

Exploring the Bioactive Compounds in Lentils and their potential for Health

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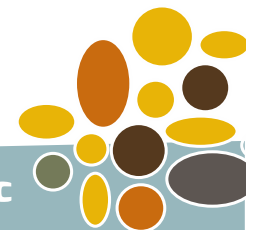
ARC Industrial Transformation Training Centre for Functional Grains

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Lentils

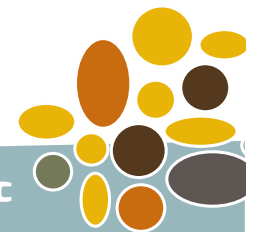
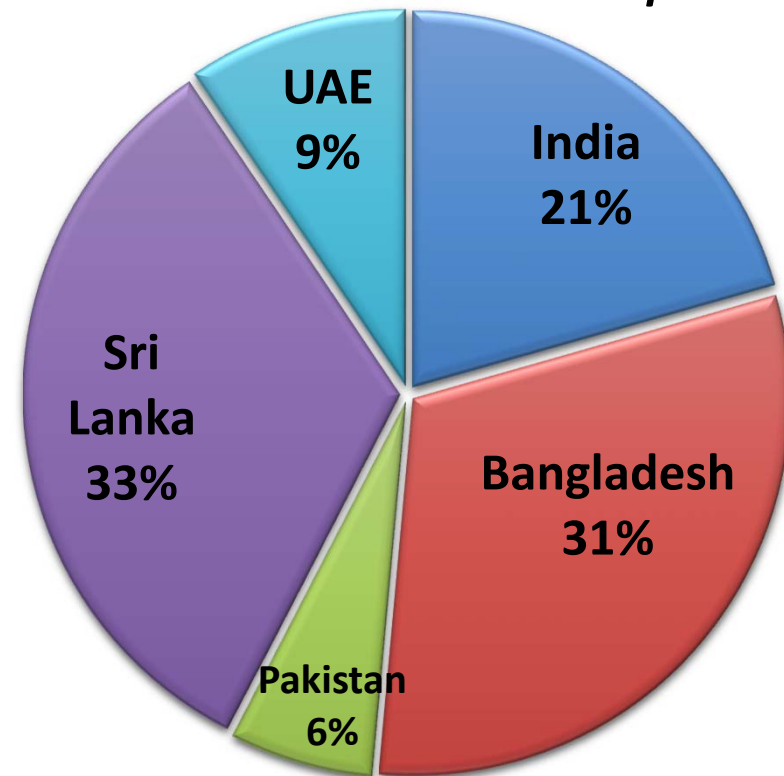
- **Indian green (large flat cotyledon)**
 - Eaten whole
- **Asian red (small cotyledon)**
 - Dahl, Flour, Purees, Soups, Stews, Thickening agents
- **Substitute food products**
 - Gluten intolerance
 - Vegans
 - Vegetarians



Australian Production

- **5 year average exports**
 - 279,000 tonnes
- **Export value**
 - \$185 million
- 95% exported
- 90% are red lentil
(Pulse Australia, 2015)

2014-2015 Australian Lentil Export



Health Claims

REVIEWS

Phytochemicals for Health, the Role of Pulses

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Pulses are the seeds or legumes that are used for human consumption and include peas, beans, chickpeas, and lentils. Pulses are an important source of macronutrients, containing almost twice the amount of protein compared to cereal grains. In addition to being a source of macronutrients and minerals, pulses also contain plant secondary metabolites that are increasingly being recognised for their potential benefits for human health. The best studied legume is the soyabean traditionally regarded as an oilseed crop rather than a pulse. The potential health benefits of soy particularly with respect to isoflavone content, have been the subject of much research and the focus of several reviews. By comparison, less is known about pulses. This review investigates the health benefits of pulses, focusing on the following categories: *(1) phytochemicals*, *(2) glycemic index*, *(3) bioactive carbohydrates*, *sterols* and *saponins*. The evidence for health properties is considered as is the effect of processing and cooking on these potentially beneficial phytochemicals.

