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Nutritional Quality of Vegetables from Malaysian Urban Community Farming

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ABSTRACT. Urban community farming has garnered interest in Malaysia due to rising household expenditures and government support through various policies and initiatives. This study evaluates the nutritional quality of nine common vegetable varieties from seven established urban community farms in Malaysia to enhance community engagement. The nutritional quality evaluation focused on sugar content, gross energy, vitamin A, vitamin C and twelve types of minerals. The analysis was conducted using specialized instruments, including High Performance Liquid Chromatography (HPLC), bomb calorimeter, and Inductively Coupled Plasma - Optical Emission Spectrometry (ICP-OES). The results indicated that all the cultivated vegetables contain at least two types of common sugars, with three of them containing all the targeted sugars. The gross energy of the cultivated vegetables, typically associated with sugars, ranges from 2900 to 3800 joules/g, with okra from Seksyen 4, Bangi exhibiting the highest value. Certain vegetables contain vitamins, with pak choy demonstrating the highest levels of vitamin A and sawi exhibiting the highest levels of vitamin C, respectively. Regarding mineral content, all vegetables contain twelve minerals, with spinach displaying the highest variety, including boron (B), potassium (K), magnesium (Mg), and phosphorus (P). The findings demonstrated that the urban farming community can produce nutritious vegetables to meet daily consumption needs and additionally decrease community expenses.

Key words: Urban community farming, Nutritional, Sugar, Gross energy, Vitamin, Mineral.

INTRODUCTION

Townships or urban areas are recognized as significant economic generators for countries worldwide. In Malaysia, approximately 75% of national income is generated from this location. The Malaysian government anticipates that the urban population will exceed 27 million by 2025 (Second National Township Policy, 2016). Hence, the township development needs to focus on various aspect such as optimum economic benefit, comprehensive utility facilities such as water supply, electricity, telecommunication and transportation. Besides all these, ensuring the food supply for the community was also included as one of the important aspects. The food supply challenge, particularly in urban regions, has been reinforced by the government through various strategies, including the National Agrofood Policy 2.0, Food Sovereignty, and Urban Community Farming (National Agrofood Policy 2021-2030 (NAP 2.0); Second National Township Policy, 2016). The National Agrofood Policy was instituted to guarantee the constant availability of food supplies for community access to adequate and nutritious sustenance. Under this policy, the government also encourages individuals or community members to produce food for daily consumption, such as fruits and common

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vegetables, due to their nutritional value, including sugar content, vitamins, and minerals (Arias, et al., 2022; Dias, 2019), as Food Sovereignty strategy.

The Food Sovereignty strategy was implemented globally as national policies in certain countries to support the food security agenda. The strategy derives from social movements, guiding grassroots advocacy and demands, local institutional policies like farmers' cooperatives, and interventions by NGOs (Sampson et al., 2021). The Food Sovereignty strategy has been strengthened by Malaysian government under 4th National Physical Plan Policy (Rameli, 2022), by optimizing usage of land to ensure national food security supported by SNTP via Urban Community Farming concept.

To date, the urban farming concept which support Food Sovereignty strategy has gain popularity among urban community. Nevertheless, the community did not take into account scientific data regarding nutritional value, which could potentially attract the interest of other urban communities to engage in this domain. This study will furnish scientific data on the nutritional values, including sugars, energy, vitamins, and minerals, of commonly cultivated vegetables in selected established urban farming communities across Malaysia.

METHODOLOGY

2.1 General

The detection of sugars and vitamin were conducted using Agilent High Performance Liquid Chromatography (HPLC) 1200 series. The centrifuge used was brand of Hettich® EBA 21 centrifuge. The determination of gross energy was conducted using IKA C 6000 Bomb Calorimeter. The minerals content was analysed using Inductively Coupled Plasma - Optical Emission Spectrometry (ICP-OES) brand Perkin Elmer Optima 5300 DV. The solvents and standards chemical (reference material) used were analytical grade.

2.2 Sample collection and preparation

Nine samples were obtained from seven established urban community farming areas in Malaysia. The fresh leafy greens and near-ripe fruit samples were diced and processed in a food blender to enhance surface area for extraction.

