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A sytemic review on total phenolic content present in various drug substance.

Una revisión sistémica del contenido fenólico total presente en diferentes fármacos.

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ABSTRACT

Antioxidant is a solidity which prevents the oxidation of a substrate.They fend off or delay the cell damage precipitated by free radical. The Antioxidant activity of the amalgam can be assessed by standard simple experiments like DPPH and FCR reagents tests .The main objective intent of this study is to evaluate and review the profitability of determining total phenolic content with the help of Folin Ciocalteu reagent (FCR) in any drug material agnate to the antioxidative property. Articles issued between 2004 to 2017 were encompassed in this review. Databases namely google scholar, PubMed were trouped for assemblaging the articles. Keyphrases like total phenolic content, FCR reagent, fruits, antioxidants were accustomed for assemblages of articles. The inspect of studies have stated that 23/30 reported praxis of FCR Reagent to dictate the antioxidative property of various drugs in impetus of qualitative and quantitative assay. The wind up of this study had disclosed that FCR is one of the frequent reagent which was used to determine the antioxidant property

Keywords Total Phenolic content, FCR Reagent, Antioxidants.

RESUMEN

Los antioxidantes son una solida defensa que evita la oxidación de un sustrato, defienden o retrasan el daño celular precipitado por los radicales libres. La actividad antioxidante de la

amalgama se puede evaluar mediante experimentos simples estándar como las pruebas de reactivos DPPH y FCR. El objetivo principal de este estudio es evaluar y revisar la rentabilidad de determinar el contenido fenólico total con la ayuda del reactivo de Folin Ciocalteu (FCR) en cualquier material farmacológico asociado a la propiedad antioxidante. Los artículos publicados entre 2004 y 2017 se incluyeron en esta revisión. Se utilizaron bases de datos, a saber, Google Scholar, PubMed, para recopilar los artículos. Se utilizaron frases clave como contenido fenólico total, reactivo FCR, frutas, antioxidantes para ensamblajes de artículos.

La inspección de los estudios ha indicado que 23/30 informó la práctica del reactivo FCR para dictar las propiedades antioxidantes de varios fármacos en el impulso de un ensayo cualitativo y cuantitativo. La conclusión de este estudio había revelado que el FCR es uno de los reactivos frecuentes que se utilizó para determinar la propiedad antioxidante.

Palabras clave Contenido fenólico total, Reactivo FCR, Antioxidantes.

INTRODUCTION

Antioxidants are the core substances which shields cells across free radicals by hiking the growth of phenols. Antioxidants are man-made or natural substances that may prevent or delay some types of cell damage. Antioxidants are found in many foods, including fruits and vegetables. They are also available as supplements. Examples of antioxidants Carotene, Lutein, Lycopene, Selenium, Vitamin A, Vitamin C, Vitamin E Vegetables and fruits are rich sources of antioxidants.Foods that are particularly high in antioxidants are often referred to as a "superfood" or "functional food."Vitamin A: Dairy produce, eggs, and liver .Vitamin C: Most fruits and vegetables, especially berries, oranges, and bell peppers.Vitamin E: Nuts and seeds, sunflower and other vegetable oils, and green, leafy vegetables.Beta-carotene: Brightly coloured fruits and vegetables, such as carrots, peas, spinach, and mangoes. Lycopene: Pink and red fruits and vegetables, including tomatoes and watermelon Lutein: Green, leafy vegetables, corn, papaya, and oranges .Selenium: Rice, corn, wheat, and other whole grains, as well as nuts, eggs, cheese, and legumes Other foods that are believed to be good sources of antioxidants include:Eggplant,Legumes such as black beans or kidney beans, Green and black teas, Red grapes,Dark chocolate,Pomegranates,Goji berries,Goji berries Foods with rich, vibrant colors often contain the most antioxidants.

