ejpmr, 2025, 12(2), 212-219

SJIF Impact Factor 7.065

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

FORMULATION AND EVALUATION OF HERBAL TEA POWDER BY USING BOUGAINVILLEA GLABRA AND CASSIA AURICULATA

Prema Rathinam[1]*, Srimathi Kumar[2], Senthilkumar Chelladurai[3], Nandhini Subramaniam[4], Mamatha Venkataswamy[5] and Sandhiya Palanivelu[6]

[1,2,4,5,6]Department of Pharmaceutics, Sri Shanmugha College of Pharmacy, Salem, Tamilnadu.
[3]Department of Pharmaceutics, Sir Issac Newton College of Pharmacy, Nagapatinam, Tamilnadu.

***Corresponding Author: Dr. Prema Rathinam**

Department of Pharmaceutics, Sri Shanmugha College of Pharmacy, Salem, Tamilnadu.

Article Received on 30/11/2024 **Article Revised on 20/12/2024** **Article Accepted on 10/01/2025**

ABSTRACT

Tea plays a significant role as a popular and essential beverage in various cultural and social gatherings. Rather than *Camellia sinensis L.*, various herbs have been widely used to promote public health with diverse therapeutic effects and prevent diseases. In the present study, we delved into the potential of two medicinal plants, *Bougainvillea glabra* and *Cassia auriculata*, to create a novel herbal tea powder. These plants have been traditionally used in various cultures for their therapeutic properties, including anti-diabetic, anti-inflammatory, anti-microbial and laxative etc. To enhance the overall health benefits and taste profile, we incorporated additional ingredients like mint, coriander, cardamom, dry ginger to curb digestive problems, strengthen the immune system, and provide a refreshing flavour. To ensure the quality and efficacy of the herbal tea powder, we conducted a series of phytochemical analysis. Parameters such as pH, tapped density, bulk density, angle of repose, loss on drying, ash value were evaluated to assess the powder properties. Additionally, a phytochemical screening was performed to identify the bioactive compounds present in the formulation. This study aims to contribute to the growing interest in herbal remedies and provide a scientifically validated approach to formulating herbal tea powders. By combining traditional knowledge with modern scientific techniques, we hope to develop a product that offers a wide range of health benefits and appeals to a diverse consumer base.

KEYWORD:- *Bougainvillea glabra, Camellia sinensis, Cassia auriculata,* Herbal tea powder, Phytochemical screening.

INTRODUCTION

Tea is the most commonly consumed beverage after water. It has a cooling, slightly bitter, and astringent flavour that many people enjoy. Tea is one of the most popular beverages, consumed daily in all domestic, social, and official meetings. It is a preparation that boosts immunity, keeps one active, rejuvenates cells, relieves stress, fatigue, tiredness, anxiety, and many more.[1] A herb in phytomedicine denote a plant or plant part that is employed in medicine-making to aid the healing process in time of illness or disease. Herbal teas consist of exclusively of one or more plant part such as leaves, flower, bark or seeds prepared by means of decoction or infusion. Herbal teas are wonderful, low calorie and relaxing drinks. They have beautiful fragrance and are very appealing. When brewed for 5-10 minutes are immediately taken. Herbal teas are usually supplied in wholesale quantity or in retail sachets.[2] These drinks are distinguished from caffeinated true teas which are prepared from the cured leaves of the tea plant, *Camellia sinensis*, as well as from decaffeinated tea, in which the caffeine has been removed. In addition to serving as a beverage, many herbal teas are also consumed for their apparent medicinal benefits.[3] Medicinal plants have been used to treat and prevent different types of the infectious disease since prehistoric times. Nearly 60 to 90% of the total population worldwide uses plant-based medication. They are reservoirs of different types of bioactive compounds such as tannins, flavonoids, and alkaloids, which also possess antibacterial properties. While in most cases, the action mechanism and efficacy of herbal extracts still need scientific validation, which facilitates important host responses.[4] A greater percentage of individuals have grown passionate about reducing the use of synthetic preservatives and switching to natural alternatives in the more recent past due to public concern about potential side effects like diabetes, cancer and cardiovascular diseases.[5] Alongside the ever-popular Non fermented and fermented varieties, tea can be made with water infusions of the roots, leaves, flowers and other component parts of a hugely diverse range of plant species. These 'herbal teas' contain a wealth of compounds and could play a significant role in

delivering nutrients and chemicals to compensate for low quality diets. Herbal teas have long-since been used as therapeutic vehicles in Chinese, Indian and other indigenous medical system.[6]