2.3 Sugar determination

The analysis was conducted using the method established by Xu et al. (2015). Two grams of the sample were weighed in a centrifuge tube and combined with 10 ml of a solution (acetonitrile: deionized water in a 20:80 ratio). The mixture was centrifuged for 20 mins at 4000 rpm and filtered into vial using nylon syringe filter. The sample solution was further subjected to HPLC system for analysis. The chromatographic instrument system was equipped with reflective index detector. The injection volume for sample was set at 5 µl. The separation was performance using NH_2 column (250 mm x 4.6 mm, i.d., 5µm) with isocratic eluent mixture of acetonitrile: water (80:20) at flow rate 0.8 ml/min for 30 minutes. Determination of sugar constituents (fructose, glucose, sucrose and maltose) was accomplished based on calibration curves performed using known concentrations of each reference standard.

2.4 Gross Energy

The chiller was adjusted to 18°C, and upon reaching this temperature, the sample (500 mg) was analysed using the bomb calorimeter. The oxygen was calibrated to 450 psi for combustion purposes. The gross energy was ascertained through combustion, yielding the calorific value (Wang et al., 2021).

2.5 Determination of vitamins content

Vitamin A and C were determined as follows:

2.5.1 Vitamin A

Five grams of the sample were weighed in a centrifuge tube, and subsequently, 50 mL of a solvent mixture (hexane: acetone: ethanol in a ratio of 25:12.5:12.5) was added. The mixture underwent additional centrifugation for 40 minutes at 4000 rpm. The sample solution was subsequently analyzed using HPLC. The injection volume was established at 5 µl. The chromatographic separation was conducted utilizing a C18 column (150 mm x 4.6 mm, i.d., 2.6µm) with an isocratic eluent mixture of methanol and hexane (70:30) at a flow rate of 0.8 ml/min for 10 minutes. The eluent was observed using a diode array detector at 450 nm (Tee and Lim, 1992). The vitamin A content in the sample was ascertained using the calibration curve of the standard.

2.5.2 Vitamin C

Five grams of the sample were weighed in a conical flask and subsequently combined with 25 mL of a diluting solution (water: ACN: acetic acid in a ratio of 94:5:1). The conical flask was enveloped in aluminum foil and immersed in a water bath at 65ºC for 15 minutes. The sample was filtered first with filter paper and then with a nylon syringe filter. A 5 µl sample was injected into the HPLC system at a flow rate of 0.6 ml/min for a duration of 5 minutes. The separation was achieved utilizing a C18 column (150 mm x 4.6 mm, i.d., 2.6µm) with an isocratic eluent composed of ammonium acetate in a 50:50 mixture of water and acetonitrile, monitored at a wavelength of 260 nm (Tai and Gohda, 2007). The vitamin C content in the sample was quantified based on the standard curve of the reference standard.

2.6 Determination of minerals content

One gram of the dried and ground sample was combined with 10 millilitres of concentrated nitric acid and agitated in a digestion tube. The test material may remain undisturbed for 24 hours. The digestion tube was subsequently positioned in the holes of the heating block and subjected to boiling for 2 hours at 115 °C. 5 mL of concentrated hydrochloric acid is introduced, and heating is sustained until a transparent solution is attained. The test material was permitted to cool at ambient temperature. The test sample volume was adjusted to 100 mL using deionised water and thoroughly mixed. The prepared solution was filtered through ashless filter paper into a plastic container. The processed test material underwent Inductively Coupled Plasma - Optical Emission Spectrometry (ICP-OES). The argon gas flow was established at 15 L/min, the auxiliary compressed air at 0.2 L/min, and the nebulizer nitrogen flow at 0.55 L/min. The identification of 12 essential minerals typically found in vegetables was achieved using wavelengths ranging from 181 to 766 nm (Kumaravel and Alagusundaram, 2014).

