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Inclusion of probiotic (*Saccharomyces cerevisiae*) on growth performance of chicken: A review

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Abstract
Food supplementation with probiotic (*Saccharomyces cerevisiae*) in poultry as a mean lead to improve the health and growth performance of poultry. The use of antibiotics in poultry with the purpose of promoting growth rate, body weight gain, increasing feed conversion efficiency, feed conversion ratio. With increasing concerns about antibiotic resistance, there is increasing interest in finding alternatives to antibiotics for poultry production. To avoid the health hazards of antimicrobials drugs like antibiotics to human as well as poultry, probiotic has been used for as an potential substitute for antibiotics and been proved to be saved in poultry production system. This increased attention toward probiotic supplementation has generated an extensive body of research in the present day. However, there is still a lot of debate in scientific literature regarding the significant effect of probiotic on immune response against specific pathogens and growth performance in poultry. The natural feed supplements can effectively be utilized to promote growth in poultry and livestock while avoiding the dangerous phenomenon of encouraging drug resistant bacteria as in the case of antibiotic growth promoters (Demir *et al*. 2003, Cross *et al*. 2007). It is not surprising, therefore, that several herbal agents have been empirically used in poultry birds and other animals.

Keywords: growth rate, body weight gain, increasing feed

Introduction
Poultry production in India has taken a huge in the last four decades, emerging from conventional farming practices to commercial production system with state-of-the-art technological interventions. In present the total Poultry population in India is about 851.81 million (As per 20th Livestock Census) and egg production is around 122.05 billion numbers during 2020-21 (Provisional). The per capita availability of eggs during 2020-21(Provisional) is around 90 eggs per annum. The Egg production has shown positive growth as 6.70% during 2020-21 (DAH&D-2021-22). Human nutritionists recommend a minimum of 180 eggs & 10 kg chicken per annum for a healthy human, which means that the Indian poultry market is heavily loaded with opportunities. Adult population in most developed countries consumes over 240 eggs and 20 kg of chicken per annum. The focus is on “development”, meaning good food, better health & living conditions for everyone. People spend more money on food when they earn more. Eggs and chicken are accepted by almost all communities and is available across the country at reasonable prices. Production of broiler meat has increased to 5.0 million tons per annum in 2017-18. Demand for processed chicken meat has been growing by 15- 20% per annum. Eggs and chicken were “agriculture produces” few years ago but are considered as “food items” today. Safe food has become a priority. Besides maintaining his production efficiency, the producer has to concentrate on the nutritive values, the adulterants and contaminants of his produce. The ministry of food processing industries at the central govt. level and food inspection authorities at the local levels has started keeping track of eggs and chicken production in India for quality and nutrients.

Feed additives and nutritional supplements are attaining importance nowadays in the poultry industry, as well as in healthcare systems, because of their wide spectrum of beneficial impacts, such as promoting growth and production, immune enhancement and health protection (Alagawany, Abd El-Hack, *et al*., 2018; Alagawany, Elnesr, *et al*., 2018; Alagawany, Elnesr, & Farag, *et al*., 2019; Alagawany, Elnesr, Farag, Abd El-Hack, *et al*., 2019; Alagawany *et al*., 2020; Arif *et al*., 2019, 2020; Shewita & Taha, 2018) [3, 4, 5, 6, 11, 12, 69]. Moreover, non-nutritional factors such as hygiene, processing of feed ingredients, ambient temperature, animal health and genetic makeup have an impact on animal performance