Three various mechanisms of Antioxidant action are :1) convey the radical character with genesis of reactive Antioxidant-derived radical 2) trapping of free radicals with formations of a stable or inert free radical trap 3) Molecules which mimic Antioxidant enzyme activities

Phenolics are mainly incorporated with simple phenols, phenolic acids (benzoic and cinnamic acid derivatives), coumarins, flavonoids, stilbenes, hydrolysable, condensed tannins, lignans, and lignins. Which are classified under secondary metabolites in plant kingdom. These

metabolites are mainly liable for the plant pigmentation, antioxidants, and protective agents against UV light.[1]

Oxygen radical scavengers are the main characteristics of Phenolic compounds. Potential of the phenolic radical shows lower electron reduction as compared to electron reduction potential of oxygen radicals. The phenoxy radicals are less reactive than oxygen radicals. Hence scavenge reactive oxygen by phenolic compounds intermediates with no such promoting further oxidative reactions. It follows that many environmental stresses leading to oxidative stress often induce the synthesis of phenolic metabolites

Phenolic compounds can act as protective agents, inhibitors, natural animal toxicants and pesticides against invading organisms, i.e. herbivores, nematodes, phytophagous insects, and fungal and bacterial pathogens. The scent and pigmentation conferred by other phenolics can attract symbiotic microbes, pollinators and animals that disperse fruits

Phenolic acids, which are readily absorbed through intestinal tract walls, are beneficial to human health due to their potential antioxidants and avert the damage of cells resulted from free-radical oxidation reactions. On regular eating, phenolic acids also promote the anti-inflammation capacity of human beings

Depending on the number of hydroxyl groups attached, phenols can be classified into three types.1) phenols: They contain one -OH group.2) Dihydric phenols: They contain two -OH groups. They may be ortho-, meta- or para- derivative.3)Trihydric phenols: They contain three -OH groups.

The DPPH assay and FCR Reagent test are customary to predict antioxidant activities by mechanism in which antioxidants act to inhibit lipid oxidation, so scavenging of DPPH radical and therefore determinate free radical scavenging capacity.

The method is widely used due to relatively short time required for the analysis.The Folin–Ciocâlteu reagent (FCR) or Folin's phenol reagent or Folin–Denis reagent, also called the gallic acid equivalence method (GAE), is a mixture of phosphomolybdate and phosphotungstate used for the colorimetric in vitro assay of phenolic and polyphenolic antioxidants.The method relies on the transfer of electrons in alkaline medium from phenolic compounds to form a blue chromophore constituted by a phosphotungstic/ phosphomolybdenum complex where the maximum absorption depends on the concentration of phenolic compounds

MATERIALS AND METHODS

The articles allied with antioxidants and total phenolic content were imperturbabled from google scholar, PubMed database between 2004 to 2017 were collected by means of key phrases like; phenolic content, DPPH, etc. Out of these 30 articles are picked for this review. The criteria used for these studies are (see table. No.1.)

i) Name of the author : Name of all the Authors Corresponding to that particular article was included here

ii) Published year: Year at which the article was published was added in this section

iii) Techniques used : In this section disparate techniques which was used to escort the experimental was mentioned

iv) Reagent used :Various reagents which were pre owned to perform the experiments were covered here

v) Species :Numerous species which are mentioned in the various articles are appended here

vi) Statistical tests : varying statistical test which are encompassed are computed here

vii) Result :concluding results from various articles are in builted here

Table. No. 1. Summary of articles including description of experimental model and methodological quality criteria

S. No.	Name of authors	Published year	Technique used	Reagents	Species used	Statistical test	Result
1.	Fehmi Odabasoglu1, Ali Aslan2, Ahmet Cakir3*, Halis Suleyman4, Yalcin Karagoz1, Mesut Halici1 and Yasin Bayir1	(2004)	Antioxidant activities by thiocyanate method	Folin-Ciocalteu's Reagent	*Usnea longissima* Ach., *Usnea florida* (L.) Weber ex Wigg. and *Lobaria pulmonaria* (L.) Hoffm	SPSS 9.0 software. one-way variance analyses (ANOVA)	it can be stated that the methanol extracts of *L. pulmonaria* and *U. longissima* exhibited potent antioxidant activity and reducing power, although the antioxidant activities of these species were lower than that of trolox