RESULTS AND DISCUSSION

3.1 Sugars content

Table 1 presents the sugar content of nine selected vegetables from seven farming communities. Mini eggplant, long eggplant, and spinach contain various types of sugars, including fructose, glucose, sucrose, and maltose. The mini eggplant from the Intan Baiduri Kepong community demonstrated the highest total sugar content among the varieties, with a total value of 6.7 g/100g. It also contained the highest concentrations of fructose and glucose, measuring 1.97 g/100g and 3.61 g/100g, respectively. These findings align with numerous prior studies on mini eggplant, which exhibit a high concentration of sugar-related constituents (Rosa-Martínez et al., 2021; Salamatullah et al., 2021; Ayaz et al., 2015).

Mustard leaf demonstrated the highest concentrations of sucrose and maltose, measuring 1.53 g/100g and 1.39 g/100g, respectively. Sucrose, comprising one glucose unit, and maltose, consisting of two glucose units, may facilitate the rapid provision of energy to the body. Research demonstrates that glucose is absorbed more rapidly and efficiently than other sugars, attributable to its greater quantity of active glucose co-transporter proteins (Sun and Empie, 2012).

Although some of the vegetables such as lady finger, round eggplant, bitter melon and mustard greens did not contain all types of sugars, the common unit of sugar such as fructose and glucose were detected. Presence of fructose in these vegetables could attract consumption due to its sweetness although at low intensity of concentration besides low in glycemic index (GI) (Rizki et al., 2020; Choo et al., 2018).

Sucrose, the sugar with the highest molecular weight, is a combination of glucose and fructose and is present in all vegetables except for bitter melon. For sucrose to be absorbed by the body, its molecular structure must be degraded through enzymatic metabolism (Luo et al., 2021). It is a slower-releasing carbohydrate compared to glucose, which may assist in regulating blood sugar levels, in addition to having a lower glycemic index (Campbell et al., 2018).

Table 1. Sugars content of vegetables from selected Malaysian community farming

Item	Location	Fructose (g/100g)	Glucose (g/100g)	Sucrose (g/100g)	Maltose (g/100g)
Okra	Percint 9 Fasa II, Putrajaya	0.9±0.02	0.85±0.05	0.08±0.01	ND
	Seksyen 4, Bangi	0.62±0.01	0.94±0.03	ND	ND
Round eggplant	Percint 9 Fasa II, Putrajaya	1.23±0.01	1.42±0.04	0.13±0.01	ND
Mini eggplant	SK Ayer Panas, Kuala Lumpur	1.82±0.07	1.42±0.05	0.41±0.02	ND
	Seksyen 16, Shah Alam	0.98±0.01	0.54±0.01	0.85±0.01	0.52±0.01
	PPR Intan Baiduri, Kepong	1.97±0.03	3.61±0.08	ND	1.12±0.01
	Felcra Lubuk Sireh, Perlis	0.71±0.02	2.19±0.03	1.06±0.03	ND
Long eggplant	Percint 9 Fasa II, Putrajaya	1.26±0.05	1.00±0.03	0.25±0.02	0.14±0.02
Mustard green	SK Ayer Panas, Kuala Lumpur	ND*	1.22±0.08	1.53±0.04	1.39±0.15

	Percint 9 Fasa II, Putrajaya	0.32±0.01	0.24±0.02	ND	ND
Bitter melon	PPR Intan Baiduri, Kepong	0.98±0.02	1.49±0.04	ND	0.81±0.07
Long bitter melon	SK Ayer Panas, Kuala Lumpur	0.33±0.02	0.44±0.03	0.09±0.01	ND
Pak choi	SK Ayer Panas, Kuala Lumpur	0.26±0.03	0.48±0.02	ND	ND
Spinach	Flat Seri Sabah Cheras	0.52±0.01	0.47±0.05	1.24±0.07	0.46±0.01

