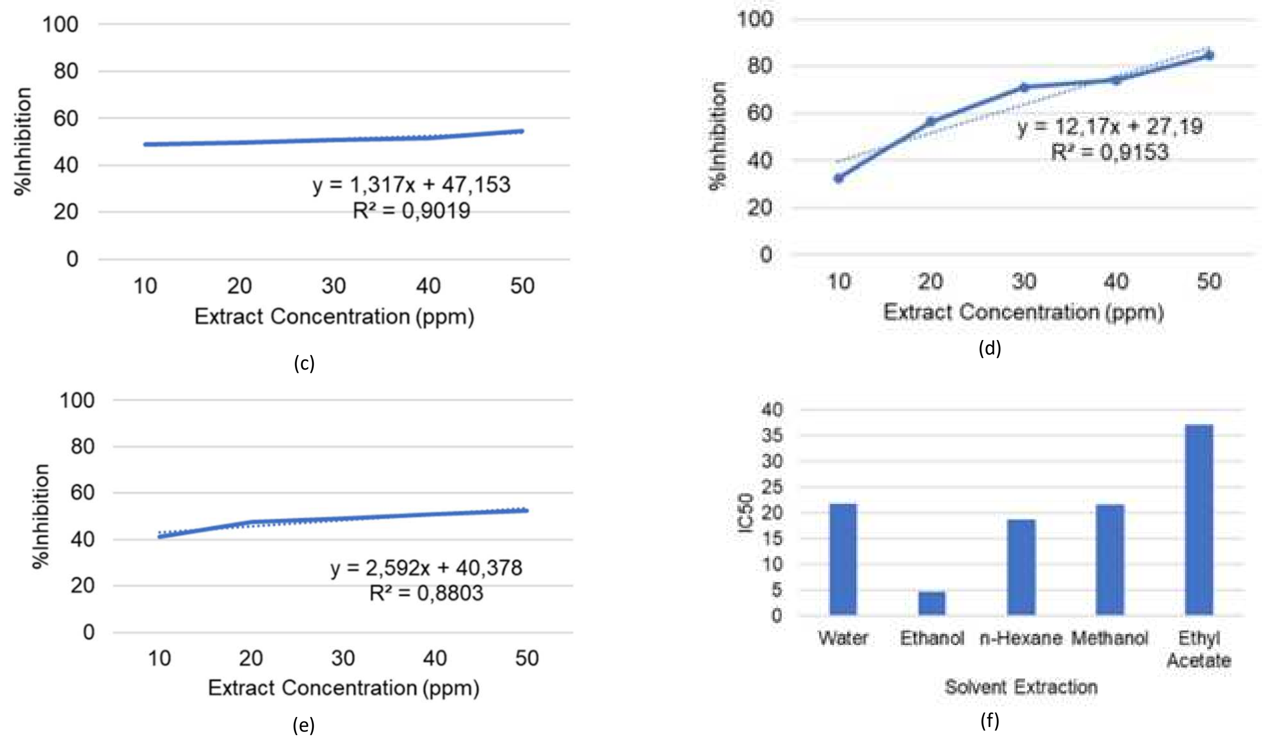

Fig. 1 The DPPH inhibitory and IC50 of Gayo Arabica Coffee Cascara Pulp Extract with varied solvent extractions, A. water extract, B. ethanol extract, C. methanol extract, D. n-hexane extract, E. ethyl acetate extract, F. IC50 revealing antioxidant activity

B. Secondary metabolites profile of cascara Gayo arabica coffee

Various solvents for extraction performed varied antioxidant activities, and varied solvents also affected the metabolites profile. Table 1—3 shows there are several solvents with the same compounds, ethanol, methanol, and ethyl acetate, with 5-Hydroxymethylfurfural compounds that function as antioxidants, antibacterial, and antiproliferative. However, the concentrations of the compounds in the three solvents were different. The highest concentration was found in ethanol solvent, and the lowest concentration of 5-Hydroxymethylfurfural was found in ethyl acetate solvent.

