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Antinutrient composition and antioxidant activity of composite functional food formulation for diabetics

KEYWORDS: composite mix, diabetes, antinutrients and antioxidant activity

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ABSTRACT *Diabetes is increasing at an alarming rate in the country and is associated with cardiac disorders including hypercholesterolemia especially in urban population. This is attributed to rapid nutritional transition, and life style changes (Shetty, 2002). In the view of the alarming global and national situation with reference to diabetes and effectiveness of various food and herbs in controlling the disease on the other, an investigation was conducted to develop a functional food formulation by making use of locally available foods. Four composite mixes were developed using wheat, ragi, bajra, soy bean, flax seed powder, cluster bean powder, drumstick leaves powder and amrutballi stem powder. Composite mixes were subjected to chemical analysis antinutrients using standard protocols. Antioxidant acivity of the formulated food composite mixes ranged from 40.91-57.66%.. These functional food formulations also exhibited good radical scavenging potential as evidenced by high values for phytates, tannic acid and anti oxidant activity.*

Introduction

Currently, functional foods are gaining acceptance in the scientific fraternity. Food or diet plays a major role in management of diabetes mellitus and hypercholesterolemia. Such a diet could be formulated by incorporation of natural plant extract/parts with known antidiabetic property. Such composite flour formulation would be acceptable for long time therapeutic usage without any side effects.

Significant levels of antioxidants have been detected in whole grains and grain based cereal products. These contain complex carbohydrates, protein, dietary fiber, oligosaccharides, minerals and phytochemicals. Growing interest in the substitution of synthetic food antioxidants with natural antioxidants and the positive health implications of antioxidants as nutraceuticals has fostered research on vegetable sources and the screening of raw materials for identifying antioxidants (Kelawal and Ananthanarayan, 2004). The cooked leaves of drumstick have been shown to decrease blood glucose (Sheila and Chellappa, 2004). Consumption of viscous dietary fibres can help to normalize blood glucose and insulin levels, reducing the severity of diabetes mellitus. Flax seed is a functional food that has recently gained attention in the area of atherosclerotic cardiovascular disease prevention because it contains three key constituents: α-linolenic acid (ALA), soluble fiber, lignans and an array of antioxidants (Bloedon et al., 2004). Tinospora cordifolia, Amarta or Guduci (Sanskrit) is found in forests throughout India. The whole plant is widely used in Ayurveda as tonic, vitalizer and as a remedy for diabetes mellitus and metabolic disorders. In the view of the alarming global and national situation with reference to diabetes, an investigation was conducted to develop a functional food formulation by making use of locally available foods such as wheat (cereal), ragi and bajra (millets), soyabean (pulse), flaxseed (oil seed), clusterbean (vegetable), drumstick leaves (green leafy vegetable) and (medicinal herb) Tinospora cordifolia and their antinutrients and antioxidant activity was analysed.

Materials and method

Locally available ingredients were selected (figure 1)wheat, ragi, bajra, soyabean, clusterbean, drumstick leaves and amrutballi stem powder. Four composite mixes were developed. Composite flour mix was made by milling ingredients completely and made to pass through 40microns sieve in case of ragi, bajra and wheat based flour mixes. Composite flour was analyzed for the antinutrients tannins and phytic acid. Analysis was done using standard AOAC (1980) procedure. Antioxidant activity was analysed by DPPH method. Analysis was done in duplicates using analytical grade chemicals. Results were expressed on dry weight basis.

Results and discussion

Tannins are condensed polyphenolic compounds. Millets like bajra, ragi and sorghum also contain a fair amount of tannin (Manay and Shadaksharaswamy 2006). A typical Indian diet based on cereals, legumes, vegetables and spices may contain 2-3 g of tannins (Gopalan et al., 2004). In the present study under table 1. tannin content ranged from 401.0 to 589.16 mg/100g. Ragi based composite mix (Composite mix II) was found to be higher. Sripriya et al.,(1996) analyzed samples of finger millet for free radical scavenging activity. They noted that non processed brown finger millet had the highest radical quenching activity and postulated that tannins and phytic acid were responsible for the activity. Chetana (2008) reported tannin content as 199.27 mg in composite mix I (Pearlmillet, Sorghum, Green gram and Soyabean) and 217.38 mg/100g in composite mix II (Finger millet, Sorghum, Green gram and Soyabean).