(Chlebicz & Slizewska, 2020; Jacob, 2015; Mohamed *et al*., 2019) [21, 45, 59]. The poultry industry has achieved tremendous progress in its production system during the last 50 years through improvements in genetic makeup, proper management and advancements in nutritional science (El-Tahawy *et al*., 2017; Gado *et al*., 2019) [29, 34]. The use of feed additives has increased and contributed to the success achieved in current broiler production (Changxing *et al*., 2019; Farag *et al*., 2019; Farghly *et al*., 2018; Soomro *et al*., 2019) [20, 31, 32, 72]. Feed additives are generally considered materials used to enhance the effectiveness of nutrients and exert their effects on improving poultry performance (Ashour *et al*., 2020; Farag & Alagawany, 2019) [13, 31]. There are a number of feed additives used in poultry feed, such as antibiotics, probiotics, oligosaccharides, enzymes and organic acids (Bin-Jumah *et al*., 2020; Elgeddawy *et al*., 2020; Hussein *et al*., 2020; Windisch *et al*., 2008) [17, 28, 44, 78]. They are included in the diet of poultry and animals for promoting growth through their potential effect in increasing feed intake (FI; Demir *et al*., 2003; Mahrose *et al*., 2019; Wang *et al*., 2019; Yatoo *et al*., 2017) [24, 56, 76, 79]. Also, low levels of additives in poultry feed can contribute

Probiotics

Probiotics are "mono or defined mixed culture of live microorganisms which when applied to animals, beneficially affect the host by improving the properties of the indigenous micro biota". *Probiotics term coined in 1965 by Lilly and Stillwell*. They are also known as DFM (direct fed microorganism). Probiotics act as growth promoters when used as feed additives and consist of live culture of one or a number of microorganisms (Hertrampf, 1979). Jernigan *et al*. (1985) [48] defined probiotics as culture of specific living microorganisms which implant in animal to which they are given ensures effective establishment of intestinal microbial population. Probiotics are live microbial feed supplements and beneficially affect the host animal by improving its intestinal microbial balance, have been used as the alternative tools for helping newly hatched chicks to colonize normal micro flora as conventionally hatched chicks do (Fuller, 1989) [33]. Generally two types of micro flora (*viz*. beneficial and harmful) colonize the gastrointestinal tract in animals. Beneficial microbes' colonize gut surfaces in a symbiotic relationship with the host and harmful microbes are potentially pathogenic. Under normal physiological conditions, the beneficial organisms predominate, which are essential to normal physiological functions such as nutrient supply to host, help in digestion of dietary nutrients and compete with potential pathogens. "Let food be thy medicine and medicine be thy food", This quote by Hippocrates, holds very true these days. There is growing interest in functional foods which can promote health beyond basic nutrition (Suvarna and Boby, 2005) [73]. Microorganisms with health promoting attributes constitute an integral part of some of the functional foods. These microorganisms with health promoting activity or attribute are widely known as probiotics. Probiotic for life as a term is a relatively new and has been adopted by (FAO/WHO, 2002) to describe a group of bacteria when administered in a sufficient quantity confer beneficial effects for humans and even-though the term probiotic was used for the first time in 1965 by Lilley and Stillwell, to define compounds produced by microorganisms able to stimulate the growth of other microorganisms, probiotic concept is very old and is associated with the consumption of fermented foods by human beings for thousands of years (Gilliland, 1990) [37]. The word "Probiotic" is derived from the Greek word 'probios' means 'for life'. (Parker, 1974) [62] used the term probiotics for microorganisms or substances that contribute to intestinal microbial balance. The definition of probiotics has been redefined several times since the first time it was proposed. For example, (Fuller, 1989) [33], in order to elaborate the microbial nature of probiotics, had defined the word as "a live microbial feed supplement which beneficially affects the host animal by improving its intestinal balance." Recently, a widely accepted definition of probiotics has been proposed as "live microorganisms, which when consumed in adequate amounts, confer a health effect on the host" (Guarner and Schaafsma, 1998) [38].

The concept of probiotics was first introduced by (Metchnikoff, 1908) based on the principle of "competitive exclusion". Through continuous infusion of friendly organisms in diet, colonization of the gastrointestinal tract by disease causing (pathogenic) organisms is prevented. It improves the health and life expectancy of the host. Havenaar, *et al.* (1992) [40] redefined probiotic as "a mono or mixed culture of living microorganisms which beneficially affect the host by improving the properties of the indigenous microflora".

Beneficial effects of probiotics 7

The beneficial effects of probiotics like Enhancement in feed consumption, Growth rate, improve feed conversion efficiency and absorption rate of nutrients, Improves overall carcass weight, Immunity against pathogenic bacteria, Prevention against aflatoxicosis, Lowers the mortality rate and Lowers the cost of production hence the farmers achieve more profit from poultry farming.

