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QUORN : An Anticipated Novel Protein Source

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ABSTRACT

Quorn is a mycoprotein, consisting of low-fat content and is free of cholesterol. In addition, it has high dietary fibre, which has found to lower blood cholesterol. Simultaneously, a consequent decrease is also found in the total cholesterol effect. Good compliance with quorn also appeared to have a significant drop in total blood cholesterol and LDL cholesterol. Moreover, it increases satiety and had also been proved to reduce glycaemia and insulinemia. Hence, it can be considered as an excellent nutritional source for the vegetarians.Perhaps, feasibly it might be the breakthrough for malnutrition dilemma. Quorn mycoprotein strains previously identified as *F. graminearum* was*F. venenatum*. It is now produced from fungus *Fusarium venenatum*, in vat fermenter, futhermore glucose and ammonium is added as the carbon and the nitrogen source respectively. Therefore it is easily cultivableand are consumed either in fresh or processed form such as mince, nuggets, sausages, etc. But the risk of sensitisation to Quorn is also found, just in those patients who are allergic to mould. Such individual might react adversely to inhaled or ingested mycoprotein. *F. venenatum* myco-protein is now used in six European countries and there are plans for it to be sold in other countries as well.

Keywords : Quorn, Production – *F. venenatum*, Pros and Cons

I. INTRODUCTION

The production of food by humans is alleged to contribute considerably to environmental impacts. Particularly meat is seen as a part of the diet with a high environmental impact. The environmental impact is seen affected by three environmental indicators required for production, viz. raw material used, the amount of molasses and nitrogen in this case, and the amount of energy required for production. This environmental impact can be changed possibly by substituting meat with meat substitutes. The fungi contains essential and nonessential amino acids, so they are considered as supreme nutritive food and feed as well. Since prebiblical times the fungi are used in fermented beverages and as dietary sources (Shakuntala Ghorai, et al 2009). The consumption of wild fungi was first reliably noted in China (Aaronson, 2000). Since the later half of the 20th century the consumption of fungi and the utilization in production of other food materials have been exploited by microbiology industry (Shakuntala Ghorai, et al 2009).

In the terms of dietary supremacy among the vegetarian platter, the fungal kingdom possesses certain natural advantages, they are: (1) good protein content, (2) chitinous wall to act as a source of dietary fibre, (3) low in fat, (4) free of cholesterol and (5) high vitamin B content. The UK Foods Standards Committee coined the term Myco-protein as the generic name of a selected strain of *Fusarium venenatum*. Formerly the product was dried and powdered for sale as high protein SCP flour, but later for its organoleptic qualities of the hyphal mass it has been developed as the meat substitute, as a high-technology product under the brand name ‘Quorn’(Shakuntala Ghorai, et al 2009).

In England, the filamentous fungi cultured as a mycoprotein source for human consumption under the trade name Quorn has been identified as *Fusarium graminearum* Schwabe A 3/5. The A 3/5 strain of Quorn has been reported to produce no toxic secondary metabolites, but plethora of mycotoxins are noted by many fusaria, including *F. graminearum*. Zearalenone and B trichothecenes is produced by F. graminearum. Zearalenone is an estrogenic metabolite and B trichothecenes such as deoxynivalenol pose threat to

plants, animals and humans as it can inhibit protein synthesis. However, soon the phylogenetic analyses of discrete DNA sequences data from 28S ribosomal DNA, β-tubulin gene exons and introns and nuclear ribosomal internal transcribed spacer region confirmed that the Quorn fungus *Fusarium venenatum*, rather than *F. graminearum* as previously reported. (O'Donnell et al, 1998)

Production Processing and Harvesting

In UK, since 1985 for the production of Quorn mycoprotein *Fusarium venenatum* has been used (Wiebe, 2004). In 1985, a company called Marlow Foods was formed by RHM and ICI jointly to produce various food products from fungal biomass. 'Quorn' was the tradename given to their mycoprotein. The initial idea was to cultivate the fungus in fermenter containing medium enriched with wheat starch as carbon and ammonia as nitrogen and energy source for growth, and then to modify the produced biomass to meet nutritional guidelines. Three methods can be used for the production of mycoprotein viz. Batch culture, Continuous culture and Air-lift fermenters. Among these the greater productivity of growth related proteins can be achieved by using Continuous culture (Alison el al, 1997).

