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Environmental factors as quality determinants on phytochemistry of *Kedrostis foetidissima* (Jacq.) Cogn. Herb

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Abstract

Usage of herbs is increasing in recent days in living beings because of their promising therapeutic potentials. The tremendous need of herbs has boosted the commercialization of its production, globally. Phytochemicals are chemical metabolites produced by plants and they are responsible for pharmacological actions. The quality and quantity of such metabolites are determined by many factors, predominantly-the environment. Hence, consideration of place where the herbs are procured and factors (such as rainfall, temperature, altitude, soil, sunlight etc.) which influence the environment are gaining more importance as quality determinants. The present study aimed to explore the impact of environment on the phytochemistry especially on the concentrations of phytochemicals of *Kedrostis foetidissima* (Jacq.) Cogn. The herb of Cucurbitaceae family having many pharmacological properties was collected from Coimbatore and Namakkal districts of Tamil Nadu where the environment is significantly different. The ethanolic extract of the whole plant was used for qualitative and quantification of phytochemicals. On qualitative phytochemical analysis, herb of different places showed up similar metabolites, but the herb from Coimbatore district showed enriched level of terpenoids, saponins, tannins, phenols, steroids, flavonoids and alkaloids than the herb of Namakkal district. On quantitative study, ethanolic extract of *Kedrostis foetidissima* (Jacq.) Cogn. Collected from Coimbatore district showed significant difference in the concentration levels of alkaloids, phenols, flavonoids, terpenoids, tannins, saponins and steroids than the herb collected from Namakkal district. This study proved the influence of environment factors on the expression of plant metabolites level and also suggested the importance of consideration of such factors in the procurement of herbs for therapy.

Keywords: *Kedrostis foetidissima*, environmental factors, phytochemicals, pharmacological actions

Introduction

Nature has always had its own remedy and food in the form of herbs and provided the same for the wellbeing of human, animals as well as birds since their life emerged (Hashemi and Davoodi, 2012) [6]. Awareness on limitations of synthetic drugs and chemicals, higher cost, adverse effects and anticipated toxicity has increased in people throughout the world and at the same time usage of herbs as health promoters are gaining much attention in both researchers and consumers (Okitoi *et al.*, 2007) [12]. Hence, the tremendous need of herbs has boosted the commercialization of its production, globally. Phytochemicals are secondary metabolites occurring in significant amounts and considered as quality determinants for their biological responses. However, these phytochemicals of plants are variable and the environmental factors, such as soil type and its nutritional status, temperature, sunlight, geographic location etc., can influence the concentration of these phytochemicals in plants (Lumpkin, 2005) [10]. The secondary metabolites of plants represent a chemical interface between plants and environment (Gobbo-Neto and Lopes, 2007) [3] and changes in the quantity of these metabolites directly influences the quality of such plants used for medicinal application (Santos *et al.*, 2006) [16].

Kedrostis foetidissima (Jacq.) Cogn is one of the promising medicinal plants of Cucurbitaceae family having many pharmacological properties. This plant is widely used in Paliyan tribes and extensively studied for treating skin diseases (Tabuti *et al.*, 2003) [18], cough in children (Karuppusamy, 2007) [8], fungal infections (Priyavardhini *et al.*, 2012) [15] and for bloat in cattle (Ole-Marion, 2003) [13]. This study was carried out to explore the impact of environment on the quality and quantity of phytochemicals of *Kedrostis foetidissima* (Jacq.) Cogn. Collected from Coimbatore and Namakkal districts of Tamil Nadu where the environment is significantly different.

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Materials and Methods

A. Collection and identification of *Kedrostis foetidissima* (Jacq.) Cogn.

Whole plants of *Kedrostis foetidissima* (Jacq.) Cogn were collected from Coimbatore and Namakkal districts of Tamil Nadu and authenticated by the Department of Botany, Aringar Anna Govt. Arts and Science College, Laddivadi, Namakkal, Tamil Nadu, India.

B. Preparation of alcoholic extract from *Kedrostis foetidissima* (Jacq.) Cogn.

Alcoholic extract of *Kedrostis foetidissima* (Jacq.) Cogn collected from two different origins were prepared from the powdered plant materials of 100 g each by using 400 ml of ethanol. The extracts were kept in an orbital shaker for 48 hours at room temperature and then filtered by using Whatman filter paper No. 1, to separate the extractable substances. The collected filtrate was then evaporated at 37 °C on hot air oven and the dried extracts were collected in a sterile container and stored at 4 °C, until used for study.

C. Phytochemical screening

Phytochemical screening was carried out and compared with its filtrate using precipitation and coloration reaction (Harborne, 1973) [5] to assess the presence or absence of bioactive molecules in the ethanolic extract of *Kedrostis foetidissima* (Jacq.) Cogn. The major phytochemical constituents identified (terpenoids, saponins, tannins, phenols,

steroids, flavonoids and alkaloids) in qualitative analysis were quantified. Phenols and tannins were estimated using Folin-Ciocalteu method (Makkar *et al.*, 1993) [11] whereas alkaloids, terpenoids and saponins were quantified by precipitation method (Harborne, 1973). The flavonoid content was determined according to Jia *et al.*, (1999) [7] whereas the steroid content was estimated by the method of Harborne (1984) [4].