Probiotics comes under the category of "Generally Recognized as Safe ingredients" classified by Food and Drug Administration (FDA) of USA. They have no side and/or residual effects. Probiotics regulates the microbial environment in the gut, reduces digestive upsets and prevents growth of pathogenic gut bacteria, thereby improve live weight gain, improve feed conversion ratio and reduces mortality (Bansal *et al.* 2011) [15].

Characteristics of an Ideal Probiotics

An ideal probiotic should have the following characteristics

- Capability of exerting beneficial effects on the host
- animal *viz*. increased growth or resistance to disease
- Non-pathogenic and non-toxic to animals and human
- Should be present as viable cells, preferably in large numbers although the minimum effective dose is not fully defined
- Ability to withstand processing and storage
- High tolerance to bile and gastric acid (low pH)
- Ability to adhere to epithelium or mucus
- Persistency in intestinal tract
- Ability to modulate immune response
- Ability to produce inhibitory compounds

Capability of altering microbial activity

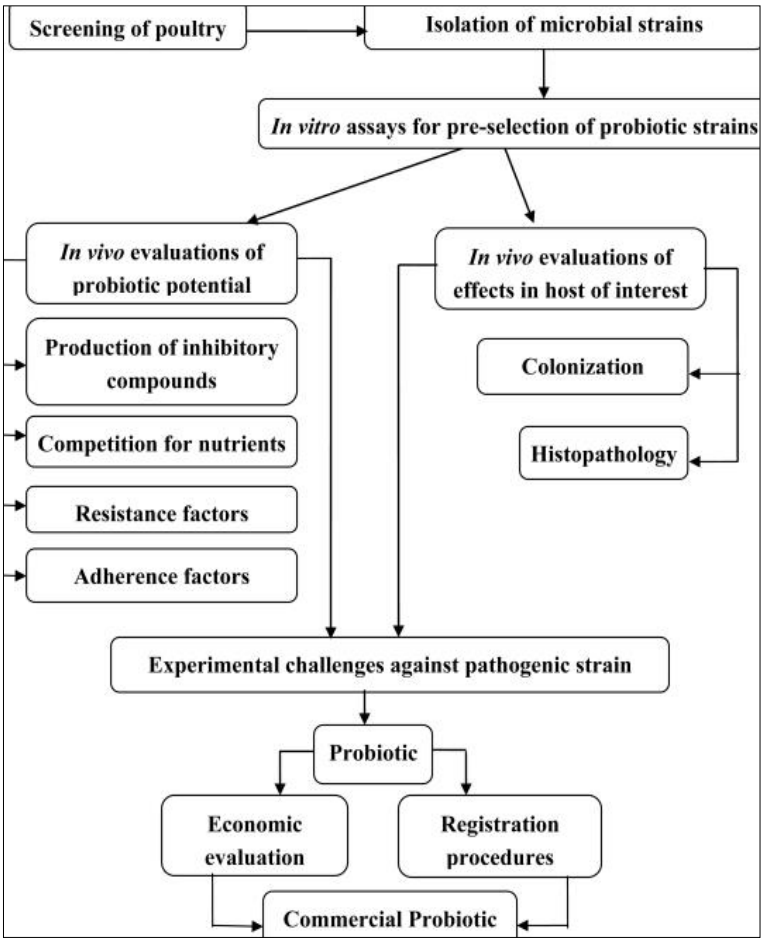

Fig 1: Selection of Probiotics

Herbal biomedicines: a source for isolation of microbes with probiotic attributes

There is a huge upsurge in demand of herbal medicine which includes herbal products and raw materials. In the global market, annual growth rate has been predicted to be in between 5% and 15% (Citarasu, 2010) [23]. In an estimate, the total herbal drug market was around US $62 billion and by the year 2050, it is expected to reach US $5 trillion. In Indian context, botanical trade accounts for US $10 billion per annum and exports around US $1.1 billion. United States is the largest market for Indian exports with a share of nearly 50%. In India, herbal biomedicines have been practiced for thousands of years, under the realm of Ayurvedic sciences. Ayurveda term is derived from -Ayur, which means life and -veda, which means knowledge. These herbal medicines are of various types, including herbal teas, infusions, decoctions, tinctures, capsules, powders, infused oils, ointments, creams, and lotions etc. along with arishta (fermented decoctions) and asavas (fermented infusions). As reported recently asava and arishta are very popular dosage forms of Ayurvedic medicines.

