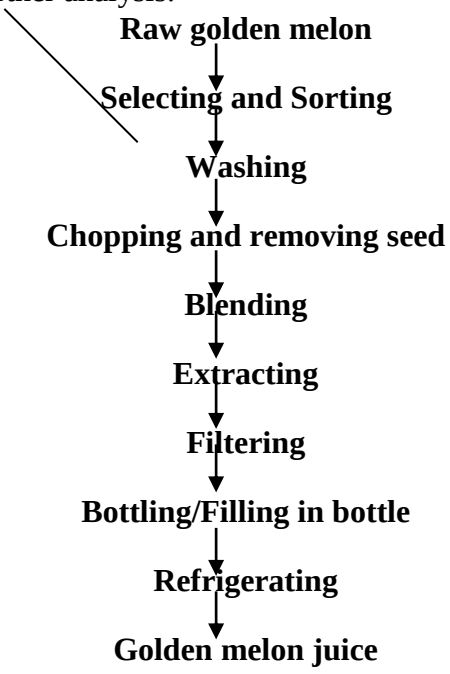

Figure 1: Production of golden melon juice

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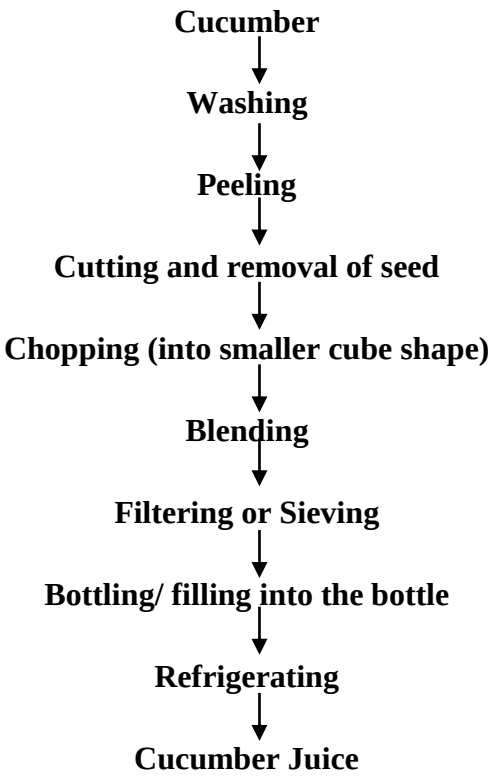

Figure 2: Production of cucumber juice.

Table 1: Formulation of the golden melon and cucumber juice

Samples	Golden-melon (%)	Cucumber (%)
A	100	0
B	0	100
C	50	50
D	70	30
E	30	70

Physico-Chemical Analysis

The physicochemical properties determined include the potential of hydrogen (pH), brix level and colour. They were determined using standard methods as recorded by AOAC (2012).

Antioxidant Analysis

The antioxidant properties determined include phenol, flavonoid, polyphenol, and vitamins A and C. They were determined using standard methods as recorded by AOAC (2012)

Statistical Analysis

The results were expressed as mean ± standard deviation and the test for statistical significance was carried out using one-way analysis of variance (ANOVA). Significant means were separated using Duncan's New Multiple Range Test (DNMRT) and differences were considered significant at $p<0.05$

RESULTS

Antioxidant Properties

Table 2 shows the physicochemical properties of golden melon-cucumber juice**.** There was a significant difference ($p<0.05$) in the pH values of samples A, B, C, D and E. pH values were significantly higher in sample D (0.222+0.00) compared to sample B (0.022+0.00) which is lower in pH content. The level of brix content in the samples varied significantly by $P< 0.05$. Sample D (0.256+0.00) was higher than sample C (0.096+0.00), sample B (0.032+0.02), sample A (0.027+0.00) and sample E (0.047+0.00). Sample A (0.027+0.00) had the lowest value. The colour content varied significantly $p<0.05$ among the samples. Sample C (2.224+0.00) was higher than the other four samples while sample E (0.298+0.00) had the least value.

Table 2: The Physicochemical Properties of Golden Melon-Cucumber Juice

Variables	Sample A	Sample B	Sample C	Sample D	Sample E
PH	0.032 ± 0.00^{d}	0.022 ± 0.00^{e}	0.182 ± 0.00^{b}	0.222 ± 0.00^{a}	0.045 ± 0.00^{c}
BRIX	0.027 ± 0.00^{e}	0.032 ± 0.00^{d}	0.096 ± 0.00^{b}	0.256 ± 0.00^{a}	0.040 ± 0.00^{c}
COLOUR	0.630 ± 0.00^{b}	0.529 ± 0.00^{d}	2.224 ± 0.00^{a}	0.598 ± 0.00^{c}	0.298 ± 0.00^{e}

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Values are means + standard deviation. There was no significant difference ($p<0.05$) between the values with the same superscript along the column.