*ND = not detected

3.2 Gross energy

Energy is the power or fuel essential for human existence. It is primarily derived from carbohydrates (sugars), lipids, and proteins. Table 2 displayed the energy content of vegetables from chosen Malaysian community farming. The energy content ranged from 2900 to 3800 joules/g. Okra from Seksyen 4, Bangi exhibits the highest energy content among its counterparts, with a value of 3895.1 joules/g. This followed by bitter melon from PPR Intan Baiduri, Kepong, mini eggplant from Seksyen 16, Shah Alam, mini eggplant from PPR Intan Baiduri, Kepong, mini eggplant from Felcra Lubuk Sireh, Perlis, mustard green from Percint 9 Fasa II, Putrajaya, okra from Percint 9 Fasa II, Putrajaya, mini eggplant from SK Ayer Panas, Kuala Lumpur, long bitter melon from SK Ayer Panas, Kuala Lumpur, spinach from Flat Seri Sabah, Cheras, round eggplant from Percint 9 Fasa II, Putrajaya and pak choi from SK Ayer Panas, Kuala Lumpur with values of 3813.1, 3794.8, 3628.5, 3603.4., 3628.5, 3570.5, 3513.1, 3431.3, 3402.5, 3351.6, 3317.4 and 3251.6 joule/g, respectively. Mustard greens from SK Ayer Panas, Kuala Lumpur exhibit the lowest energy content, measuring below 3000 joules/g. Despite the low sugar content in okra from Seksyen 4, Bangi, its elevated energy value may be attributed to other components such as lipids and proteins, as evidenced by studies on soybean, baby corn, cabbage, carrot, cauliflower, cucumber, jackfruit, peas, potato, sweet corn, tomato, and radish leaves (Valentim et al., 2023; Bakshi et al., 2016). Despite the identical species of mustard green being cultivated at SK Ayer Panas, Kuala Lumpur, and Percint 9 Fasa II, Putrajaya, the gross energy value content is markedly dissimilar. This may be attributed to environmental factors, particularly soil, temperature, humidity, and fertilization. Numerous prior studies indicate that environmental factors, including soil pH, structure, and temperature fluctuations, significantly affect plant growth and its constituents. (Zhang et al., 2018; Zhang et al., 2016).

Table 2. Energy content of vegetables from selected Malaysian community farming

Item	**Location**	**Average (Joule/g)**
Okra	Percint 9 Fasa II, Putrajaya	3513.1± 1.2
	Seksyen 4, Bangi	3895.1± 0.5
Round eggplant	Percint 9 Fasa II, Putrajaya	3317.4± 1.6
Mini eggplant	SK Ayer Panas, Kuala Lumpur	3431.3 ± 1.3
	Seksyen 16, Shah Alam	3794.8 ±3.3
	PPR Intan Baiduri, Kepong	3628.5±0.2
	Felcra Lubuk Sireh, Perlis	3603.4 ±3.3
Long eggplant	Percint 9 Fasa II, Putrajaya	3628.5±0.2
Mustard green	SK Ayer Panas, Kuala Lumpur	2917.4 ±1.9
	Percint 9 Fasa II, Putrajaya	3570.5 ±2.8
Bitter melon	PPR Intan Baiduri, Kepong	3813.1 ± 1.4
Long bitter melon	SK Ayer Panas, Kuala Lumpur	3402.5 ± 1.7
Pak choi	SK Ayer Panas, Kuala Lumpur	3259.5 ± 2.9
Spinach	Flat Seri Sabah, Cheras	3351.6 ± 1.8

3.3 Vitamins and minerals

Vitamins and minerals play an important role for physiological functions for human. Both constituents could react as antioxidants agent and immune function as reported in many studies (Dasgupta and Klein, 2014; Puścion-Jakubik et al., 2021). Distribution of vitamins and minerals in plants especially vegetables have also been reported widely by researchers (Slavin and Lloyd, 2012; Achikanu et al., 2013). In this study, vitamin A and C together with 12 minerals content were determined from selected vegetables planted in urban community farming area.

3.3.1 Vitamin A Content

Table 3 displayed the vitamin A content of vegetables from chosen Malaysian community agriculture. The vitamin A content varies from 0.11 to nearly 109 mg/100g of fresh vegetables. Pak choi sourced from SK Ayer Panas, Kuala Lumpur exhibits the highest vitamin A content, measuring 108.55 mg/100g. This is followed by mini eggplant from Felcra Lubuk Sireh, Perlis; mustard green from Percint 9 Fasa II, Putrajaya; spinach from Flat Seri Sabah, Cheras, Kuala Lumpur; mustard green from SK Ayer Panas, Kuala Lumpur; okra from Percint 9 Fasa II, Putrajaya; long eggplant from Percint 9 Fasa II, Putrajaya; long bitter melon from SK Ayer Panas, Kuala Lumpur; okra from Seksyen 4, Bangi, Selangor; and round eggplant from Percint 9 Fasa II, Putrajaya, with values of 96.69, 80.38, 43.99, 33.24, 3.16, 2.01, 0.6, 0.18, and 0.11 mg/100g, respectively.