2.	Yean-Yean Soong *, Philip J. Barlow	2004	ABTS cation radical-scavenging and FRAP assays	FCR assay was used to for total phenolic content.	*Avocado (Persea Americana Mill.), jackfruit (Artocarpus heterophyllus Lam.), longan (Dimocarpus longan Lour.), mango (Mangifera indica L.), and tamarind (Tamarindus indica L.)* were purchased on several separate occasions from local markets in Singapore.	Correlation	total antioxidant capacity and phenolic content of fruit seeds than of the edible portions. The AEAC and FRAP of heated MSKP products were increased to considerably more than those of freeze-dried sample
3.	Jasna Bertoncelj *, Urs˘ka Dobers˘ek, Mojca Jamnik, Terezija Golob	28 January 2007	DPPH, TPTZ	sucrose, fructose, glucose, maltose, and gallic acid were purchased from Sigma (St. Louis, MO, USA). Folin–Ciocalteu's phenol reagent	Seventy honey samples were obtained directly from beekeepers during the 2004 harvest from different locations across Slovenia.	Means, standard deviations (SD). One-way analysis of variance (ANOVA)	all types of honey contained phenolic compounds and possessed antioxidant activity.

4.	Mohammad Ali Ebrahimzadeh, Fereshteh Pourmorad* and Ahmad Reza Bekhradnia	8 August, 2008	Folin-Ciocalteau method, Metal chelating activity	Gallic acid, quercetin, EDTA and other necessary agents were purchased from Merck and Fluka companies. All	Medicinal plants from Iran	mean ± SD. Statistical analyses were performed by Student's *t*-test	direct relation between chelatory activity and the content of active compounds, phenol and flavonoid in some extracts Extracts with high phytochemicals and chelating activity can be observed
5.	Mahassine Amensoura, Esther Sendrab, Jamal Abrinia, Samira Bouhdida, José Angel Pérez-Alvarezb and Juana Fernández-López b	2009 April	, DPPH	Folin-Ciocalteau assay	aqueous extracts of myrtle (*Myrtus communis)* leaves and berries	one-way ANOVA analysis	highest correlation (r = 0.949), followed by the reducing power assay (r = 0.914) and the lowest for the β-carotene linoleic acid assay (r = 0.722

6.	Mohammed Fadlinizal Abd Ghafar, K. Nagendra Prasad, Kong Kin Weng and Amin Ismail	7 October, 2009	DPPH, (FRAP) assay	1-Diphenyl-2-picryl hydrazyl (DPPH), 2,4,6-tripyridyl-s-triazine (TPTZ), hesperidine, gallic acid and aluminium trichloride were from Sigma Chemical Co. (St Louis, MO, USA). Folin-Ciocalteau reagent (FC reagent), sodium carbonate and ferrous sulphate,	*Citrus species*	means ± standard deviations (SD) of three replicate determination, variance (ANOVA	t C. hystrix exhibited the highest antioxidant, flavonoid and phenolic content and can be used potentially as a readily accessible source of natural antioxidant.
7.	Carolina Henríquez1*, Sergio Almonacid2, Italo Chiffelle3, Tania Valenzuela3, Manuel Araya4, Lorena Cabezas4, Ricardo Simpson2, and Hernán Speisky5	October-December 2010)	(FRAP) assay, antioxidant capacity	(Folin-Ciocalteau assay)	Different fruit tissue Of five *apple* cultivars grown in chile	mean ± standard error (SE). These evaluations were performed by one-way ANOVA and statistical significance by Student's *t* test	the total phenolic content, antioxidant capacity, mineral composition, and physical and chemical characteristics vary considerably depending on the *apple* cultivars and fruit tissues analyzed

8.	Iuliana Spiridon, Ruxanda Bodirlau, Carmen-Alice Teaca	24 February 2011	DPPH assay	Folin-Ciocalteu phenol reagent method	*Romanian herbal medicine*	± SD. Correlation between analysis	*Origanum vulgare* extract showed the highest antioxidant activity and total phenolic content compared to the other plants extracts.
9.	Maizura, M., *Aminah, A. and Wan Aida, W. M.	(2011)	DPPH radical scavenging assay and FRAP ferric-reducing antioxidant power assay	Folin-Ciocalteu phenol reagent method	kesum (*Polygonum minus*), ginger (*Zingiber officinale*) and turmeric (*Curcuma longa*) extract	analysis of variance (ANOVA) and Duncan's multiple-range test (P< 0.05). Pearson's correlation was used	*kesum* had the highest total phenolic content and antioxidant activity compared to *ginger* and turmeric there was no synergistic effect observed for all plants extract mixture