To produce the mycoprotein the optimum growth temperature is 30^oC in the presence of medium containing glucose syrup and choline (longer hyphae are formed in presence of choline). Hydrolysed corn, wheat, rice or potato starch or molasses can be used for glucose source (Trinci, 1989). In surface culture method the mycoprotein production was piloted using *Fusarium venenatum* from date syrup. Under optimum conditions date syrup 14g/l, $(NH_4)H_2PO_4$3.5 g/l, KH_2PO_4 1.6 g/l, temperature 30^o C, time 72 h, seed age 48 h and seed size 10% v/v the dry weight of biomass obtained was 5.46 g/l (Hoseyni et al, 2010).

The processing of mycoprotein involves the reduction of RNA content to meet the World Health Organization (WHO) guidelines for human consumption. The RNA content of mycoprotein is reduced to 1% of the dry weight by heating the culture to 60^o C for 20-30 minutes. This treatment allows the RNases to break down ribosomal RNA, which diffuses through the hyphal walls into the culture broth and so is removed from the final product. The obtained product is spread over a large moving filter through which most of the liquid is drained by vaccum, seperating a thin, malleable sheet of Quorn mycoprotein. When harvested the mycoprotein is pale and buff in colour with a mild flavour, so in the end it is supplemented with appropriate colors and natural flavours (Trinci, 1989).

Pros

Mycoprotein is a high quality protein food containing essential amino acids. If a group of human is fed with mycoprotein rather than meat, had beneficial effects on plasma cholesterol (13% reduction) and low-density lipoproteins (LDL-9% reduction), while an escalation of 11% was seen in level of high-density lipoprotein (HDL). Therefore, mycoprotein can be included in a range of food that is lipid-lowering or lipid-normalizing diet because it contains high polyunsaturated:saturated fatty acid ratio and substantial amount of dietary fibre, at the same time it contains low fat content (Turnbull et al, 1990).In contrast, 35.6% of fall was seen in the total cholesterol level of those fed with Quorn (Ruxton and McMillan, 2010).

The biomass extracts (in distilled water and ethanol) derived from the fungi *Fusarium venenatum* grown in Vogel's media shows anti oxidant and anti tumor activity without causing effect on RBC and vero cell line. 1000 µg/ml of ethanol extract showed the highest scavenging activity, and a decrease in viability was recorded in increased concentration of ethanol extract i.e. 2.3, 11.2, 41.2 and 49.4% of viability was recorded in 500, 100, 50, 10 µg/ml respectively (Prakash and Namasivayam, 2013).

Table 1. Quorn myco-protein compared with traditional animal protein sources

	Cheddar cheese	Raw chicken	Raw lean beef	Stewing steak	Fresh cod	Raw beef sausage	Quorn myco-protein
Protein (g.100 g^{-1})	26.0	20.5	20.3	20.2	17.4	9.4	12.2
Dietary fibre (g.100 g^{-1})	0	0	0	0	0	0	5.1
Total fats (g. 100 g^{-1})	33.5	4.3	4.6	10.6	0.7	24.1	2.9
Fats ratio (polyunsaturated fatty acids: saturated fatty acids)	0.2	0.5	0.1	0.1	2.2	0.1	2.5
Cholesterol (mg.100 g^{-1})	70	69	59	65	50	40	0
Energy (kJ 100 g^{-1})	1697	506	514	736	318	1250	334

The comparison of Quorn and traditional animal protein source is illustrated in table 1. Quorn mycoprotein contains no cholesterol and has a relatively high ratio of polyunsaturated fatty acid to saturated fatty acids. And it contains the dietary fibre, which do not exist in other animal protein sources (Trinci, 1989).

Cons

Nonetheless Quorn has many benefits, on the other hand it can react as an allergen too. Nearly 1/140000 consumer has reported adverse reaction after eating Quorn. The risk of sensitization to Quorn is low, but it might react adversely to patients who are allergic to mould. Cross reactivity indicated that Quorn shared multiple allergenic determinants with other fungi, *Aspergillus fumigatus*, *Cladosporium herbarum* and *Alternaria alternata*(Katona and Kaminski, 2002).

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