KEYWORDS: Piles; phytochemicals; macroalgae

INTRODUCTION

Pulses have traditionally played a major role in providing food nutrition particularly in the Indian subcontinent and other developing countries, while in western countries, the staple diet has been based on animal derived proteins.

Traditionally, pulses were consumed with minimal processing, and consumers were interested primarily with size, shape, and color characteristics. The markets were driven by price and availability. As the countries of the Indian subcontinent developed, a greater emphasis was placed on processing characteristics, which included hydration and cooking times as well as dehulling and splitting efficiency. This represents the current status for the majority of markets that consume pulse grains as a staple diet. While these market traits represent basic quality characteristics, the underlying chemical characteristics are based on protein and starch composition and phenolic compounds that affect the taste and color of the seed coat and cotyledon.

The nutritional properties of pulses have been investigated extensively and have been reported to impart physiologically beneficial effects in humans. Pulse grains are high in protein, carbohydrates, and dietary fiber and are a rich source of other

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nutritional components (1). The chemical composition and nutritive value of Australian pulses has been collated by Peterson *et al.* (2).

The value of pulses can be enhanced by physically fractionating the grain into basic constituents such as protein, starch, and fiber and using these products to supplement other food ingredients to enhance the nutritive value of food. There is now an increased awareness of the health-associated value of pulses in western countries. Pulse grains contain a large number of bioactive compounds which have a metabolic benefit when consumed on a regular basis (3).

Demand has increased regarding the use of pulses for human consumption either to extract a functional compound (e.g., starch protein or fiber) or to incorporate this into cereal-based products or to extract phytochemicals which are bioactive and can be used as nutraceutical products.

Figure 1 represents the changing emphasis for plant breeding and consumer demand. There is a need to increase the knowledge base for pulses by understanding more of the functional and bioactive properties of pulses, cereals, (2).

Considerable genetic variation has been reported in the chemical composition of pulses both between and within species. In addition, chemical composition is modified by environmental factors during plant development, and many of the phytochemicals are secondary metabolites produced during seed development and seed maturation.

This paper reviews the current knowledge around certain classes of plant phytochemicals, including starch, phytoesterols,

- Anti Cancer
- Anti Obesity
- Anti Hypertension
- Antioxidant

Legume-Derived Bioactive Compounds for the Prevention and Treatment of Breast Cancer

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Brazil

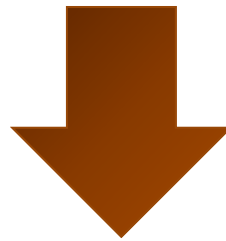
1. Introduction

Breast cancer is one of the most prevalent cancer types among women worldwide (Jemal et al., 2011); however, its incidence rates among populations are heterogeneous. Epidemiologic studies have shown that breast cancer incidence in Asian women is 40% lower than in Caucasian women (Goldin et al., 1986). A reasonable explanation for the difference in the cancer incidence rates could be related to intrinsic biological characteristics present in each population. For example, in general, breast cancer growth requires the presence of estrogen and it is known that Asian women have lower estrogen serum levels than Caucasian women



Bioactive Composition

Any primary or secondary metabolite that has an impact on cell function and maintenance



Functional food

Cardiovascular Disease (CVD): Lentils significantly lowered blood pressure in a hypertensive rat model (Kendall, de Souza, Jayalath Cozma & Sievenpiper, 2014).

Obesity: Human cohorts fed lentils leading to noticeable weight loss and improved glycemic control (Hanson, Zahradka & Taylor, 2014).





Functional Food?