Probiotic (*Saccharomyces cerevisiae*) is a species of yeast. It has been instrumental to winemaking, baking, and brewing since ancient times. It is believed to have been originally isolated from the skin of grapes. *Saccharomyces cerevisiae* as probiotic microorganism *Saccharomyces cerevisiae* has been known to thrive in diverse environments such as plants, animals, soil and water. *Saccharomyces cerevisiae* has also been reported in fermentation of several food preparations and beverages. Faeces of humans and animals can also be exploited for isolation of Probiotic yeast strains (Liong, 2011) [54]. Recently there is increased interest in developing Probiotic yeast for human and animal use. Among yeast strains *Saccharomyces cerevisiae* and *Saccharomyces cerevisiae* var boulardii are the only yeast strains commercialized for human consumption (Liong, 2011) [54].

There are several beneficial effects of *Saccharomyces cerevisiae* which have been attributed to human health and well-being. Food supplementation with *Saccharomyces cerevisiae* has also lead to enhanced body weight gain with increase in probiotic uptake (Lutful Kabir, 2009) [83]. *Saccharomyces cerevisiae* and *Saccharomyces cerevisiae* var boulardii have found to be effective in treatment and prevention of various type of diarrhoea including diarrhoea caused by pathogens, antibiotic associated diarrhoea and acute diarrhoea in children. It has also been found effective in lactose intolerance, vaginal yeast infections and food allergies (Liong, 2011) [54]

Effect of probiotics (*Saccharomyces cerevisiae)* on broiler chicks

Growth Performance

In the study of (Ahiwe *et al.* 2019) [1] reported that whole yeast and its derivatives can improve meat yield of broilers and through its effect on white blood cell, lymphocyte and monocyte counts, may be linked to an amelioration of stress induced by *Salmonella* lipopolysaccharide in broilers. They also noted that autolysed yeast, yeast cell wall and its enzymatically hydrolysed components when supplemented at 2 g kg^{-1} diet may act as an appropriate alternative to

antibiotics in broilers production.

Inclusion of a *Saccharomyces cerevisiae* base direct-fed microbial could improve body weight, body weight gain and feed consumption in broiler when compared to the control group [12,20].

Dietary direct-fed microbials (DFM) supplementation as probiotic that contained a mixture of *Lactobacillus reuteri*, *Bacillus subtilis* and *Saccharomyces cerevisiae* significantly increased the body weight gain of broilers during 0-21 days. The feed intake was reduced, whereas the feed conversion was improved significantly when birds were fed DFM at 0-7 days of age[32].

Alkhalf *et al.* (2010b) [8] showed that probiotics supplement in broilers' diet increased body weight and average daily weight gain of 3-6 week old bird. It is clearly evident from the result of Kabir *et al*. (2004) [51] that the live weight gains were significantly (P<0.01) higher in experimental birds as compared to control ones at all levels during the period of 2nd, 4th, 5th and 6th weeks of age, both in vaccinated and non-vaccinated birds

Huang *et al*. (2004) [43] demonstrated that inactivated probiotics, disrupted by a high-pressure homogenizer, have positive effects on the production performance of broiler chickens when used at certain concentrations. evaluated the effect of mushroom on the growth performance of broiler. The highest body weight was recorded on day 28 in group A (control healthy). Hasan *et al.* (2015) [39] investigated the effects of probiotic on growth performance, parameters in broilers during high environmental temperature. Macari and Maiorka (2000) [55] and Santin *et al.* (2001) [66] observed that 0.2% of cellular wall from *Saccharomyces cerevisiae* (MOS from yeast cellular wall) increased weight gain in comparison to the control animals. They showed that cell wall of *Saccharomyces cerevisiae* improved the intestinal mucosa aspects and suggested that it might be the explanation for the improvement in performance of broilers supplemented with *Saccharomyces cerevisiae*.