Table 3 shows the antioxidant properties of golden melon juice. There was a significant difference of $P<0.05$ in the vitamin A content of samples A, B, C, D and E. Vitamin A content was significantly higher in sample C (6.379+0.00) compared to sample D (6.621+0.01), E (4.435+0.10), and B (4.140+0.02) while sample A (3.160+0.04) has the least value in vitamin A content. The vitamin C content for samples A (20.720+ 0.04), B (22.452+0.03), C (33.192+0.03), D (28.258+0.06), and E (18.590+0.25), were significantly different $p<0.05$. Sample C (33.192+0.03) had the highest value in vitamin C content followed by sample D (28.258+0.06), while sample E (18.590+0.25) had the lowest value. The polyphenol content for sample A (20.120+0.42), sample E (19.165+0.04), sample D (18.386+0.029), sample B (16.285+0.02) and sample C (14.289+0.04) were significantly different ($p<0.05$). Sample A (20.120+0.42) had the highest value while sample C (14.289+0.04) had the lowest value. The phenol content of sample A (6.864+0.03) was higher than sample E (6.826+0.00), D (6.502+0.01), B (4.427+0.00) and sample C (14.160+0.08) and was significantly different ($p<0.05$). The flavonoid content of sample B (1.813+0.00) had the highest value followed by sample A (1.655+0.00), C (1.510+0.02), E (1.309+0.00) while sample D (1.236+0.00)) had the least value and were significantly different ($p<0.05$).

Table 3: Shows the Antioxidant Properties of Golden Melon-Cucumber Juice

Variables	Sample A	Sample B	Sample C	Sample D	Sample E
Vitamin A	3.160 ± 0.04^{e}	4.140 ± 0.02^{d}	6.379 ± 0.00^{b}	6.621 ± 0.01^{a}	4.435 ± 0.10^{c}
Vitamin C	20.720 ± 0.04^{d}	22.452 ± 0.03^{c}	33.192 ± 0.03^{a}	28.258 ± 0.06^{b}	18.590 ± 0.25^{e}
Polyphenol	20.120 ± 0.42^{a}	16.285 ± 0.02^{d}	14.289 ± 0.04^{e}	18.386 ± 0.029^{c}	19.165 ± 0.04^{b}
Phenol	$6.864+0.03^{a}$	4.427 ± 0.04^{c}	4.160 ± 0.08^{d}	6.502 ± 0.01^{b}	6.826 ± 0.00^{a}
Flavonoid	1.655 ± 0.00^{b}	$1.813+0.00^{a}$	1.510 ± 0.02^{c}	1.236 ± 0.00^{a}	1.309 ± 0.00^{d}

Values are means + standard deviation. There was no significant difference ($p<0.05$) between the values with the same superscript along the column.

Discussion

The presence of physicochemical and antioxidant properties in fruits and vegetables is crucial for protecting the body from free radical damage and for delaying or blocking the oxidation of lipids and other biomolecules, to prevent and repair damage to body cells caused by free radicals (Shahidi & Naczk, 2004; Henning et al., 2017). It is on this note that this study was carried out to determine the physico-chemical and antioxidant properties of golden melon-cucumber juice. The result revealed that the pH content of the samples ranged from 0.022% to 0.222% which was lower compared to the value of 3.0% to 5.0% for golden melon and cucumber juices as reported by Harris et al. (2011). It was also lower than the result of 5.40% to 5.48% obtained by Braide et al. (2012) on the fruit and vegetable juice. The difference in value could be a result of processing or the percentage of blend used for the formulation. Thus, the low pH observed in this study could be one of the contributing factors responsible for the shelf–stability of the products. However, the pH concentration of the fruit juice blend was acidic which may help increase the shelf