Bougainvillea glabra from the family of Nyctaginaceae belongs to the genus *Bougainvillea* and this genus has 18 species of plants of which three of them *B. glabra, B. spectabilis and B. peruviana* have gained a lot of importance in the horticulture field. Its stems are thin, with recurred prickles and leaves covered with small hairs. It produces abundant flowers with white and purple bracts. There are many varieties with different colors: red, orange, yellow, violet etc. In traditional uses, the plant is used in variety of disorders like diarrhea, reduces acidity, cough and sore throat decoction of dried flowers for the blood vessels and leucorrhoea and decoction of the stem in hepatitis. The main part used is leaves. *Bougainvillea glabra* is reported to have a wide range of medicinal properties like anti-viral, anti-diabetic, anti-fertility, anti-inflammatory, anti-microbial activity and also considered to be larvicidal.[7] *Cassia auriculata* L, sometimes referred to as "Tanner's cassia" (Caesalpiniaceae), is widely distributed throughout India. It is a spreading shrub, brown branchlets and pubescent branchlets. The nature of its leaves is alternating, stipulate, and thin. It blooms all year long with bright yellow, irregular, bisexual flowers. Fruits are small, oblong, thin, and pale brown in appearance.[8] The purpose of this research is to formulate the herbal tea powder. Teas are normally prepared from young leaves, leaf buds and internodes of varieties of the tea plant *Camellia sinensis* or *Camellia assamica*. It contains caffeine and it has been used to increase alertness. Caffeine is bitter substance that stimulate Central nervous system (CNS) that leads to harmful effects on human body. Therefore, herbal tea powder was developed using *Bougainvillea glabra* and *Cassis auriculata* to improve the taste, aroma and health promoting properties which can complement to commercial tea. Firstly, the plant materials were collected from the local area. Then dried under the shade for a week and it is made into a coarse powder. By combining the two powders, herbal tea powder is formulated with addition of herbal excipients. Then further proceeded the evaluation parameters.

Plant profile

Bougainvillea glabra

- *Bougainvillea glabra* from the family of Nyctaginaceae belongs to the genus *Bougainvillea* and this genus has 18 species of plants of which three of them *B. glabra, B. spectabilis* and *B. peruviana* have gained a lot of importance in the horticulture field. Its stems are thin, with recurred prickles and leaves covered with small hairs. It produces abundant flowers with white and purple bracts.[9]

- The phytochemical substances that are extracted from stem, flowers, and leaves of *B. glabra* are alkaloid, flavonoids, furanoids, glycosides, phenols, phlobotannins, quinones, saponins, steroids, tannins, and terpenoids. The other active constituents are bougainvinones peltogynoids, essential oils including methyl salicylate, terpinolene, a-(E)-ionone, pinitol, β-sitosterol, quercetin, and quercetin-3-O-rutinoside.[10]

Taxonomical classification

Kingdom	Plantae
Subkingdom	Tracheobionta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Caryophyllidae
Order	Caryophyllales
Family	Nyctaginaceae
Genus	*Bougainvillea*
Species	*glabra*

Cassia auriculata

The medicinal plant *Cassia auriculata L*, sometimes referred to as "Tanner's cassia" (Caesalpiniaceae), is widely distributed throughout India. The phytochemical substances that are extracted from flowers of *C. auriculata* contains phenolic acids (gallic and ferulic), theanine, theacrine, theophylline as well as quercetin and quercetin hexoside, and catechins (catechin, epigallocatechin, catechin gallate, and epicatechin gallate), fatty acids and their esters (dodecanoic, hexadecanoic, 8-octadecanoic, 9-octadecanoic), along with alkenes and saponins.[11]

Taxonomical classification

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Fabales
Family	Fabaceae
Subfamily	Caesalpinoideae
Genus	*Cassia*
Species	*auriculata*

MATERIALS AND METHODS

Collection of plant materials

Bougainvillea glabra and *Cassia auriculata* were collected from the local area. The above-mentioned plants were examined, identified and authenticated by Siddha Medicinal Plants Garden, Central Council for Research in Siddha, Ministry of Ayush, Govt. of India, Mettur, Tamilnadu. The flowers and bracts were air dried and pulverized into coarse powder.