10.	Xiaonan Lu a, Jun Wangb, Hamzah M. Al-Qadiri c, Carolyn F. Ross a, Joseph R. Powers a, Juming Tang d, Barbara A. Rasco a,⇑	(2011)	DPPH Assay, TEAC Assay	Folin–Ciocalteu reagent, 2,2-diphenyl-picrylhydrazyl (DPPH), 2,20-azino-bis-(3-ethylbenzothiazoline-6-sulphonate) diammonium salts (ABTS), 2,4,6-Tris(2-pyridyl)-s-triazine (TPTZ), 6-hydroxy-2,5,7,8-tetramethyl-2-carboxylic acid (Trolox), 2,20-azobis(2-amidinopropane)dihydrochloride (ABAP), hydrochloric acid (HCl), ferric chloride (FeCl3), acetate and gallic acid	*onion (Allium cepa) and shallot (Allium oschaninii)*	values and standard deviations were calculated using Excel (Microsoft Inc. one-way analysis of variance (ANOVA) and t-test to evaluate	chemometrics models indicated that hydroxyl and phenolic functional groups were most closely correlated with antioxidant capacity. The use of mid-infrared spectroscopy to predict the total antioxidant capacity of vegetables provides a rapid and precise alternative to traditional wet chemistry analysis

11.	Chung-Weng Phang1, Sri Nurestri Abd Malek1*, Halijah Ibrahim1 and Norhanom Abdul Wahab2	June, 2011	DPPH, Reducing power test, SOD (superoxide dismutase) inhibition activity assay	Folin-Ciocalteu methodButylated hydroxyanisole (BHA), ascorbic acid, Folin-Ciocalteu's phenol reagent, b-carotene, linoleic acid, tween 80, gallic acid, 2,2-diphenyl-1-picrylhydrazyl (DPPH) and potassium ferricyanide were acquired from Sigma-Aldrich Company. Methanol, hexane, ethyl acetate, superoxide dismutase (SOD) assay Kit-WST and trichloroacetic acid	crude and fractionated extracts of *Alpinia mutica* rhizomes	± SD of three parallel measurements. Analysis of variance, Duncan's Multiple Range test (DMRT) was used	rhizome extract of *A. mutica* especially the ethyl acetate fraction possesses good antioxidant activity and can be potentially used as natural antioxidants
12.	Adriana Maria Fernandes de Oliveira	26 October 2012	DPPH and TEAC assays	Folin-Ciocalteau's reagent as described by Gulcin *et al*. An aliquot of the samples, dissolved in ethanol, Sodium carbonate (300 µL, 15%) was added to the mix	Malvaceae Family Species	No test	species the Malvaceae family have a high content of phenolic compounds and a good antioxidant activity,

13.	R. Thomas*, R. Tripathi, S. D. Kamat and D. V. Kamat	29 December , 2011	Folin Ciocalteau method, Indigo carmine method and the DPPH	Hot Aqueous Extract, Microwave Extract, Sonication Extract	Phytochemicals of *t.chebula* extracted	No test	microwave extract of *T. chebula* yielded the highest phenolic and tannin content and showed highest antioxidant activity
14.	Reihani, S. F. S. and *Azhar, M. E.	19 April 2012	*(TPC),* DPPH free radical scavenging assay	Ferric reducing antioxidant potential assay,	aqueous extracts of selected traditional Malay salads	analysis of variance (ANOVA), SPSS version 18, Duncan's multiple range test	phenolic compounds along with Ulam Raja.

15.	Padma R, Parvathy NG, Renjith V, Kalpana PR, Rahate	2013	Folin denis method, Folin Ciocalteu calorimetric method had been used.	Folin denis reagent, Na2CO3 mixing in the extract.	methanolic extract of Imperata cylindrica	One-way ANOVA Test	Plant extract showing the maximum antioxidant property
16.	Roberto stevanato,* sabrina fabris, and federico momo	2004	Folin-Ciocalteu method, DPPH methods	DPPH, 4-aminoantipyrine, hydrogen peroxide, Folin-Ciocalteu reagent	Tea and Wine	No test	the total phenols content found by applying the three methods are discussed in terms of the different specificities of the analytical basis