TABLE I
METABOLITE PROFILES OF CASCARA GAYO ARABICA COFFEE IN ETHANOL SOLVENT

Retention time	% Area	Compound	Biological Activity
21.377	22.31	5-Hydroxymethylfurfural	Antioxidant, antibacterial, and antiproliferative [32]
29.277	21.07	Caffeine	Antioxidant and antimicrobial [33]
30.701	12.85	n-Hexadecanoic acid	Anti-cancer, antioxidant, anti-cancer, anti-alopecic, anti-inflammatory [34] 35]
32.435	11.94	Cis-Vaccenic acid	Antibacterial, hypolipidemic effect, antioxidant, anti-inflammatory[36]
28.005	3.93	Hydrazinecarboxamide, 2-(2-methylcyclohe)	Anticonvulsant[37]

TABLE II
METABOLITE PROFILES OF CASCARA GAYO ARABICA COFFEE IN METHANOL SOLVENT

Retention time	% Area	Compound	Biological Activity
21.830	16.61	5-Hydroxymethylfurfural	Antioxidant, antibacterial, and antiproliferative [32]
29.326	12.55	Caffeine	Antioxidant and antimicrobial [33]
28.295	10.59	Quinic Acid	Anti-HIV-1 Antioxidant [38] 37]
30.706	7.38	n-Hexadecanoic acid	Anti-cancer, antioxidant, anti-cancer, anti-alopecic, and anti-inflammatory [34] 35]
32.416	5.71	cis-Vaccenic acid	, antibacterial, hypolipidemic effect, antioxidant, and anti-inflammatory[36]

TABLE III
METABOLITE PROFILES OF CASCARA GAYO ARABICA COFFEE IN N-HEXANE SOLVENT

Retention time	% Area	Compound	Biological Activity
28.934	57.53	Caffeine	Antioxidant and antimicrobial [33]
35.413	5.94	Hexadecanoic acid, 2-hydroxy-1-(hydroxyl)	No activity was reported [40]
30.534	5.26	Palmitic acid n-Hexadecanoic acid	Anti-cancer antioxidant, anti-cancer, anti alopecic, anti-inflammatory [34], [35]
36.947	4.50	9-Octadecenoic acid (Z)-, 2,3-dihydroxypropil ester	Hepatoprotective activity[41], anti-cancer [42], antifungal, antibacterial [43]
30.029	4.34	Hexadecanoic acid, methyl ester (CAS) methyl palmitate	Antioxidant, hemolytic, hypocholesterolemic[43]

In addition, the n-hexadecenoic acid (Table 4) compound, which functions as an antioxidant, is also found in several solvents, namely ethanol and n-hexane solvents, but with different compound concentrations, the highest concentration of n-hexadecenoic acid compounds is found in ethanol solvents. The caffeine compound that functions as an antioxidant and antimicrobial is also found in several solvents, namely ethanol, methanol, n-Hexane, and ethyl acetate, with caffeine compound concentration found in n-Hexane solvent, 57.53%, and the lowest caffeine concentration was found in methanol solvent, 12.55%.

The water and methanol solvent fractions also have the same compound, quinic acid, which functions as an antioxidant with the highest concentration in the water solvent fraction. The utilization of natural products in the cosmetic application is becoming a great interest nowadays as phenolic compound biological activity proved to have anti-aging activity and the ability to protect skin from ultraviolet radiation [31]. An animal study conducted by Marija et al. [47] shows that a dietary supplement derived from a vegetable from the genus Brassica reduced the effect of skin aging. Puxvadee et al. [48] use *Phyllanthus emblica L.* branch in topical gel to evaluate the efficacy of the anti-aging activity. Clinical improvement was observed in the effect of skin aging, such as reduction of skin wrinkles, enhanced skin elasticity, and lightening skin color.

TABLE IV
METABOLITE PROFILES OF CASCARA GAYO ARABICA COFFEE IN ETHYL ACETATE SOLVENT

Retention time	% Area	Compound	Biological Activity
21.187	13.88	5-Hydroxymethylfurfural	Antioxidant, antibacterial and antiproliferative [32]
29.130	13.81	Caffeine	Antioxidant and antimicrobial [33]
27.307	9.83	1(2H)-Naphthalenone, octahydro-4a,8a-dim	Antioxidant [44]
30.605	8.16	n-Hexadecanoic acid	Anti-cancer, antioxidant, antialopecic, anti-inflammatory [34],[35]
32.347	6.90	Oleic acid	Lower blood pressure, anti-cancer, hepatoprotective, anti-inflammatory [45], [46]

IV. CONCLUSION

In conclusion, various solvents affected the antioxidant and metabolite profiles of cascara Gayo Arabica coffee extracts. The ethanolic extract performs the high antioxidant activity with the lowest IC50 of DPPH inhibition, while the lowest antioxidant activity was ethyl acetate solvent treatment. Polar and non-polar solvents performed different metabolites and shifted the retention time of compounds.

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