Lentil Composition

Distribution of Phenolics Macronutrients

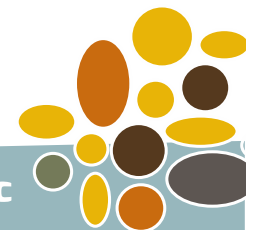
- Cotyledon
 - Magnesium, Phosphate, Calcium, Potassium, Sulfur, & Iron
 - Polysaccharides
 - Non-flavonoid
 - Tannins & tannin compounds (Seed Coat)
 - Hydroxy benzoic
 - Molybdenum & Boron
 - Catechins & flavanols
 - Hydroxycinnamic
 - Proanthocyanidins
- Seed Coat
 - Seed Coattease Inhibitors
 - Riboflavin (B₂)
 - Quercetin diglycoside
 - Glycosides (Flavonols & Flavones)
 - Starch
 - Trans-*p*-coumaric acid
 - Trans-resveratrol-3-O-glucoside
 - *P*-hydroxybenzoic acid
 - Proanthocyanidin



Project Overview



- **Identification of the bioactive compounds in lentils.**
- **Comparison of bioactives compounds between lentil cultivars.**
- **Changes in bioactives.**
 - Germination
 - Environment
 - Processing
- **Presence of inhibitors & inhibitory actions of lentil extracts.**
- **Chemometric model**



Investigation of Inhibitors

- Hypertension
 - **ACE Inhibitors (ACEi)**
 - O-aminobenzoylglycine fluorescence assay.
- Obesity
 - **Pancreatic Lipase Inhibitors**
 - Porcine pancreatic lipase inhibition assay.

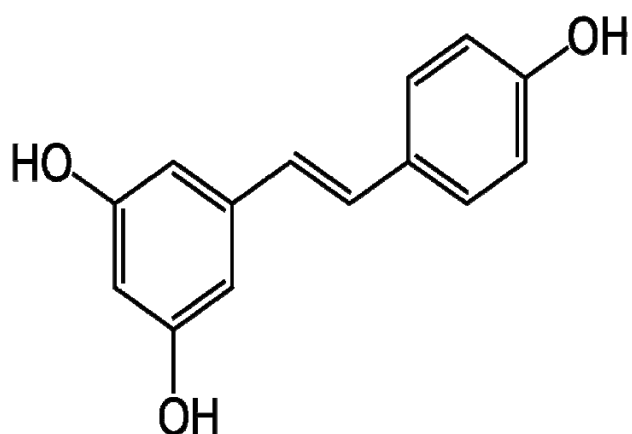


Investigation of Chemical Composition

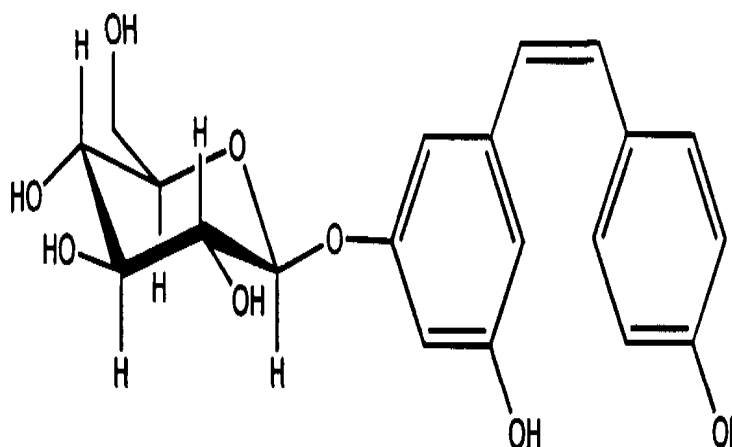
- **Determination of Total phenols (TPC)**
 - Folin Ciocalteu assay.
- **High Performance Liquid Chromatography**
 - RPLC-DAD.
- **Liquid Chromatography & Mass Spectrometry**
 - LCMS.



To hydrolyze or not ?