Materials required

S. No	Ingredients
1.	*Bougainvillea glabra*
2.	*Cassia auriculata*
3.	Jaggery
4.	Coriander
5.	Mint powder
6.	Ginger powder
7.	Cardamom
8.	Water

Preparation of herbal tea

Coarse powder of *Bougainvillea glabra* and *Cassia auriculata*

↓

Mixed with sugar syrup

↓

The mixture was heated on mild fire till it attained more than two thread consistency of sugar syrup .

- 1 hrs 30 min of heating - adhesion of syrup to spoon.
- 1 hrs 50 min of heating - syrup was found to be in a two thread consistency.
- 2 hrs 5 min of heating - not instant dissolution in water.

↓

Add coriander, Mint and Dried ginger powder.

↓

Add cardamom as a flavouring agent.

↓

The contents were removed from heat source.

↓

Thus obtained mass was dried in hot air oven and subjected to sieve and obtain the granules.

↓

Herbal tea is obtained.

Phytochemical screening[12]

A number of qualitative chemical tests were performed to determine the characteristics of the given extracts in terms of chemical composition. Qualitative phytochemical analysis was performed using the methods of Kokate (1994) and Kokate et al (1995). The following tests were performed on the extracts to identify the various plant species present.

1. Detection of alkaloids

Dragendroff's test: To 2 ml of the filtrate, 1 ml of Dragendroff's reagent was added to the side of the test tube. A red-orange discharge indicated a positive test.

2. Detection of flavonoids

Lead acetate test: The extract (50 mg) was dissolved in distilled water and 3ml of 10% lead acetate solution was added. Appearance of white colour indicated the test as positive.

3. Detection of carbohydrate

Fehlings test: 1 ml of filtrate was boiled on water bath with 1 ml each of Fehlings solution A and B. A blue precipitate indicated the presence of sugar.

4. Detection of terpenoids

Salkowski test: Extract (5 ml) was mixed with chloroform (2 ml), and concentrated sulphuric acid (3 ml) was carefully added to form a layer. A reddish brown coloration of the inter face was formed to show positive results for the presence of terpenoids.

5. Detection of cardiac glycosides

Borntrager test: To 2ml of filtered hydrolysate, 3ml of chloroform was added and shaken, chloroform layer was separated and 10% ammonia solution was added to it. Pink colour indicate the presence of glycosides.

6. Detection of tannins

Ferric chloride test: The extract (50mg) was dissolved in 5ml of distilled water. To this, few drops of neutral

5% ferric chloride solution were added. A dark green colour indicated the presence of tannins.

7. Detection of Proteins and Amino acids

Millons test: To 2 ml of filtrate, few drops of Millons reagent were added. A white precipitate indicated the presence of proteins.

8. Detection of phytosterols

Libermann- Burchards test: The extract (50mg) was dissolved in 2ml acetic anhydride. To this, one or two drops of concentrated sulphuric acid were added slowly along the side of the test tube. An array of colour changes showed the presence of phytosterols.

9. Detection of steroids

Salkowski test: Extract (5 ml) was mixed with chloroform (2 ml), and concentrated sulphuric acid (3 ml) was carefully added to form a layer. A reddish-brown coloration of the inter face was formed to show positive results for the presence of terpenoids.

10. Detection for phenolic compounds

Detection of saponins: The extract (50mg) was diluted with distilled water and made upto 20ml. The suspension was shaken in a graduated cylinder for 15minutes. A 2cm layer of foam indicated the presence of saponins.

Evaluation parameters

Organoleptic test

Organoleptic study is basic study to identify and evaluate the quality of the product. Prepared herbal tea has reported the following parameters like colour, odour and taste.

Bulk density

Bulk density and tapped density: Bulk density can be identified as the volume occupied by the solid plus the volume of voids when divided into powder.

Procedure: Fill the cylindrical container with the material, gently tapping the container to remove any air pockets. Use the funnel to pour the material into the container, if necessary. Use the scoop or spoon to level the material with the top of the container. Record the volume of the material (V) in mL or cm^3. Weigh the container with the material (M) using the balance or scale.

