

Cottonseed Meal: A Rich Source of Protein for Human Consumption

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Cotton crop is grown as commercial crop for its fiber needs in textile industry. In addition to its importance as the fiber producer, cotton seeds are a rich source of nutritious cooking oil and protein. Cotton seeds are major protein resource (23%) after soybean (56%) and rapeseed (20%). For each kg of cotton fiber production, the plant yields approximately 1.65 kg of seed, but their consumption is hampered due to the presence of gossypol in the seed. Gossypol is polyphenolic binaphthyl dialdehyde, a toxic yellow pigment found mainly in the pigment glands of cotton seeds and confers resistance to insect pests and pathogen [1,2]. Gossypol is also toxic to monogastric, ruminant animals and human if consumed, which may cause growth depression, abnormalities to intestine, reproductive and other internal organs [3,4].

Cotton is grown in > 80 countries as cash crop with an approximate of 296 lakh hectares of world area under cultivation. More than 20 million farmers in developing countries from Asia and Africa are dependent on cotton cultivation, but unfortunately the children belonging to most of these regions are suffering with malnutrition. Some 795 million people in the world approximating to 12.9% of the population is undernourished and do not have enough food to lead a healthy active life. According to FAO data, world's most malnourished country is Haiti with lowest per capita food availability of 1976 calories/person/day followed by DR Congo (2056 calories/person/day), Chad (2076 calories/person/day), Kenya (2092 calories/person/day), Ethiopia (2097 calories/person/day), Mozambique (2112 calories/person/day), Madagascar (2117 calories/person/day), Tanzania (2137 calories/person/day), Sierra Leone (2162 calories/person/day), Guatemala (2244 calories/person/day) (www.worldatlas.com). Low energy availability would reduce work capacity of an individual. In addition, children needs high levels of energy intake for proper growth and development, and being malnourished would compromise immune system and make people more susceptible to health problems.

Cottonseeds can be a good source of protein for animal and human consumption provided the gossypol content and fibre content are taken into account [5,6]. Animal and human research studies have shown that consumption of gossypol-free glandless cottonseed flour promoted the growth, increased weight gain, and a positive nitrogen balance [4]. Several methods are available to detoxify cottonseed meal from gossypol, including solvent extraction [7-9], treatment with ferrous sulfate and calcium hydroxide [10-12], microbial fermentation [13,14] and many. Among these, most of the methods affected the nutritive quality of the protein and hence the microbial method was considered as promising one because the fermented cottonseed meal was expected to contain several exoenzymes along with some bioactive molecules such as vitamins [15]. In addition, microbial methods available for detoxification of gossypol were mainly achieved through fungus which could be again harmful if cross contamination could occur via fungal spores and also the biodegradation efficiency was not very high. Therefore, protocols are required to be developed and optimized to detoxify cottonseed meal from gossypol to promote its safe consumption without affecting the nutritive value of the protein and also encourage the proper utilization of cotton seeds which can contribute in combatting malnutrition.

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