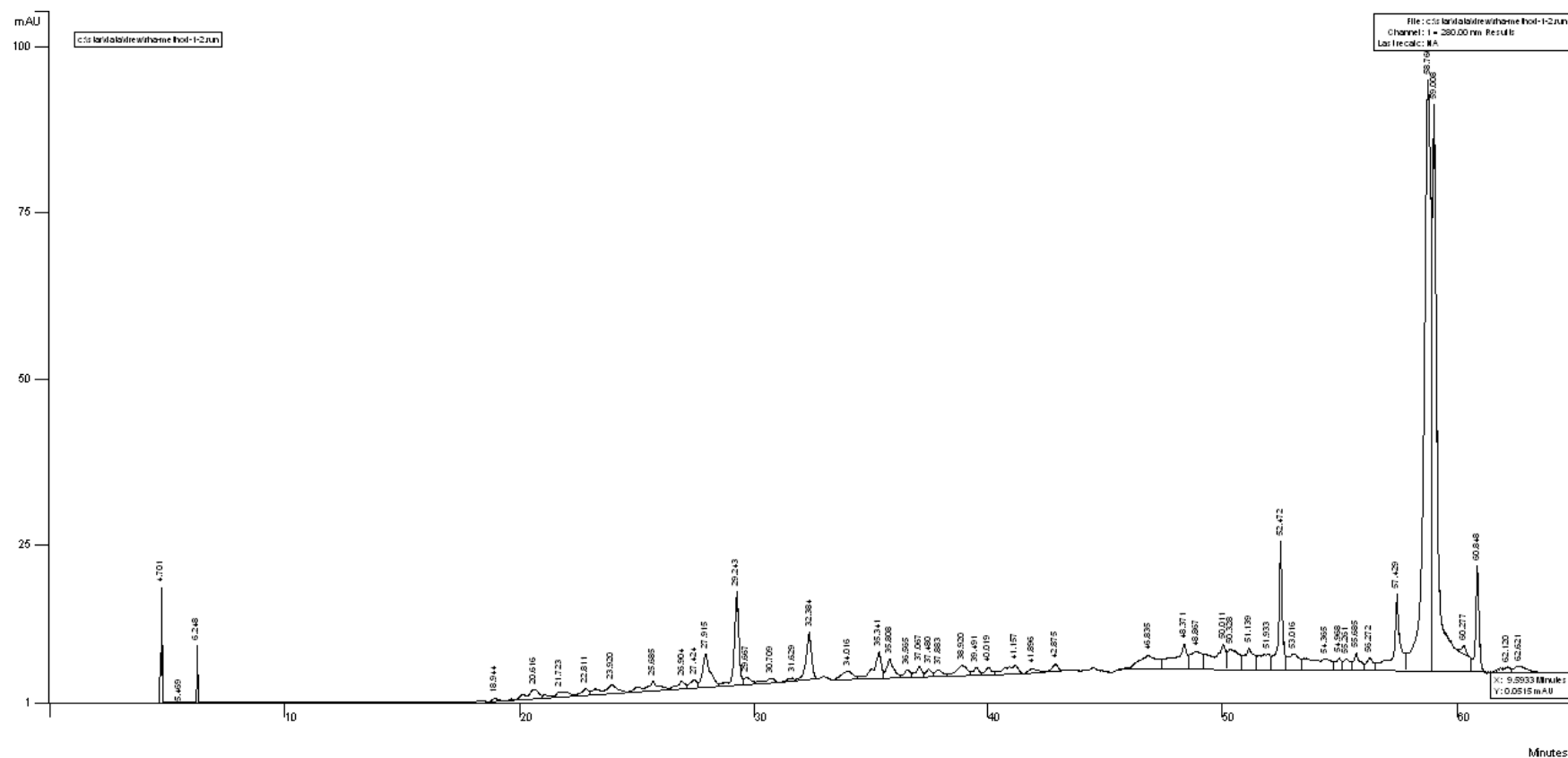


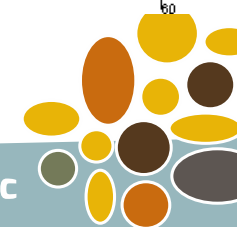
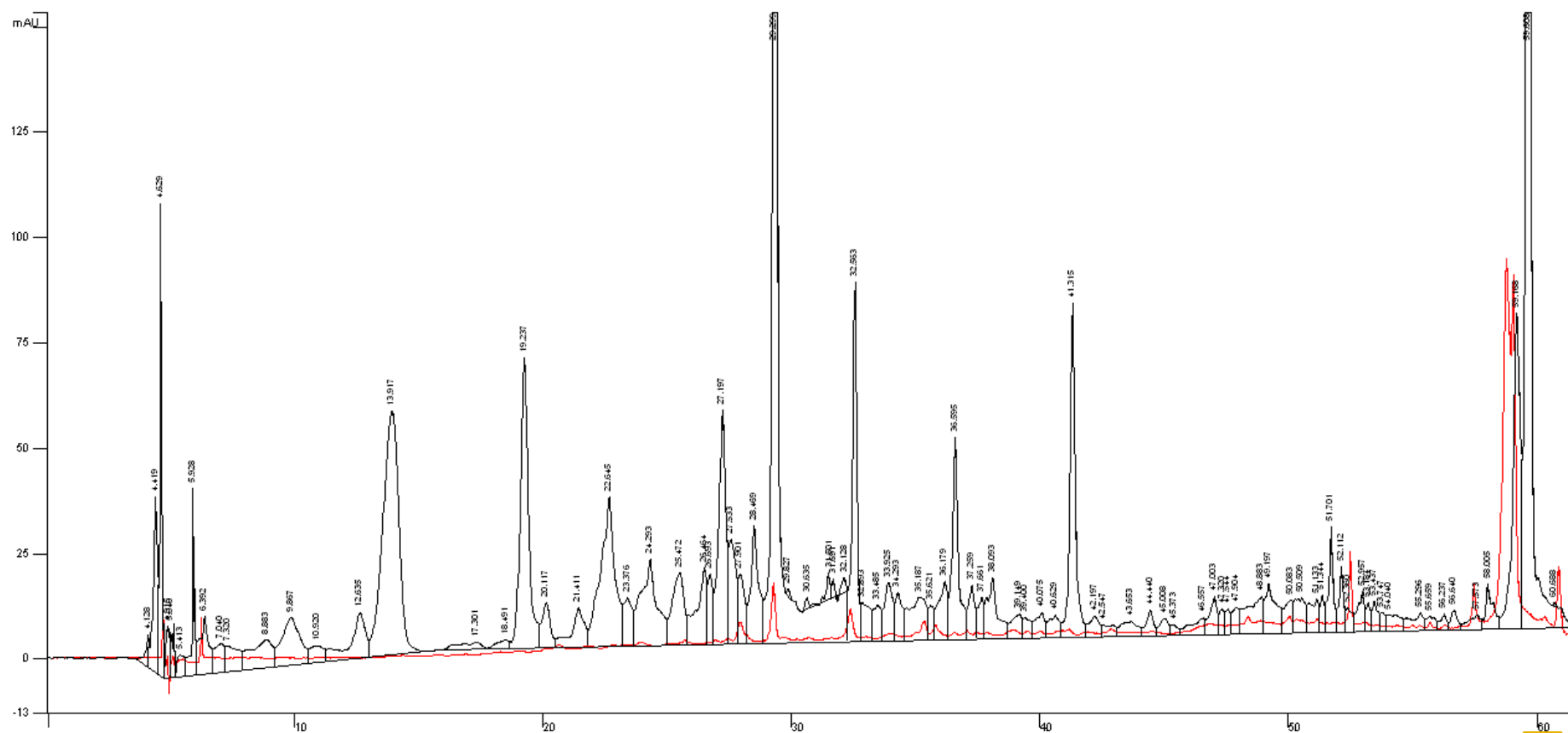
Resveratrol



Resveratrol glucoside







Lentil Samples

Australian Red	Canadian Red	Australian Green	Canadian Green
Nipper	Blaze	Flash	Milestone
Bounty	Red Bow	Cobber	Sedley
Herald	Red Chief	Aldinga	
Hurricane	Rosebud	Matilda	
Northfield	Ruby	Boomer	
Nugget		Greenfield	
Ace		Giant	
Blitz			
Bolt			
Digger			
Jumbo			

(Green n= 10, Red n= 16, Sample Size n= 25)



Thank you for listening

Questions?