Jin *et al.* (1997) [50] reported improved growth performance and feed conversion in broilers upon addition of probiotics to the diet. According to them the mode of action of probiotics in poultry included

- Maintaining normal intestinal microflora by competitive exclusion and antagonism,
- Altering metabolism by increasing digestive enzyme activity and decreasing bacterial enzyme activity and ammonia production,
- Improving feed intake and digestion, and
- Neutralizing enterotoxins and stimulating the immune system.

They also opined that if the right strain of bacteria, optimal concentration of viable cells was given under non-stress conditions, the beneficial impact of culture supplementation was significant. Average body weights of all supplement groups were higher and differed significantly (P<0.01) from control group. Another study was agreed with these findings of Mountzouris *et al.* (2010) [60] where it is concluded that probiotic inclusion level had a significant effect on broilers growth responses. Similarly, Alkhalf *et al.* (2010b) [8] showed that probiotics supplement in broilers diet increased body weight and average daily weight gain of 3-6 week old bird. This is consistent with the present study, in terms of the increase in production parameters of broiler influenced by the addition of probiotics. The present studies indicated the beneficial impact of probiotic supplementation on poultry performance and efficiency. Stanely *et al.* (1993) observed that the use of *Sac. Cerevisiae* served as a source of vitamins, unidentified growth factors, enzymes and proteins which increased overall biological value of nitrogenous compounds absorbed along the digestive tract. They observed that the increase in body weight gain was 13.16 per cent in chicks receiving aflatoxin contaminated feed with incorporation of 0.1 per cent *Sac. Cerevisiae*. It was concluded, as there was a significant antagonistic interaction between aflatoxin and 0.1 per cent *Sac. Cerevisiae*.

Body weight gain

Shareef and Dabbagh (2009) [68] observed that Saccharomyces cervisiae supplementation of broilers, to the level of 1, 1.5 and 2%, were significantly, increase the body weight gain, feed consumption and feed conversion efficiency. The beneficial effect of *Saccharomyces cerevisiae* is attributed to the fact that it is a naturally rich source of proteins, minerals and B-complex vitamins. Bradley *et al.* (1994) [18] observed that increased weight gain at 7, 14 and 21 days of age in poults fed with diet containing *Sac. Cerevisiae* var boulardii (SCB) at 0.01, 0.02 and 0.06 per cent of the diet. Increased body weights were maintained from 21 to 35 days of age in poults fed 0.02 per cent SCB. Zhang *et al*. (2005) [80] reported that body weight gains were linearly (p<0.05) increased in birds fed with 0.3, 1.0 and 3.0% *Saccharomyces cerevisiae*, respectively, when compared with those fed with the basal diet with 0% *Saccharomyces cerevisiae*. Mordenti (1986) [84] and Chang *et al*. (2001) [19] who reported that probiotics promote growth in farm animals by breaking down the hydrocarbons contained in the diet, which means the food is being split into its most basic elements. This allows almost total absorption through the digestive system. In this way, probiotics dramatically increased overall nutrition and enhance rapid cellular growth and development. Shim *et al.* (2012) [71] conducted two experiments to evaluate a multi-microbe probiotic formulation processed at low (LT) or high (HT) drying temperature. Improvement in overall weight gain, FCR and retention of CP were observed in birds fed the positive control (PC; basal diet +10 mg/kg avilamycin) and probiotic diets when compared with birds fed the negative control (NC; basal diet without any antimicrobial) diet. Author reported that high drying temperature had no effect on the efficacy of the multi-microbe probiotic formulation; while the probiotic HT formulation was more effective at 0·60% level. Bansal *et al.* (2011) [15] who observed that the inclusion of probiotic in diet affected body weight gain. Broiler group fed with, diet P (with Probiotic) were significantly heavier than the group fed with, diet P0 (without Probiotic). The inclusion of probiotics showed increased feed efficiency and better quality of broiler meat. Hasan *et al.* (2015) [39] investigate the effects of probiotic on growth performance, parameters in broilers during high environmental temperature. A total of 30, at 7 days old (Cobb-500) broilers were randomly divided into 5 groups (n=6). Heat stress broilers were held at 35 ± 2°C temperature and 70±5% relative humidity respectively where as normal temperature was 25 ± 2°C and relative humidity was 60 ± 5%. Normal control group (NE-T) fed the normal diet with normal environmental temperature. The results revealed that supplementation of probiotic produced a significantly (p<0.01) increased of the