Calculate the bulk density (ρ) using the formula:

- $\rho = M / V$
- Units: g/mL or g/cm^3. Repeat the measurement multiple times to ensure accuracy and precision.

Tapped density

Tapped density is a different type of bulk density obtained by tapping or vibrating the container in a particular method to achieve more effective particle parking and therefore, it is usually higher than bulk density.

Procedure: Fill the cylindrical container with the material, gently tapping the container to remove any air pockets. Record the initial volume (V0) of the material. Tap the container gently but firmly, using the tapping device, to remove any air pockets. Continue tapping until the volume of the material no longer changes. Record the final volume (Vf) of the material.

Calculate the tapped density (ρt) using the formula:

- $\rho t = M / Vf$
- Units: g/mL or g/cm^3. Repeat the measurement multiple times to ensure accuracy and precision.

Carr's index and Hausner ratio

They are used in describing the flowability of powder. Carr's index can be determined as the ratio of the difference of the tapped and the bulk densities to the tapped density. According to Carr (1965), who introduced the flowability index, an excellent flowability is between the Carr index of 5–15% while Carr index of above 25% normally shows poor flowability.

Carr's index = (Tapped density-bulk density/ bulk density) × 100

Hausner's ratio = Tapped density/Bulk density

Angle of repose

It was determined using funnel method. In a funnel, the accurately weighed powder was taken. The funnel height was arranged in a manner that the funnel tip just touches the "apex of the heap" or "head of blend." Through the funnel, "the drug excipient blend" was allowed to flow freely on to the surface.

Angle of repose $(\theta) = \tan^{-1}$ (h/r)

pH test

The herbal tea was brewed using 200 mL boiling water. At room temperature, the brew was allowed to cool. The digital pH meter was used to determine the pH of the brew solution. We were testing the pH of the brew solution after it had been stored at 0°C in the refrigerator.

Procedure: Rinse the pH electrode with distilled water. Dip the pH electrode into the pH buffer solution (pH 7). Adjust the pH meter to read pH 7. Repeat with pH 4 and 10 buffer solutions. Dip the pH electrode into the sample. Stir the sample gently. Wait for the reading to stabilize. Record the pH value.

Loss on drying[13]

Take a clean dry petri dish and weigh it. Weigh 2 g of sample powder and transfer to petri dish and weight. Place the Petri dish in a tray dryer and weigh it every 5 min. Allow it to dry until it is constant weight then down the constant dry weight. Calculate the percentage loss on drying and moisture content for the sample.

LOD (%) = [(Wet weight - Dry weight) / Wet weight] x 100

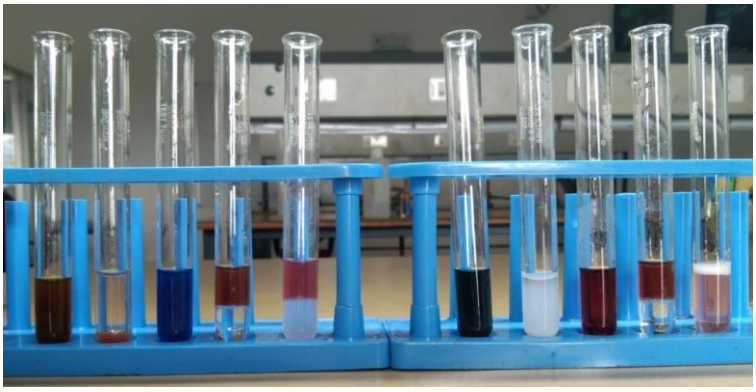
Ash value[13]

Ash value is helpful in determining the quality and purity of crude drug, especially in powder form. The objective

of ash vegetable drugs is to remove all traces of organic matter, which may otherwise interfere in an analytical determination.

