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Study on effect of chitosan on body weight gain and anti-microbial activity in swiss albino mice

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Abstract

A study was conducted to determine the effect of chitosan on body weight gain and anti microbial activity in swiss albino mice. A total of 12 swiss albino mice were selected and subjected for two dietary supplement with chitosan (200mg & 1gm/ Kg body weight respectively). The experimental trials were conducted for 5 weeks & dietary supplementation of chitosan was given at weekly intervals.The results of the study indicated that there is increase in the body weight gain of mice by every week due to the dietary suplementation of chitosan.Similarly every week faecal samples were collected & subjected for anti microbial activity by estimating E-coli Counts. There was decrease in the E.coli count for every week with the dietary supplementation of Chitosan indicating the growth promoting and antimicrobial activity of Chitosan.

Introduction

The usage of different additives instead of antibiotics has been recommended as a way to improve growth and to enhance gut health of animals which makes it possible to reduce or eliminate the use of antibiotic in feeds. Among these additives, Chitosan the second most abundant carbohydrate polymer in nature (Singla & Chawla, 2001; Luo & Wang, 2013) has been demonstrate to have positive effect on farm animals.

Chitosan is a polysaccharide prepared by deacetylation of Chitin which is widely distributed in the exoskeleton of living organisms such as Crustacea, insects and fungi (Crini, 2005; Huang et al, 2007, Li etal, 2009 & Xia et al, 2011). It was reported previously that dietary supplementation of chitosan was able to improve animal performance (Khajarern & Khajareran, 2002a.b, Shi et al, 2005) and has become a new candidate as a growth promoter for farm animals(Huang et al, 2005, Yuan & Chen, 2012). Hence present study was conducted in white swiss albino mice.

Material & Methods

Raw material used was *Penaeus monodon*, commonly known as Giant Tiger Prawn and *Penaeus indica* or Indian Prawn. The inedible parts including head,shells and tails were removed from the whole body for extraction of chitosan.

The chemicals used in this extraction process consists of

1. 4% Sodium Hydroxide (w/v – 1:4.5)
2. 4% Hydrochloric Acid (v/v – 1:4.5)
3. 50% Sodium Hydroxide (w/v – 1:20)
4. 1% (v/v) Acetic Acid

Chitin and chitosan were prepared from prawn shell waste. Biomass of shrimp waste collected was 5 grams. The shell waste was washed with tap water and dried for further use.It was then de-proteinised in 4% aqueous sodium hydroxide (1:4.5;w/v) at room temperature (25^{o}c) for 21 hours. After draining the alkali, for the removal of residual protein from the shell,it was washed with distilled water repeatedly

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unless the ph drops to neutral. The de-proteinised shell was de mineralized by 4 % HCL (1:4.5; v/v) at room temperature for 12 hours.The acid was drained off and washed thoroughly with distilled water. The chitin was dried at ambient temperature (30 ±2°C). The Chitosan was prepared by deacetylation of chitin by treating with 50% aqeous sodium hydroxide(1:20;w/v) at 40°C for 3 days.After deactylation,the alkali was drained off and washed with distilled water thoroughly until the pH is less than 7.5. Finally,the chitosan was dried at ambient temperature (30 ±2°C).

Hence present study was conducted in white swiss Albino Mice with two dietary supplementation of chitosan i.e. 200 mg / kg body weight & 1 gm / kg body weight. For this experiment three groups of Mice were selected Group- I for 200 mg/kg body weight dietary supplemention of chitosan, Group – II 1gm / kg body weight of dietary supplementation of chitosan along with control group. The dietary supplementation was given at weekly intervals and correspondingly body weights were taken.

Along with the body weight for the groups I & II along with the controls faecal samples were also collected for estimation of E Coli counts to determine the anti microbial activity of chitosan.

Experimental Design

Table 1:

S. No	Groups	Dietary Supplementation of Chitosan	Number
1	Control	-	2
2	Group - I	200 mg/ kg body weight	5
3	Group – II	1gm/kg body weight	5

Results & Discussions

The Chitosan was extracted from Biomass of shrimp and fed with two dietary supplementation viz. 200 mg & 1gm / Kg body weight to the white swiss albino mice for 5 weeks duration period. The effect of Chitosan supplementation on body weight of swiss albino mice was determined and there was increase in the body weight of mice and were shown in the Table 2. Chen et al(2001) reported that compound Chitosan enhanced the activity of pepsin in rats. Hence,increase in the body weight in Albino mice might be due to increase in feed efficiency & feed intake due to enhanced activity of pepsin in the stomach.

The antimicrobial activity of the Chitosan was determined by subjecting faecal samples that were collected on Zero day, First week, Second week, Third Week, Fourth Week & Fifth Week respectively. The detailed results were shown in the Table 3. The table 3 indicated that there is decrease in the E Coli count from first week to fifth week of two dietary supplementation (both 200 mg/kg & 1 gm/kg) of chitosan compared to the control group showing antimicrobial effect of chitosan. The antimicrobial activity of chitosan indicated that there is decrease in the E.coli count because dietary chitosan could inhibit the proliferation of E.coli in the intestine there by improving the micro ecological environment in the gut.These studies are in agreement with Xu et al , 2012. Further chitosan provided a beneficiary environment for the proliferation of enterocytes, preventing intestinal atrophy Han et al, 2012. Our studies also showed that chitosan was an effective polysaccharide in maintaining intestinal structure

Table 2: Body Weights of Mice at Different Periods of Experimental Study

Period	Control	Group – I (200 mg/ kg body weight)	Group – II (1gm/kg body weight)
Zero Day	14 gms	14 gms	14 gms
1st Week	18 gms	20 gms	22 gms
2nd Week	20 gms	28 gms	30 gms
3rd Week	22 gms	30 gms	33.5 gms
4th Week	24 gms	35 gms	39 gms
5th Week	26 gms	39 gms	44 gms

Table 3: Table showing E.coli with the Two Dietary Supplements of Chitosans

S. No	Dietary Supplementation of Chitosan	E-Coli Count (CFU/gm)	
		0 Day	5th Week
1	Control	5×10^8	5×10^6
2	200 mg/Kg	4.8×10^8	3×10^6
3	1gm/Kg	4.8×10^8	1.5×10^3

and function which might be one of the reasons for increase in growth performance in mice fed with chitosan dietary suppliments.

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