Vegetables cultivated at SK Ayer Panas, Kuala Lumpur consistently demonstrated substantial values in terms of sugar content and gross energy. Despite utilizing the same species of vegetables, such as okra, mini eggplant, and mustard greens, the vitamin content exhibits varying values. Both results may be attributed to environmental conditions, particularly soil, temperature, humidity, and fertilization, as previously discussed in relation to gross energy.

Table 3. Vitamin A content of vegetables from selected Malaysian community farming

Item	Location	VITAMIN A (mg/100g)
Okra	Percint 9 Fasa II, Putrajaya	3.16 ± 0.01
	Seksyen 4, Bangi Selangor	0.18 ± 0.05
Round eggplant	Percint 9 Fasa II, Putrajaya	0.11 ± 0.01
Mini eggplant	SK Ayer Panas, Kuala Lumpur	ND*
	Seksyen 16, Shah Alam, Selangor	ND
	PPR Intan Baiduri, Kepong, Selangor	ND
	Felcra Lubuk Sireh, Perlis	96.69 ± 0.15
Long eggplant	Percint 9 Fasa II, Putrajaya	2.01 ± 0.6
Mustard green	SK Ayer Panas, Kuala Lumpur	33.24±0.9
	Percint 9 Fasa II, Putrajaya	80.38 ± 0.63
Bitter melon	PPR Intan Baiduri, Kepong, Selangor	ND
Long bitter melon	SK Ayer Panas, Kuala Lumpur	0.6 ± 0.1
Pak choi	SK Ayer Panas, Kuala Lumpur	108.55 ± 0.46
Spinach	Flat Seri Sabah, Cheras, Kuala Lumpur	43.99 ± 0.4

*ND = not detected

3.3.2 Vitamin C Content

Vitamin C, also referred to as ascorbic acid, is a water-soluble vitamin. Numerous prior studies have documented its significant role in health benefits, highlighting its antioxidant properties along with anti-inflammatory and immune-supporting effects (Spoelstra-de Man et al., 2018; Jouybar et al., 2012), among others. Given the significance of vitamin C for human health, the USFDA has established the recommended daily allowance (RDA) for adults at 100-120 mg per day (Naidu, 2003). The human body is incapable of synthesizing vitamin C due to the absence of L-gulonolactone oxidase. It can be generated by the majority of plants, including fruits and vegetables (Ali et al., 2024).

Table 4 displayed the vitamin C content of vegetables from a selected Malaysian community farm. The vitamin C concentration in the vegetables varies from 4 to 24 mg/100g. Mustard greens from Percint 9 Fasa II, Putrajaya, exhibit the highest vitamin C content among the samples, with a value of 24.0 mg/100g. This is followed by bitter melon from PPR Intan Baiduri, Kepong; okra from Percint 9 Fasa II, Putrajaya; spinach from Flat Seri Sabah, Cheras; long bitter melon from SK Ayer Panas, Kuala Lumpur; pak choi from SK Ayer Panas, Kuala Lumpur; okra from Seksyen 4, Bangi; and mini eggplant from Seksyen 16, Shah Alam, with respective values of 16, 11, 10, 9, 8, 5, and 4 mg/100g.

The highest content of vitamin C in mustard green which belongs to leafy vegetables under family of Brassica could be due to presence of L-gulonolactone oxidase besides environment factors. This finding agreed with many previous studies report within leafy vegetables especially family of Brassica that possess significant amount of vitamin C due to the presence of L-gulonolactone oxidase which is important for the last step of vitamin C biosynthesis (Castro et al., 2023; Gao et al., 2021; Yuan et al., 2020).