Procedure: Weigh a portion of the sample (W1) into a crucible. Place the crucible in the muffle furnace at 500-600°C. Heat for 2-3 hours or overnight. Remove the crucible from the furnace and let it cool. Weigh the crucible and ash (W2)
Calculate the total ash content (%):
Total Ash Content (%) = ((W2 - W1) / W3) x 100
Repeat the measurement multiple times to ensure accuracy and precision

RESULTS AND DISCUSSION



S. No	Phytochemical tests	Combined extracts (Herbal tea)
1.	Test for alkaloids Dragendroff's test	+
2.	Test for flavonoids Lead acetate test	+
3.	Test for carbohydrates Fehling's test	+
4.	Test for terpenoids Salkowski test	+
5.	Test for cardiac glycosides Borntrager's test	+
6.	Test for tannins Ferric chloride test	+
7.	Test for protein and amino acids Millons test	+
8.	Test for phytosterols Liberman-burchards test	+
9.	Test for steroids Salkowski test	+
10.	Test for phenolic compounds Saponins test	+

Organoleptic evaluation

- Colour- Brown
- Odour- Pleasant
- Taste- Mild astringent

Bulk density

Bulk density = Mass/ Volume
= 68.74/79 = 0.87 g/ml

The bulk density of herbal tea powder was found to be **0.87g/ml**

Tapped density

Tapped density = Mass/ Volume
= 68.74/62 = 1.10 g/ml
The tapped density of herbal tea powder was found to be **1.10 g/ml**

Carr's Index
Carr's index = Tapped density – Bulk density/ Tapped density × 100
= 1.10 – 0.87/ 1.10 × 100 = 20.9%

Carr's Index	Flow property
≤10	Excellent
11 - 15	Good
16 - 20	Fair
21 - 25	Passable
26 - 31	Poor
32 - 37	Very poor
>38	Very very poor

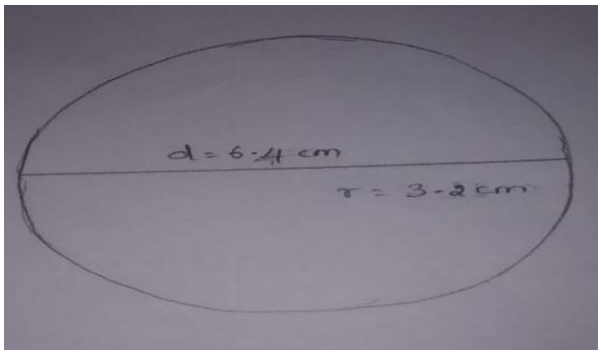
From the result, the flow property of the herbal tea powder was identified as **Fair.**

Hausner ratio
Hausner ratio = Tapped density/ Bulk density
= 1.10/0.87 = 1.26

Hausner ratio	Flow property
1.00 - 1.11	Excellent
1.12 - 1.18	Good
1.19 - 1.25	Fair
1.26 - 1.34	Passable
1.35 - 1.45	Poor
1.46 - 1.59	Very poor
>1.60	Very very poor

From the result, the flow property of the herbal tea powder was identified as **Passable.**

Angle of repose



Angle of repose (ɵ) = $\tan^{-1}$ (h/r) (h = 2.5, r = 3.23)
=37º59´

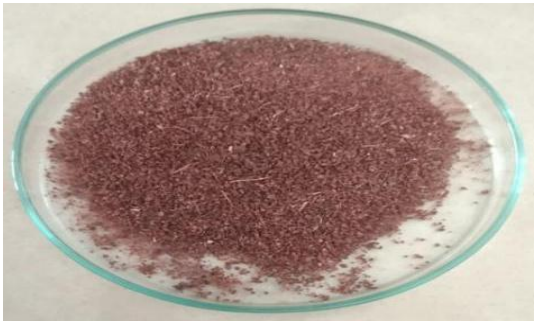
Angle of repose	Flow property
25 - 30	Excellent
31 - 35	Good
36 - 40	Fair
41 - 45	Passable
48 - 55	Poor
56 - 65	Very poor
>60	Very very poor

From the result, the flow property of the herbal tea powder was identified as **fair.**

pH test

pH of the herbal tea decoction was found to be 5.54, slightly acidic in nature which is nearer to average pH value of normal tea i. e., 4.9 to 5.5.