Phytic acid

Phytate (myo-inositol hexaphosphate, IP6) is an important storage compound in seeds including cereals and legumes. Phytates are thought to exihibit antioxidant properties by sequestering the iron before it can be involved in damaging processes, thus, protecting against degenerative diseases. Pendelton (2009) reported that phytates have been shown to reduce the digestion of starch and reduce the overall glycemic index of the foods and also decrease cholesterol and triglycerides production by the liver. Chetana (2008) reported phytate content as 127.75 mg in composite mix I (Pearlmillet, Sorghum, Green gram and Soyabean) and 193.90 mg/100g in composite mix II

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(Finger millet, Sorghum, Green gram and Soyabean). In the present study under table 1. phytate content ranged from 192.75-235.26 mg/100g. Ragi based composite mix (Composite mix I) was found to be higher in phytate content. Thus, addition of functional ingredients has marginally increased the phytate content in the formulations.

Antioxidant activity

Radical scavenging is the main mechanism by which antioxidants act in foods. Several methods have been developed in which the antioxidant activity is assessed by the scavenging of synthetic radicals in polar organic solvents at room temperature (Pokarny et al, 2001). In the last few decades, several epidemological studies have shown that a dietary intake of foods rich in natural antioxidants correlates with reducced risk of coronary heart diseases. This association has been partially explained as the basis of the fact that the polyphenols interrupt lipid peroxidation induced by reactive oxygen species. In the present study (table 1) antioxidant activity ranged from 40.91 to 57.66 per cent. Highest activity was found in composite mix-I followed by composite mix-IV, composite mix-II and composite mix-III (46.00, 42.50 and 40.91 respectively). Similar experiments showed that ragi had greater antioxidative activity than flaxseed, wheat, amaranth or sesame seeds (Kelawala and Anantanarayana, 2004). Since composite mix-I is based on finger millet followed by wheat and pearl millet. The notable medicinal properties of amrutballi (Tinospora cordifolia) reported are anti-diabetic, hepatoprotective, anti stress, anti-arthritic and antioxidant (Singh et al 2003). Arabshahi et al, (2007) has demonstrated that extracts of drumstick leaves, mint leaves and carrot tuber are potential source of antioxidants. It may be noted in the present study functional food formulation did contain drumstick leaves powder and Amrutballi stem powder in lower concentrations than what has been reported.

Conclusion

Locally available ingredients with known functional value such as, ragi, bajra, whole wheat, soybean, flax seed, drumstick leaves, cluster beans and amrutaballi stem powder were selected. These functional food formulations exhibited good radical scavenging activity as evidenced by high values for phytates, tannic acid and anti oxidant activity.

Table 1 : Anti nutrient and antioxidant composition of composite functional food formulation

Composite mixes	Tannins (mg)	Phytates (mg)	Antioxidant acivity (%)
Composite mix I	589.16	235.26	57.66
Composite mix II	470.66	233.33	42.50
Composite mix III	450.16	235.16	40.91
Composite mix IV	401.00	192.75	46.00
F -value	*	*	*
SEm±	1.94	0.35	0.35
CD	5.74	1.04	1.03

*Significant at 5 per cent level

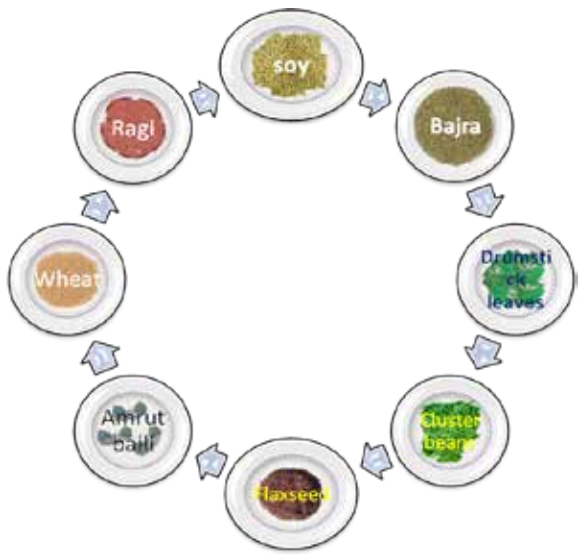

Figure 1 : Selected ingredients used in the preparation of functional food formulations

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