Table 4. Vitamin C content of vegetables from selected Malaysian urban community farming

Item	Location	Vitamin C (mg/100g)
Okra	Percint 9 Fasa II, Putrajaya	11.0 ±1.0
	Seksyen 4, Bangi	5.00± 0.1
Round eggplant	Percint 9 Fasa II, Putrajaya	ND*
Mini eggplant	SK Ayer Panas, Kuala Lumpur	ND
	Seksyen 16, Shah Alam	4.00± 0.1
	PPR Intan Baiduri, Kepong	ND
	Felcra Lubuk Sireh, Perlis	ND
Long eggplant	Percint 9 Fasa II, Putrajaya	ND
Mustard green	SK Ayer Panas, Kuala Lumpur	ND
	Percint 9 Fasa II, Putrajaya	24.0 ±1.0
Bitter melon	PPR Intan Baiduri, Kepong	16.00 ± 0.2
Long bitter melon	SK Ayer Panas, Kuala Lumpur	9.0 ±1.0
Pak choi	SK Ayer Panas, Kuala Lumpur	8.0 ±1.0
Spinach	Flat Seri Sabah, Cheras	10.0 ± 0.2

*ND = not detected

3.4 Minerals content

Minerals are crucial for enhancing bodily functions, particularly in sustaining optimal health. Twelve significant minerals have been emphasized in numerous nutritional studies, namely aluminum (Al), boron (B), calcium (Ca), copper (Cu), iron (Fe), potassium (K), magnesium (Mg), manganese (Mn), sodium (Na), phosphorus (P), sulfur (S), and zinc (Zn) (Weyh et al., 2022; Hunt and Meacham, 2001).

Table 5 displayed the mineral content of twelve minerals in vegetables from selected Malaysian community farming. The chosen vegetables contain all twelve mineral constituents, despite being cultivated in various locations. Spinach cultivated at Flat Seri Sabah, Cheras exhibits the highest percentage of elemental types among vegetables, comprising four elements: boron (B), potassium (K), magnesium (Mg), and phosphorus (P), with respective values of 0.0038%, 8.6515%, 0.7379%, and 0.5437%. This was succeeded by the cultivation of mustard greens at Precinct 9, Phase II, Putrajaya, incorporating three mineral types: aluminum (Al), calcium (Ca), and sulfur (S), with respective concentrations of 0.0465%, 2.0839%, and 0.8719%. Pak choi cultivated at SK Ayer Panas, Kuala Lumpur contains two predominant minerals: iron (Fe) at 0.405% and manganese (Mn) at 0.553%. Other vegetable varieties, including okra from Seksyen 4, Bangi, and mini eggplant from PPR Intan Baiduri, Kepong, exhibit elevated mineral concentrations, specifically zinc (Zn) and manganese (Mn), with values of 0.2522% and 0.018%, respectively.

According to prior research (Waseem et al., 2021; Fadupin et al., 2017), spinach is recognized for its substantial mineral content, particularly potassium, magnesium, and phosphorus. Potassium, magnesium, and phosphorus are crucial for blood pressure regulation, enzyme activation, and maintaining healthy bones, respectively (Chan et al., 2024; Weyh et al., 2022; Serna and Bergwitz, 2020). The elevated sulfur content in mustard greens relative to other vegetables may be attributed to the presence of isothiocyanate compounds, as indicated by prior research (Lima et al., 2019).

Table 5. Mineral content of vegetables from selected Malaysian urban community farming