Loss on drying



LOD (%) = [(Wet weight – Dry weight) / Wet weight] x 100
(W1= 93.47, W2= 85.48)
= 8.54%

From the result, the percentage of loss on drying of herbal tea powder was found to be **8.54%.**

Ash value

Total Ash Content (%) = ((W2 - W1) / W3) x 100
W2 = Weight of crucible after ash (44.49)

W1 = Weight of empty crucible (44.16)
W3 = Weight of the sample (4)

= 8.2 %w/w

From the result, the total ash content of herbal tea powder was found to be **8.2% w/w.**

CONCLUSION

Tea consumption, whether as a refreshing drink, a healthy beverage, or a medicinal tea, should be encouraged for further research and publication. Upon conducting a thorough literature survey, it was discovered that exploring the topic of tea could prove to be quite intriguing for research purposes. Here a new combination of herbal tea powder was prepared by using the medicinal plants with mint, coriander, cardamom, dry ginger. The evaluation involved a comprehensive study of its morphological, physiochemical and phytochemical aspects. The formulated herbal tea powder has minimal side effects and its caffeine free, thus avoiding the risk of addiction. This tea is perfect for individuals with diabetes or digestive issues.

REFERENCES

1. Nikam PH.et al., Future Trends in Standardization of Herbal Drugs, Journal of Applied Pharmaceutical Sciences, 2012; 2(6): 38 - 44.
2. Lai, P. K and Roy, J. Antimicrobial and chemopreventive properties of herbs and spices Current Medicinal Chemistry, 2004; 11(11): 1451-1460.
3. Vijaya S.Rabade and Shailju G.Gurunani. Preparation and Evaluation of Herbal Tea Powder, International Journal of Pharmacy and Biological Sciences, 2021; 11(4): 107-113.
4. Mishra, D., Singh, R. K., Srivastava, R. K., and Dubey, S. R. Ethnomedicinal plants used to cure the gynaecological disorders by ethnic populace of Sitapur district, Uttar Pradesh, India. Med. Plants Int. J. Phytomed. Relate. Ind, 2013; 5: 238-245.
5. Orozco-Villafuerte, J., Escobar-Rojas, A., Buendía-González, L., García-Morales, C., Hernandez-Jaimes, C., & AlvarezRamirez, J. Evaluation of the protection and release rate of Bougainvillea (*Bougainvillea spectabilis*) extracts encapsulated in alginate beads. Journal of Dispersion Science and Technology, 2018; 40: 1065 - 1074.
6. Tandon N, Yadav SS Contributions of Indian Council of Medical Research (ICMR) in the area of medicinal plants/ traditional medicine. Ethnopharmacology, 2017; 197: 39 - 45.
7. Md. Zahidul Islam, Md. Tanvir Hossain, Foysal Hossen, Mir Salma Akter and Mohammad Arif Mokammel. In-vitro antioxidant and antimicrobial activity of *Bougainvillea glabra* flower. Res. J. Med. Plant, 2016; 10: 228-236.
8. Zipora Tietel, Devanesan Arul Ananth, Thilagar Sivasudha and Liron Klipcan. *Cassia auriculata* L.– A mini review of phytochemical compounds and their antidiabetic mechanisms. AIMS Agriculture and Food, 2024; 9(1): 374 - 392.
9. T. K. Lim. Edible Medicinal and Non-Medicinal Plants, Flowers. Springer Science & Business, 2014; 8: 489 - 494.
10. Ikpeme EV, Ekaluo UB, Udensi OU, Ekerette EE, Pius M. Phytochemistry and reproductive activities of male albino rats treated with crude leaf extract of great Bougainvillea *(Bougainvillea glabra)* Asian J Sci Res, 2015; 8: 367 - 73.
11. Uppugalla S, Boddula R, Srinivasan P. Methyl triphenyl phosphonium permanganate as a novel oxidant for aniline to polyaniline-manganese (II, IV) oxide: material pseudo capacitor. for Journal high of performance Solid State Electrochemistry, 2018; 22(2): 407 - 15.
12. Prema Rathinam K. B. Chandra Sekhar, D Satheesh Sekhar, Antimicrobial activity and phytochemical constituents of combined extracts of cissusquadrangularis and aegle marmelos Int. J. Res. Pharm. Sci, 2012; 3(1): 135 -139.
13. Mukherjee PK, Venkatesh M, Kumar V., An overview onthe development in regulation and control of medicinaland aromatic plants in the Indian System of Medicines., BolLatinoam Caribe Plant Med Aromaticas, 2007; 6(4): 129 -137.