D. Statistical analysis

All statistical analyses were performed by one-way ANOVA procedure using SPSS® 20.0 software.

Results and Discussion

The qualitative phytochemical analysis of *Kedrostis foetidissima* (Jacq.) Cogn ethanolic extract of two different origins showed the presence of phytocomponents and the results are presented in Table 1. The result revealed some important phytochemicals such as terpenoids, saponins, tannins, phenols, steroids, flavonoids and alkaloids in *Kedrostis foetidissima* (Jacq.) Cogn plant extracts with varying degree of precipitation. The plant sample collected from Coimbatore area showed comparatively a better degree of precipitation than the plant samples of Namakkal region. The presence of phytochemical components identified in this plant extract is also in agreement with previously reported results of Vasantha *et al.*, 2012 [19].

Table 1: Qualitative analysis of phytochemicals in the ethanolic extract of *Kedrostis foetidissima* (Jacq.) Cogn plant of different origin

S. No.	Phytochemicals	Whole plant of <i>Kedrostis foetidissima</i> (Jacq.) Cogn. collected from	
		Coimbatore	Namakkal
1.	Terpenoids	+++	++
2.	Saponins	++	+
3.	Tannins	++	+
4.	Phenols	++	+
5.	Steroids	+++	++
6.	Flavonoids	++	+
7.	Alkaloids	++	+

+ - Mild, ++ - Moderate, +++ - High degree of precipitation.

On quantification, significant difference in the concentration of phytocomponents noticed between the ethanolic extract of *Kedrostis foetidissima* (Jacq.) Cogn. of different locations (Table 2).

Table 2: Quantitative analysis of phytochemicals present in the ethanolic extract of *Kedrostis foetidissima* (Jacq.) Cogn plant of different origin

S. No.	Phytochemicals	Whole plant of <i>Kedrostis foetidissima</i> (Jacq.) Cogn collected from	
		Coimbatore	Namakkal
1.	Terpenoids (%)	68.43 ± 0.50	48.50 ± 0.85
2.	Saponins (%)	1.86 ± 0.38	1.24 ± 0.86
3.	Tannins (mg/g)	1.75 ± 0.45	0.86 ± 0.45
4.	Phenols (mg/g)	2.48 ± 0.48	0.48 ± 0.60
5.	Steroids (mg/g)	0.58 ± 0.14	0.42 ± 0.74
6.	Flavonoids (mg of rutin/g)	2.72 ± 0.50	1.95 ± 0.35
7.	Alkaloids (mg/g)	58.40 ± 0.65	48.10 ± 0.23

Plants have requirements for their growth. Environment provides all the nutrients to meet their requirements in order to reach highest concentration of the potential health promoting compounds in them. Environmental factors such as seasonal changes, light, geoclimate, humidity and soil fertility

as well as cultivation techniques affect both the qualitative composition and quantitative amount of phytochemicals in plants (Lumpkin 2005) [10]. Geographical parameters like elevation, rainfall, soil type and temperature of Coimbatore is significantly different from Namakkal (Table. 3).

Table 3: Geographical comparison of Coimbatore and Namakkal districts

S. No.	Geographical Parameters	Coimbatore	Namakkal
1.	Location	Western Ghats	Base of Kolli Hills
2.	Elevation	411 meters	218 meters
3.	Temperature	18-35 °C	25.1-38.5
4.	Rainfall (Annual)	700 mm	502 mm
5.	Soil type	Black & Red Loamy	Red soil, black soil, brown soil, Alluvial soil & mixed soil.

Coimbatore is located at the base of Western Ghats where the geoclimate parameters are highly favorable for the growth of medicinal plants. High elevation from the sea level, black and red loamy soil, more annual rainfall and less temperature than Namakkal will have the impact on quality and quantity of secondary metabolites. Studies on the impact of geographical location on carotenoid content and bioaccessibility in

tomatoes (Aherne *et al.*, 2009)^[1], antioxidant activity of *Linum usitatissimum* (Sudhansu *et al.*, 2012)^[17], soil type on affecting the phytonutrients of vegetables (Brown *et al.*, 1984)^[2], rainfall to change the hydrolysable tannins amounts (Leonardo *et al.*, 2013)^[9] and temperature on the levels of glucosinolates in broccoli (Pereira *et al.*, 2002)^[14] also suggested the importance of consideration of such factors. On both qualitative and quantitative analysis, this study showed significantly higher values of terpenoids, saponins, tannins, phenols, steroids, flavonoids and alkaloids of *Kedrostis foetidissima* (Jacq.) Cogn plant collected from Coimbatore than the same plant collected from Namakkal and proved the influence of environment factors on the expression of secondary metabolites.

Conclusion

The chemical variability in *Kedrostis foetidissima* (Jacq.) Cogn plant determined by qualitative and quantitative analysis reflects the environmental influence on its phytochemical concentrations. This work also suggests the consideration of such factors in research on exploring their biological activities.

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