An Effect of Light Intensity on the Total Flavonoid and Phenolic Content of Moringa Oleifera

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Abstract

Flavonoid and phenolic compounds are secondary metabolites produced by plants in response to harsh environmental conditions. Light is one of the most important ingredients that affects their production. *Moringa oleifera* (also known as *M. oleifera*), a plant belonging to the family *Moringaceae* is having bioactivity due to the flavonoid and phenolic contents of the plant. The objective of the research is to determine the effect of varying light intensity on the total flavonoid and total phenolic contents of *M. oleifera*. Total flavonoid contents was determine based on the aluminium chloride colourimetry method while total phenolic contents were determined based on the folin-chiocalteau reagent. The results obtained in the study shows that the flavonoid and phenolic contents recovered from sun exposed plants was higher than that of shaded plants. Besides, comparison of the means showed that there is a statistically significant difference between the flavonoid and phenolic contents of the studied plant ($P < 0.05$). This leads to a conclusion that high light intensity can increase the concentration of flavonoid and phenolic contents of *M. oleifera*.

Keywords: Flavonoid, light intensity, *Moringa oleifera*, and phenolic content.

1. Introduction

Moringa oleifera is a drought-resistant tree belonging to the family *Moringaceae*. This fast-growing deciduous tree is widely cultivated in a tropical region. It produces edible pods and leaves which are having high application in traditional medicine. Moreover, the plant can be used in water purification. Numerous researchers reported the medicinal benefit of the tree. The antioxidant activity [1,2,3,4,5,6,7, and 8], photoprotective effect [9], bioactive flavonoids [10], immunomodulatory effect [11], antidiabetic [12], antibacterial [13], anticancer [14], antiproliferative effect [15] and antiulcerogenic effect [16] were reported.

Phenolic compounds and flavonoids are plant secondary metabolites produced as a response to harsh environmental condition. They function as UV filters, antimicrobial agents, and

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pollinator attractants. The availability of phenolic and flavonoid in a plant makes a plant useful for healing and curing diseases [29]. Light is an important environmental factor that can affect the accumulation of phenolic and flavonoid contents of a plant. This is possible because every plant has a specific light requirement for its maximum production of flavonoid and phenolic compounds. For instance, *Lithocarpus litseifolius* [17] and *Zingiber officinale* [18] accumulates high amount of flavonoid under lower light intensity while Glycine max seedling [19] produces a high amount of flavonoids under high light intensity. *Labisa pumila* accumulates more phenolic and flavonoid under lower light intensity [20]. *Anoectochilus roxburghii* produced a high amount of flavonoid under blue light and high amount of phenolic under red film [21]. Due to these variations, there is a need to know the level of light intensity that leads to a maximum accumulation of flavonoid and phenolic contents of *M. oleifera*. As such, the objective of this research is to evaluate the effect of varying light intensity on the total phenolic and flavonoid contents of *M. oleifera*.

2. Methodology

2.1 Plant Material

Sun exposed and shaded *M. oleifera* plants were sampled randomly. Leaves were harvested and dried. Extraction was done according to Chai et al. [22] using ethanol as a solvent. The plant extract was then stored at lower temperature and later used for the determination of total flavonoid and phenolic contents of the plant.

2.2 Determination of the Total Flavonoid Content

This was achieved using the colourimetry method. The plant extract was mixed with 10% aluminium chloride and 1M potassium acetate. Absorbance was recorded at 420nm. Quercetin was used as a standard and the result was expressed as mg/g quercetin equivalent [23].

2.3 Determination of the Total Phenolic Content

The total phenolic content was determined spectrophotometrically using Folin-chiocalteau reagent. The plant extract was mixed with the reagent and $NaCo_3$. Absorbance was recorded at 730nm. Gallic acid was used as a standard and the result was expressed as mg/g Gallic acid equivalent [24].

2.4 Statistical analysis

SPSS statistical software was used to analyse the data. Differences in the means of the total phenolic and flavonoid contents of sun exposed and shaded plants were compared using T-Test at 95% confidence level. Results were given as mean plus or minus standard deviation.

3. Result and Discussion

The total flavonoid and phenolic content of *M. oleifera* are represented in Figure 1. From the result obtained, it is seen that leaves of sun exposed plant were having higher flavonoid and phenolic contents than leaves of the shaded plant. This may be due to the photoprotective role of flavonoid and phenolics. Comparison of means showed that there is a statistically significant difference between the total flavonoid and phenolic content of sum exposed and shaded *M. oleifera* ($P < 0.05$).

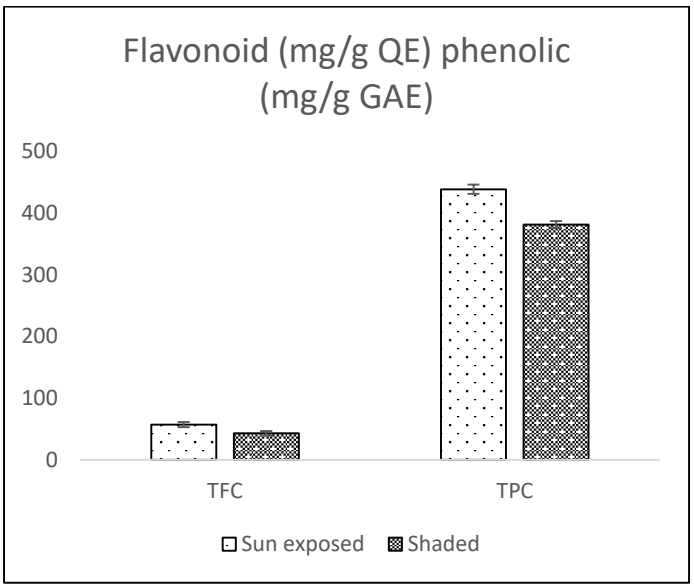

Figure 1. The total flavonoid and phenolic content of sun exposed and shaded *M. oleifera*

The total flavonoid content of sun exposed plant was found to be 57mg/g QE FW. In another study, the total flavonoid content of *M. oleifera* was found to be 90mg/g QE [25], about 80mg/g QE of flavonoid was recovered by [14], 13g/100g QE [3], and 27mg/g QE [8]. The total phenolic content of sun exposed plant was found to be 438 mg/g GAE FW. In another study, the phenolic content recovered from *M. oleifera* was found to be about 2000mg/g GAE [25], 900 mg/g [14], 1460mg/g [13] and 52 µg/mg [9].

Many plants produce a high amount of phenolic content under high light intensity. For instance *Zingiber officinale* [18], *Zea* mays sprouts [26], *Labisa pumila* [20], *Glycine max* sprout [19] and *Gracila pumila* [24] requires a high amount of light for a maximum accumulation of

phenolics. On the other hand, flavonoid accumulation can be high in shaded or sun exposed plant. Some plants, for example, *Piper aduncum* [27] and *Zingiber officinale* [18] requires a moderate amount of shading for their maximum accumulation of flavonoid. besides, *Centella asiatica* [28] requires a sunny condition for their maximum accumulation of flavonoid.

4. Conclusion

The light intensity can affect the accumulation of flavonoid and phenolic contents of *M. oleifera*. The phenolic content recovered from the plant exceeds the flavonoid content recovered. Moreover, sun exposed plant was having higher amount of flavonoid and phenolic contents than shaded *M. oleifera*.

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