17.	Khaled Tawaha a, Feras Q. Alali b,c,*, Mohammad Gharaibeh d, Mohammad Mohammad a, Tamam El-Elimat c	26 January 2007	Folin–Ciocalteu colorimetric method, ABTS_+ method	gallic acid as a standard phenolic compound, Folin–Ciocalteu reagent	Jordanian plant species	SD from two extraction replicates, each run in duplicate, student t-test was applied to test for significant differences	phenolic compounds were the predominant antioxidant components in the investigated plant species.
18.	Wiwat Wangcharoen1 and Wallaya Morasuk2	2007	(FRAP) assay, DPPH, ABTS radical cation decolorization assay, Folin-ciocalteau micro method	Trolox (6-hydroxy-2,5,7,8-tetramethychroman-2-carboxylic acid) [Aldrich], TPTZ (2,4,6-tripyridyl-s-triazine), DPPH (2,2-diphenyl-1-picrylhydrazyl) [Sigma], ABTS (2,2'-azinobis (3-ethylbenzothiazoline-6-sulfonic acid)), Folin-Ciocalteu phenol reagent, ferric chloride, ferrous sulphate, gallic acid, glacial acetic acid, hydrochloric acid, sodium acetate, potassium persulphate, sodium carbonate, vitamin C	holy basil	randomized complete block design (RCBD),	randomized complete block design (RCBD) was used, Duncan's new multiple range test (DMRT

19.	Elizabeth A Ainsworth1,2 & Kelly M Gillespie2	April 2007	F–C assay	Folin–Ciocalteu (F–C) reagent	plant tissues	No test	F–C assay provides a convenient, rapid and simple estimation of the content of total phenolics and other oxidation substrates in plant extracts7
20.	Azizah Othman a, Amin Ismail a,*, Nawalyah Abdul Ghani a, Ilham Adenan	December 2005	Ferric reducing/antioxidant power (FRAP) assay	b-Carotene, linoleic acid, Tween 20, butylated hydroxytoluene (BHT), 2,2-diphenyl-2-picrylhydrazyl (DPPH), ascorbic acid, Tris–HCl, 2,4,6-tripyridyl-s-triazine (TPTZ) and ferulic acid were purchased from Sigma Chemical Co. (St. Louis, MO, USA); Folin–Ciocalteu reagent	*cocoa beans*	mean ± standard deviation. Data were analysed using one-way ANOVA using SPSS	antioxidant capacity and phenolic content of Malaysian cocoa beans were comparable to Ghanaian, Ivory Coast, and Sulawesian beans

21	Bilal Okmen , Hasan O. Sigva , Sevgi Mutlu , Sami Doganlar , Ahmet Yemenicioglu & Anne Frary	2009	Folin-Ciocalteu procedure of Singleton and Rossi	2,2′-azinobis-(3-ethyl-benzothiazoline-6-sulfonic acid)] decolorization assay of Re et al.[18]. ABTS radical cation (ABTS.+) solution, Folin-Ciocalteu as reactive reagent, gallic acid as standard	*Turkish* Eggplant, Cultivars	variance (ANOVA) and Fishers PLSD were used for statistical analysis of the data. Significance was determined at $P < 0.05$.	breeders can use the information to develop eggplant cultivars with high antioxidant activity.
22.	Hasnah Osman *, Afidah A. Rahim, Norhafizah M. Isa and Nornaemah M. Bakhir	2009	ABTS free radical scavenging activity, Folin-Ciocalteu method, Coupled oxidation of β-carotene and linoleic acid	β-carotene bleaching and the 2,2′-azinobis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) radical cation assay, ferulic acid (Sigma Chemical Co.) as a standard [25]. Folin-Ciocalteu reagent (0.25 mL, Fluka)	*Paederia foetida* and *Syzygium aqueum*	No test	β-carotene bleaching assay were correlated (R2 = 0.9849) with those of the ABTS assay.