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life of the juice, because the microorganism reproduction rate which speeds up the rate of fruit deterioration is minimized in an acidic medium. The pH value of a preserved product is becoming increasingly recognized for its crucial contribution to product quality. This is due to the important role it plays in preventing microbial deterioration (Oyaizu, 2006). The total soluble solid (brix) content was significantly different ($p<0.05$) in samples A, B, C, D and E and the values ranged from 0.027% to 0.256% which was significantly lower than the value of 3.60% to 13.80% obtained by Eziaghighala et al. (2010) in their study. The total sugar content of the fruit juice samples was found to increase significantly ($p<0.05$) with increasing volume of golden melon juice. The slight difference in the value obtained could be attributed to the percentage of golden melon added to the sample during processing. The decrease in values showed that the chemical reactions that should consume and reduce the concentration of sugar are at a minimum (Akande & Ojekemi, 2013). From this study, the colour of the golden melon-cucumber juice samples ranged from 0.298% to 2.224% which are significantly different ($p<0.05$) from one another. This was contrary to the result of 0.36% to 0.68% obtained by Olayinka and Etejere (2013), in the fruit and vegetable (golden melon-cucumber) juice. The slight changes could result in the colour of the juice increasing during storage at 24^0C for a few days. The fruit juice is slightly acidic in pH and lower in colour, this indicates that the fruits were matured before harvesting and processing. The antioxidant properties result revealed that the phenol content of the samples ranged from 4.160% to 6.864% with sample A (6.864%) having the highest value and were significantly different ($p<0.05$) from one another except for sample A (6.864%) and E (6.826%). This result was slightly lower than the value 6.32% to 10.20% reported by Bao *et al.*, (2005). This implies that the inclusion of cucumber in golden melon increases the phenol content and the consumption of the golden melon-cucumber juice may be beneficial to the body system. The phenol compounds have potent antioxidant properties that allow them to scavenge free radicals, activate antioxidant enzymes, reduce alpha-tocopherol radicals, and inhibit oxidases, it has been suggested that they can shield the human body system from free radicals and also the phenol compounds are used as purgatives, to treat stomach ache and constipation. (Bao etal., 2005; Pulido et al., 2000). Total flavonoids are found in trace quantity in all the samples. However, the 100% golden melon juice contains the highest quantity of flavonoids, but the inclusion of 30% cucumber juice slightly reduces the number of flavonoids in samples C, D and E which was significantly different ($p<0.05$) from one another. The value of flavonoid content ranged from 4.160% to 6.864% with sample A (100% golden melon) having the highest value and sample C (70% golden melon + 30% cucumber) having the lowest value. This result was contrary to the value of 0.19 % to 0.57% obtained by Okay and Emenike (2006) in their study, on the evaluation of the phytonutrients and Vitamin C content of citrus juice. The positive difference in the value could be that the golden melon used in the processing has 100% wholesomeness than the one used by Okay and Emenike (2006). Flavonoids are potent water-soluble antioxidants and can scavenge free radicals to stop oxidative cell damage and have powerful anticancer properties. The presence of flavonoids in fruit juice may provide defence against inflammation, free radicals, microbes and tumour growth (Daffodil et al., 2016). The polyphenol content value of sample A (100% golden melon) was significantly higher than samples B, C, D and E at

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($p<0.05$). The value ranged from 14.289% to 20.120% in samples C and A which was lower than the value of 25.41% to 27.30% obtained by Sharma et al., (2009) in their study, on the effects of pretreatment conditions on antioxidant parameters of juice from cucumber and golden melon. The variation in polyphenol content as observed in the result presented in (Table 2) may be due to changes in surrounding storage temperature. This gradual decrease in polyphenol content during storage was also observed by Awsi and Dorcus (2012) in his study of quality evaluation of pineapple juice with cucumber and carrot juice.

The vitamin C content of the samples ranged from 18.59mg/100g to 33.19mg/100g with sample C (33.19mg/100g) having the highest value compared to sample E (18.59mg/100g) with least value. This result was similar to the value of 20.23mg/100g to 38.68mg/100g reported by Levine et al. (1993). However, the addition of cucumber juice to golden melon increases significantly its vitamin C content at ($p<0.05$). This suggests therefore that blending of two or more fruit blend together to form a juice could improve the nutrient of a product. Vitamins have some special roles which are essential for life and most of them are not produced by the body. Vitamin C, which is naturally present or added to most juices, is necessary for the body to form collagen, cartilage, muscle and blood vessels, and aids in the absorption of iron. Vitamin C is a vital nutrient in many multicellular organisms, especially in humans (Veerasamy et al., 2020). Vitamin C is a water-soluble vitamin which exhibits antioxidant properties that can serve as a means for the treatment of certain diseases such as catarrh (Abitogun et al., 2010). The consumption of golden melon-cucumber juice could provide a measure of Vitamin C needed by the body for its physiological functions. Sample C (70% golden melon + 30% cucumber) has a vitamin A content of 6.68mg/100g which is significantly higher at ($p<0.05$) than samples A, B, D and E respectively. The value of vitamin A content of the samples in this study ranged from 3.160mg/100g to 6.379mg/100g which was higher when compared to the value 0.01mg/100g to 0.12mg/100g obtained by Edem and Miranda (2011), in their study, where 100% golden melon was significantly higher ($p<0.05$) than other samples. The increase in vitamin A content of the sample in this present study could be attributed to the addition of 30% cucumber to 70% golden melon. Vitamin A regulates hormonal immune responses and cellular immunological responses, and it is important in the immune system's development (Huang et al., 2018).

Conclusion

This study established that golden melon-cucumber juice possessed an appreciable amount of physicochemical and antioxidant properties, revealing that sample D (70% cucumber + 30% golden melon) contains the most desirable physicochemical profile compared to other counterparts. The inclusion of cucumber in golden melon juice increases the physicochemical properties of the sample. However, sample D (70% cucumber + 30% golden melon) contains appreciable amounts of vitamins A and C in terms of antioxidant properties while sample A (100% cucumber) possessed the most desirable amount of polyphenol and phenol in the juices which enhances their nutritional qualities and a source of antioxidant property that may improve health status. The presence of flavonoids in fruit juice may offer protection against inflammation, free radicals, microbes and tumour formation.

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