live body weight as compared to normal and heat stress control group. The highest weight gain was recorded in HS-B as probiotic group (1660.00b ± 6.124 gm) and the lowest weight gain was recorded in HS-A as heat stress group (1303.00e ± 4.899 gm.

Banday and Risam (2002) [14] have suggested that probiotic supplementation improved performance of broilers. Zhang and Kim (2014) [82] reported an overall increase in body weight gain in chicken fed with multistrain probiotics compared with that in control group fed basal diet.

Modirsanei *et al.* (2003) [58] concluded that there was improvement in broiler performance when probiotics were added to the diet and have these recommended the inclusion of probiotics as growth promoter in rations of broiler chickens. The addition of 0.3% of powdery of *Saccharomyces cerevisiae* to broilers, improved weight gain and feed intake compare to granular yeast and control diets in broiler. Zhang and Kim (2014) [82] reported an overall increase in body weight gain in chicken fed with multistrain probiotics compared with that in control group fed basal diet. Paryad and Mahmoudi (2008) [63] reported that chicks fed with 1.5% *Saccharomyces cerevisiae* had higher body weight gain when compared with the other dietary treatments

Barrow (1992) [16] reported that probiotics for chickens are designed either to replace beneficial organisms that are not present in the alimentary tract or to provide the chicken with the effects of beneficial bacteria. By similar way the microbial flora of the alimentary tract was supported by *Saccharomyces cerevisiae* and it was found that significant increase ($p<0.05$) in body weight gain. This was observed in birds on the 37th day. Panda *et al.* (2000) [61] observed significant body weight gain from zero to four weeks of probiotic supplementation but no difference subsequently after four weeks of age in broiler chicks. Modirsanei *et al*. (2002) [58] reported improvement in broiler performance when probiotics were added to the diet and recommended the inclusion of probiotics as growth promoter in rations of broiler chickens. Baghel and Singh (2004) opined that the probiotics have been found to improve the production performance of poultry, establish an environment to increase the digestibility of feeds and were a potential alternative to antibiotics in poultry diet. The finding of the present study are in accordance with the work of Shareef and Dabbagh, (2009) [68] who reported that *Saccharomyces cervisiae* supplementation of broilers, to the level of 1, 1.5 and 2%, were significantly, increased the body weight gain, feed consumption and feed conversion efficiency. The beneficial effect of *Saccharomyces cerevisiae* is attributed to the fact that it is a naturally rich source of proteins, minerals and B-complex vitamins. Zhang *et al*. (2005) [80] reported that body weight gains were linearly ($P<0.01$) increased in birds fed with 0.3, 1.0 and 3.0% *Saccharomyces cerevisiae*, respectively, when compared with those fed with the basal diet without *Saccharomyces cerevisiae*. Zhang and Kim (2014) [82] reported an overall increase in body weight gain in chicken fed with multistrain probiotics compared with that in control group fed basal diet. Chang *et al*. (2001) [19] who reported that probiotics promote growth in farm animals by breaking down the hydrocarbons contained in the diet, which means the food is being split into its most basic elements. This allows almost total absorption through the digestive system. In this way, probiotics dramatically increased overall nutrition and enhance rapid cellular growth and development. The above results were in agreement with Babatunde, (1996) who reported that supplementation of dried yeast (*Saccharomyces cerevisiae*) to the high fiber diets improved body weight gain of broiler chicks; feed efficiency was also improved in broilers fed 0.1, 0.2 and 0.3% of dried yeast ($P<0.01$). Gao *et al.* (2008) [35] observed that dietary supplemental yeast culture at 0.25% improved average daily gain and feed efficiency during grower and overall periods in broilers ($P<0.05$). Similarly, Willis *et al.* (2013) [17] found an improved BW gain of broilers with the supplementation of mushroom extract to 21 d of age; however, this supplementation did not sustain improved weight gains up to d 49 when the trial was completed. In another research by Duk *et al*. (2004) [26] using of *Saccharomyces cerevisiae* supplement on the growth performance showed that the performance of the broilers which were fed from different levels of SC had increased in three-week old ($P<0.01$) and this increase can be witness in five week old as well. But by increase the rate of SC in ($P<0.01$) feed intake in the groups fed by enriched SC has been low compared with gain weight.