23	Antonio Vega-Gálvez a,*, Karina Di Scala b,c, Katia Rodríguez a, Roberto Lemus-Mondaca a,d, Margarita Miranda a, Jessica López a, Mario Perez-Won	(2009)	drying process, Physico-chemical analysis, Rehydration analysis, Folin–Ciocalteau's (FC) method	FC is added after 5 min; 2 ml of Na2CO3 (200 g/l), mg acid gallic/100 g dry matter	*red pepper*	Statgraphics_ Plus 5 (Statistical Graphics Corp., Herndon, VA, USA). The results were analysed by an analysis of variance (ANOVA, (LSD) test with a significance level of a = 0.05 and a confidence interval of 95% (p < 0.05). In addition, the multiple range test (MRT) used	air-drying temperature on physico-chemical properties, firmness, rehydration, colour and antioxidant activity due to total phenolic content and ascorbic acid of *red pepper* during hot air-drying between 50 and 90 _C was investigated

24.	Shruti Shukla a,*, Archana Mehta a, Jinu John a, Siddharth Singh a, Pradeep Mehta a, Suresh Prasad Vyas	2009	Folin–Ciocalteau Reagent, DPPH, EDTA/NBT system	Nitro blue tetrazolium (NBT), 2,2-diphenyl-1-picrylhydrazyl (DPPH) were purchased from Sigma Germany, Gallic acid (standard solution) (Loba Chemie, Mumbai), Sodium carbonate (S.D-Fine Chemicals, Mumbai) and Sodium nitroprusside (10 mM) solution and trichloro acetic acid (TCA) (S.d-fine chemicals, Mumbai), FCR Reagent, gallic acid	*Caesalpinia bonducella seeds*	SD Mean value had been usedof three replicates	. bonducella has a significant potential to use as a natural antioxidant agent.
25.	Ardelan Alizadeh1*, Morteza Khoshkhui2, Katayoun Javidnia3,4, Omidreza Firuzi4, Enayatollah Tafazoli2 and Ahmad Khalighi5	January, 2010	Gas Chromatography-Mass Spectrometry (GC/MS, Gas chromatography, DPPH	Folin-Ciocalteu reagent, Na2CO3 7.5%, garlic acid in methanol, DPPH (2,2-diphenyl-1-picrylhydrazyl), gallic acid monohydrate (3,4,5-Trihydroxybenzoic acid) and sodium carbonate were purchased from Sigma chemical Co. (St. Louis, USA). Folin Ciocalteu reagent, methanol and acetone were purchased from Merck Co. (Darmstadt, Germany). Trolox and Quercetin hydrate	*Satureja hortensis L.* (Lamiaceae)	standard deviation. Analysis of variance was performed by ANOVA by the software SAS (version 9.2 for windows).	chemical fertilizers increased fresh and dry plant weight. The use of 1500 mg/plant of compelet fertilizer increased the essential oil yield and efficiency.

26.	Angeline Torey, Sreenivasan Sasidharan, Lachimanan Yoga Latha, Sivaramakrishnan Sudhakaran & Surash Ramanathan	(2010	*DPPH radical scavenging assay, Xanthine oxidase assay,* ascorbic acid equivalents (AAE	Folin-Ciocalteu reagent, 2,2-diphenyl-1-picrylhydrazyl (DPPH) reagent, gallic acid, allopurinol, ascorbic acid, xanthine, and xanthine oxidase were purchased from Sigma-Aldrich (St. Louis, MO), methanol, hydrochloric acid (HCl), and phosphate buffer solution (pH 7.5) were purchased from Merck (Darmstadt, Germany). Butylated hydroxytoluene (BHT) was purchased from Fluka (Buchs, Switzerland). Sulfuric acid, sodium phosphate, ammonium molybdate, and sodium carbonate (Na2CO3)	extracts of *Ixora coccinea*		*coccinea* could be considered as a potential source ofnatural antioxidant
27.	St ´ ephanie dudonn ´ e,†,‡ xavier vitrac,*,‡ philippe couti ` ere,† Marion woillez,† and jean-michel m´ erillon‡	2009	Spectrophotometric and Spectrofluorometric Measurements, DPPH Radical, ABTS Radical, ABTS Radical, Folin-Ciocalteu method	2,2-Diphenyl-1-picrylhydrazyl (DPPH), 6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid (Trolox), 2,2′-azinobis(3-ethylbenzothiazoline-6-sulfonic acid) diammonium salt (ABTS), potassium persulfate, fluorescein, 2,2′-azobis (2-methylpropionamidine) dihydrochloride (AAPH), phosphate buffer, 2,4,6-tri(2-pyridyl)-striazine	Plant Extracts of Industrial Interest Using DPPH, ABTS, FRAP, SOD, and ORAC Assays	means (standard deviation (SD) of three measurements . Statistical analysis was performed using Student's *t*-test and $P < 0.05$ was considered	extracts presented the highest phenolic content (300-400 mg GAE/g). Mate (*Ilex paraguariensis*) and clove (*Eugenia caryophyllus clovis*) aqueous extracts