Item	Location	%Al 396 nm	%B 249 nm	%Ca 317 nm	%Cu 324 nm	%Fe 239 nm	%K 766 nm	%Mg 285 nm	%Mn 257 nm	%Na 257nm	%P 214nm	%S 181 nm	%Zn 213 nm
Okra	Percint 9 Fasa II, Putrajaya	0.0034	0.0021	0.8762	0.009	0.0072	2.1662	0.4385	0.0018	0.0201	0.4538	0.2339	0.0045
	Seksyen 4, Bangi	0.0010	0.0018	0.6543	0.0008	0.012	2.1456	0.3763	0.0115	0.001	0.4108	0.0041	0.2522
Rround eggplant	Percint 9 Fasa II, Putrajaya	0.0014	0.0015	0.1326	0.0013	0.0046	2.2889	0.1373	0.0015	0.0271	0.249	0.1869	0.0018
Mini eggplant	SK Ayer Panas, Kuala Lumpur	0.0003	0.002	0.1858	0.0008	0.0063	2.2634	0.1443	0.0018	0.0173	0.3067	0.1807	0.0019
	Seksyen 16, Shah Alam	0.0012	0.0013	0.1145	0.0004	0.0055	2.2524	0.1988	0.0016	0.0113	0.3167	0.2697	0.002
	PPR Intan Baiduri,Kepong	0.0016	0.0016	0.212	0.0013	0.0041	2.0729	0.1824	0.018	0.0178	0.2669	0.269	0.002
	Felcra Lubuk Sireh,Perlis	0.0003	0.0014	0.1765	0.0004	0.0039	2.0693	0.1528	0.0014	0.0188	0.2578	0.0014	0.0017
Long eggplant	Percint 9 Fasa II, Putrajaya	0.0007	0.0015	0.2465	0.001	0.0081	2.5455	0.1642	0.0011	0.0212	0.2898	0.1942	0.0017
Mustard green	SK Ayer Panas, Kuala Lumpur	0.0034	0.0034	1.7027	0.0004	0.0083	3.123	0.2906	0.0027	0.0368	0.4113	0.347	0.0094
	Percint 9 Fasa II, Putrajaya	0.0465	0.0024	2.0839	0.0006	0.0511	4.1032	0.2572	0.0026	0.1247	0.4868	0.8719	0.0044
Bitter melon	PPR Intan Baiduri, Kepong	0.0009	0.0017	0.3276	0.0006	0.004	2.7289	0.2353	0.0015	0.0285	0.4192	0.227	0.0027
Long bitter melon	SK Ayer Panas, Kuala Lumpur	0.0091	0.0041	0.18	0.0024	0.0074	2.2414	0.1667	0.0022	0.0419	0.3349	0.4548	0.0029
Pak choi	SK Ayer Panas, Kuala Lumpur	0.0037	0.0032	1.5143	0.0035	0.405	3.4105	0.3136	0.0028	0.553	0.5206	0.768	0.0068
Spinach	Flat Seri Sabah, Cheras	0.0127	0.0038	0.6603	0.0011	0.0151	8.6515	0.7379	0.0057	0.4892	0.5437	0.4616	0.0047

CONCLUSION

This study demonstrated that vegetables cultivated through urban community farming possess significant nutritional value, including sugars, gross energy, vitamins, and minerals, despite being grown in various locations. Three vegetables, namely mini eggplant from Seksyen 16, Shah Alam; long eggplant from Percint 9 Fasa II, Putrajaya; and spinach from Flat Seri Sabah, Cheras, contain all varieties of targeted sugars, whereas others contain at least two types. All vegetables analysed displayed varying energy content typically associated with sugars. Vitamin A was identified in all vegetables, excluding mini eggplant and bitter melon. Regarding vitamin C, five vegetable varieties contain it, with two detectable only at specific locations, while the others were undetectable. Ultimately, all vegetables cultivated in urban community farming were determined to contain twelve specific minerals according to the analysis. These findings indicate that vegetables cultivated in urban community areas have significant nutritional value. The scientific findings from this study aim to invigorate the expansion of urban farming activities in the future.

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AUTHOR CONTRIBUTIONS

Mohd Nazrul Hisham Daud: Conceptualisation, methodology, formal analysis and investigation, writing-original draft preparation, writing-review and editing, resources; Mohd Lip Jabit: methodology, formal analysis and investigation; Norhasni Ramli: methodology, formal analysis and investigation; Nur Syafini Ghazali: Sample collection and postharvest handling; Joanna Cho Lee Ying: Sample collection and postharvest handling; Azirah Omar: methodology, formal analysis and investigation.

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DATA AVAILABILITY

Not applicable.

COMPETING INTEREST

The authors declare that there are no competing interests.

COMPLIANCE OF ETHICAL STANDARDS

Not applicable.

SUPPLEMENTARY MATERIAL

Not applicable.

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