Koc *et al.* (2010) [53] in their study made an attempt on the growth performance of broiler chickens that were fed with graded levels of *Saccharomyces cerevisiae*. At three weeks of age, the body weight gains linearly ($P<0.01$) increased by an average of 4.2, 7.8 and 13.2% in birds that were fed with 0.3, 1.0 and 3.0% *Saccharomyces cerevisiae* respectively, when compared with those fed the basal diet without *Saccharomyces cerevisiae.*

Feed consumption

Shareef and Dabbagh, (2009) [68] reported that Saccharomyces cervisiae supplementation of broilers, to the level of 1, 1.5 and 2%, were significantly, increase the feed consumption. The beneficial effect of *Saccharomyces cerevisiae* is attributed to the fact that it is a naturally rich source of proteins, minerals and B-complex vitamin. Mazaheri *et al.* (2014) [57] who investigated the effect of diets of mushroom waste in broiler diets resulted in an increase of feed intake. Broiler chickens that received mushroom waste at 6% level had a significantly higher feed intake than those birds fed on a control diet ($P<0.05$). Supplementation of probiotic to broiler diet had no significant effect on feed intake. No interactional effect was found between the levels of mushroom waste and probiotic on feed intake. Similarly, Hosseini *et al*. (2013) [41] and Rahman *et al*. (2007) [64] reported that probiotic had no significant effect on feed intake. Rahman *et al*. (2007) [64] was hypothesized that probiotic not only enhanced the digestive rate but also increased the nutrients retention and decreased their passage rate. The findings of the present study are in accordance with the work of Kavyani *et al*. (2014) [52] observed that the highest daily feed intake in the groups receiving mushroom in their diet. Increase feed intake in broiler giving mushroom as feed additive compared to control was also observed by Giannenas *et al*. (2010) [36]. The results obtained in this experiment are in concurrence with Kumprecht *et al.* (1994) [85] as they studied the effects of *Saccharomyces cerevisiae* var. elipsoideus and Streptococcus faecium C-68 (SF-68) as probiotics on broilers and reported improved feed intake and FCR. Mazaheri *et al*. (2014) [57] also investigated the effect of diets of mushroom waste in broiler diets and observed increase in the feed intake. Broiler chickens that received mushroom waste at 6% level had a significantly higher feed intake than those birds fed on a

control diet (P>0.01). Supplementation of probiotic to broiler diet had no significant effect on feed intake.

