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Letter to the Editor

Digestive Stability and Enzyme Inhibitory Potential of *Dillenia indica* L. Bark Extract: Implications for Public Health in Aging Populations

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Dear Editor-in-Chief

The increasing social and economic challenges associated with global population aging have propelled aging-related research to the forefront of public health discourse. Over recent decades, advances in biomedical science and healthcare systems have significantly extended global life expectancy (1, 2). According to the WHO, the global population aged 60 years and older is projected to exceed 2 billion by 2050 (3). This demographic shift presents profound implications for public health systems, particularly with the rising prevalence of age-associated metabolic disorders and degenerative skin conditions, which are now recognized as major contributors to the global burden of disease (4).

In response, there is growing interest in preventive health strategies that utilize natural, plant-derived compounds with functional bioactivity. Among these, *Dillenia indica* L., traditionally consumed in various Asian cultures, has attracted attention due to its antioxidant and therapeutic potential (5). However, a critical aspect of its potential application in public health its bioactive stability during digestion remains insufficiently characterized.

We aimed to evaluate the antioxidant potential and enzyme inhibitory stability of *Dillenia indica* L. bark extract under simulated gastrointestinal conditions, using in vitro digestion models that mimic salivary (SSF), gastric (SGF), and intestinal (SIF) environments. The extract, prepared with 70% ethanol, was analyzed for total phenolic content (TPC), total flavonoid content (TFC), and inhibitory activity against α-glucosidase, elastase, and tyrosinase key enzymes implicated in glycemic control and skin aging.

As shown in Table 1, both TPC and TFC exhibited marked reductions following digestion. TPC declined from 120.25 ± 3.61 mg GAE/g in the control to 32.63 ± 1.47 mg GAE/g post-SIF, while TFC decreased from 236.18 ± 1.23 mg CAE/g to 34.02 ± 0.73 mg CAE/g. Despite these losses in antioxidant content, enzyme inhibitory activities remained notably resilient. α-Glucosidase inhibition a key mechanism in managing postprandial hyperglycemia was preserved above 98% across all digestion phases. Elastase inhibition, essential for maintaining skin collagen integrity and delaying cutaneous aging, also retained over 83% activity post-intestinal digestion. In contrast, tyrosinase inhibition showed a substantial decline, though residual activity remained functionally relevant.

Table 1: Antioxidant and enzyme inhibitory activities of *Dillenia indica* L. bark extract under simulated digestion conditions

Condition	[1]TPC (mg GAE/g)	[2]TFC (mg CAE/g)	[3]α-Glucosidase Inhibition (%)	[4]Elastase Inhibition (%)	[5]Tyrosinase Inhibition (%)
Control (undigested)	120.25 ± 3.61	236.18 ±1.23	99.62 ± 0.16	90.49 ± 1.24	88.37 ± 0.75
SSF	99.28 ± 3.41***	144.56 ±1.91***	99.68 ± 0.08ns	91.96 ± 0.90ns	82.37 ± 0.85**
SGF	56.07 ±2.61***	59.53 ± 2.76***	99.62 ± 0.05ns	87.64 ± 3.13ns	68.12 ±3.43***
SIF	32.63 ±1.47***	34.02 ± 0.73***	98.01 ± 0.23ns	83.78 ± 1.14ns	31.49 ± 2.88***

[1]TPC and [2]TFC were measured to evaluate antioxidant capacity, while [3]α-glucosidase, [4]elastase, and [5]tyrosinase inhibitory activities were assessed using standard colorimetric assays (6, 7). Abbreviations: TPC, total phenolic content; GAE, gallic acid equivalent; TFC, total flavonoid content; CAE, catechin equivalent; SSF, simulated salivary fluid; SGF, simulated gastric fluid; SSF, simulated intestinal fluid. Values are expressed as mean ± SD (n = 3). $^{**}P < 0.01$, $^{***}P < 0.001$ vs. control; ns: not significant.

These findings underscore the digestive stability of certain bioactive constituents within the extract, suggesting its potential utility as a non-pharmacological intervention for age-related chronic conditions. From a public health perspective, the extract's retained inhibitory activity against α-glucosidase and elastase following simulated digestion highlights its promise as a dual-functional agent for supporting glycemic control and dermal health two critical domains in aging populations that impose substantial health and economic burdens on global healthcare systems (8).

Given the increasing demand for sustainable, food-based interventions in chronic disease prevention, *D. indica* L. bark extract represents a promising candidate for incorporation into functional foods, nutraceuticals, or cosmeceutical formulations. Its demonstrated digestive resilience enhances its translational potential for population-level health promotion. Nonetheless, further research is warranted to identify the specific digestion-resistant compounds responsible for these effects and to elucidate their mechanisms of action in vivo. Additionally, the limitations of the in vitro model should be acknowledged, as it does not fully capture the complexity of human gastrointestinal physiology, including microbiota interactions and systemic bioavailability.

In conclusion, this study contributes to a growing body of evidence supporting plant-derived bioactives as viable tools in public health nutrition and aging-related disease prevention. The observed functional stability of *Dillenia indica* L. bark extract post-digestion reinforces its potential role in integrative, preventive health strategies aimed at mitigating the impacts of an aging global population. We respectfully share these findings with the public health community to encourage further interdisciplinary research and consideration of plant-derived bioactives in preventive health strategies, particularly for aging populations.

Conflict of interest

The authors declare no conflict of interest.

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