			(TPTZ), iron (III) chloride hexa-hydrate, and Folin-Ciocalteu reagent were purchased from Sigma-Aldrich (France). Sodium acetate trihydrate was obtained from VWR Prolabo (France), iron (II) sulfate hepta-hydrate and gallic acid were from Acros Organics (France), and hydrochlorid acid and sodium carbonate			also showed strong antioxidant properties and a high phenolic content (about 200 mg GAE/g
28.	Tangkanakul, P., Auttaviboonkul, P., Niyomwit, B., Lowvitoon, N., Charoenthamawat, P. and *Trakoontivakorn, G.	*2009)*	*ORAC assay, DPPH*	Folin-Ciocalteu reagent, adapted from Singleton and Rossi	Asian foods	mean ± standard deviation (SD) from three independent samples	Thai foods in retort pouches provide antioxidant capacity. Also, antioxidative activity was derived from total phenolic

29.	Yim HS1,2*, Chye FY2, Tan CT1, Ng YC1 & Ho CW1	2010	Folin-Ciocalteu method, Ferric reducing antioxidant power (FRAP) assay, DPPH, ABTS	Gallic acid, 6-hydroxy-2,5,7,8-tetramethyl chroman-2-carboxylic acid (Trolox), 2,4,6-tripyridyl-s-triazine (TPTZ), linoleic acid, Tween 40 (polyoxyethylenesorbitan monopalmitate), ascorbic acid, sodium carbonate anhydrous, chloroform, iron (III) chloride anhydrous, and potassium persulfate were purchased from Fisher Scientific (UK). Folin-Ciocalteu's phenol reagent, and 2,2'-azino-di[3-ethylbenzthiazoline sulfonate] (ABTS) were from Merck (Germany). 2,2-diphenyl-1-picryhydrazyl (DPPH), β-carotene, butylated hydroxy anisole (BHA) and sodium acetate buffer (0.3 M)	Extract of *Pleurotus ostreatus*	One-way analysis of variance (ANOVA) with Tukey's multiple comparisons and Pearson's correlation coefficient	*P. ostreatus or oyster mushroom* has long been cultivated commercially due to its economic value and its use as a food in Malaysia. P. ostreatus has the potential to be a source of antioxidant

30.	Nickavar B, Esbati N.	2012	DPPH, ABTS_scavenging capacity, b-carotene bleaching assay	2,20-diphenyl-1-picrylhydrazyl), ABTS_þ [2,20-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid], and linoleic acid/b-carotene bleaching assays	*Three Thymus Species*	computer software GraphPad prism 3.02 for Microsoft Windows (GraphPad Software, San Diego, CA, USA).	significant correlations were found between the flavonoid content and DPPH_/ABTS_þ radical scavenging activities, but not between the b-carotene bleaching inhibition system and the flavonoid content

RESULTS

On comprehensive evaluation of 30 articles around 23/30 reported application of FCR Reagent to determine antioxidative property of various drugs with all qualitative and quantitative work with comparative analysis.

DISCUSSION

Drugs are identified, selected, collected, standardized by various methodology and sources. They entail chemical constituents like primary metabolites and secondary metabolites, which are differentiated by each other. Primary metabolites are those constituents which are having special action, affinity towards therapeutic one, while secondary one having no such special therapeutic action. Plant kingdom possess various number of constituents as compare to others sources of drug material.Phenolics are aromatic benzene ring compounds with one or more hydroxyl groups produced by plants mainly for protection against stress.Phenolics a vital important roles in plant development, particularly in lignin and pigment biosynthesis. They also furnish structural integrity and scaffolding support to plants.There upon phenolic content is one of the extensive assays for ascertaining the antioxidant property of any drug substances with scavenger property towards systemic free radicles in it. There are various quantitative analysis through which the total phenolic content of any substance is reckoned through various techniques like DPPH, FCR Reagent, etc. review was done by assessment of articles collected in between 2004 to 2017 from numerous database like google scholar and PubMed.

As conclusion FCR is one of the familiar techniques which is used to establish antioxidant property in any substances.

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