Feed conversion efficiency

Shareef and Dabbagh, (2009) [68] reported that probiotics supplementation of broilers, to the level of 1, 1.5 and 2%, were significantly, increase the feed conversion efficiency. The beneficial effect of *Saccharomyces cerevisiae* is attributed to the fact that it is a naturally rich source of proteins, minerals and B-complex vitamin. Babatunde, (1996) reported that supplementation of dried yeast (*Saccharomyces cerevisiae*) to the high fiber diets improved feed conversion efficiency was improved in broilers fed 0.1, 0.2 and 0.3% of dried yeast (P<0.05). Toghyani *et al.* (2012) [74] determined the impacts of two levels of oyster mushroom (*Pleurotus ostreatus*) powder on productive performance. A total of 240, day-old male broiler chicks (Ross 308) were randomly assigned to one of four treatments with four replicates of 15 chicks based on a completely randomized design. The dietary treatments consisted of the basal diet as control, prebiotic group receiving 1 g/kg A-Max® (Mannan-oligosaccharides), 10, and 20 g/kg oyster mushroom powder added to the basal diet. The obtained results showed that inclusion of 20 g/kg mushroom powder significantly improved feed efficiency was improved only over the starter (P＜0.05) period compared to the control group. conclusion the obtained results indicated that oyster mushroom powder at an inclusion level of 20 g/kg of diet had favorable effects on performance criteria of chicks reared to 28 day of age. Krueger *et al.* (1990) [86] observed improve feed efficiency by 3.16 per cent upon feeding of 454 and 908 g *Sac. Cerevisiae* per ton of feed in broiler chickens from 28 to 49 days of age. Dilworth and Day (1978) [25] reported that the improvement feed efficiency in broilers that were fed with diets containing probiotic cultures at the levels of 0.0250, 0.0375, 0.0500, 0.0625 and 0.0750 per cent. The probiotics are beneficial microorganisms, which contribute to the maintenance of ideal microbial balance in the digestive tract by a mechanism known as competitive exclusion. Kabir (2009) [83] recorded that *Saccharomyces cerevisiae* supplementation for broilers, to the level of 1, 1.5 and 2%, significantly increased the feed consumption and feed conversion efficiency. Ali *et al.* (2017) [87] conducted a study was performed for investigating the dietary effect of different levels of mushroom (*Agaricus bisporus)* powder on average feed efficiency (feed/kg body weight gain) was 1.84, 1.52, 1.58 and 1.59 (P<0.01) in 30 days for group T_0, T_1, T_2, and T_3 respectively. Silva *et al.* (2000) observed that better feed conversion in broilers during the period 1-21 days when the diets supplemented with antibiotics and probiotics. Jernigan *et al.* (1985) [48] said that probiotics were also used in animal feedstuffs as growth promoters and opined that the information available was fragmentary. Jin *et al.* (1998) [49] and Besnard *et al.* (2000) [88] observed worse feed conversion in the control group when compared to groups of broilers and turkeys that were fed with probiotics based on Lactobacillus sp and *Saccharomyces cerevisiae* in the diets respectively. Derebashi and Damir, (2004) reported that using mannan oligosaccharide (Cell wall of yeast) had a significant improvement in feed conversion compared with broilers which had received probiotics with organic acids. Broiler chicks fed with *Saccharomyces cerevisiae* had higher feed conversion efficiency when compared with the other dietary treatments according to the research done by Paryad and Mahmoudi, (2008) [63].

Upendra (1999) [75] reported that the significantly improved weight gain in *Sac. Cerevisiae* supplemented group on day 14, 28 and 42 and improved FCR by 11.42 per cent by the end of 42nd day experimental trial. Aluwong *et al.* (2013) [10] has reported that the broilers fed a higher dosage (>1.0%) of *Saccharomyces cerevisiae* diets gave higher (p<0.01) body weight, low FCR compared to the broilers fed low dosage of SC at day 35. Altahi *et al.* (2008) [9] observed the influence of youghurt and commercial probiotics on performance of broilers. The 5 experimental treatments were T_1 i.e. control and T_2, T_3, T_4 received 3g, 4g, 5g of sour yoghurt respectively per liter of drinking water, and T5 received probiotics 1g per 10 litre of water. Improvement was observed in body weight gain feed conversion ratio of broilers of T_5 group at 35 days of age compared to other groups. Satisfactory improvement was also observed in birds of T_4 treatment group. It was concluded from study that youghurt and commercial probiotics could show beneficial effect on broiler performance.

Conclusion

Thus, it observed that dietary addition of probiotics (*Saccharomyces cerevisiae*) improved average body weight, average daily gain, feed conversion ratio, better nutrient digestibility, immunity and health in chicken without any adverse effects. However further research with more numbers of poultry would be needed for better understanding the effect of probiotics supplementation in high energy die

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