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EFFECT OF COMMERCIAL (Y-MOS) YEAST ON PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKS

أثر الخميره التجارية (Y-MOS) في الأداء العام للدجاج اللاحم وخصائص الذبيح

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بسم الله الرحمن الرحيم

إستـهلال

قال تعالى:

﴿وآية لهم الأرض الميتة أحييناها وأخرجنا منها حباً فمنه يأكلون﴾ **يس**(33)

صدق الله االعظيم

DEDICATION

I would like to make a number of important dedications with this work.

First, to **my mother** and **my father**

who have allowed me to become the person I am, and they were my eyes when I couldn’t see.

To my dearest helpmate, **my wife**

for constant encouragement, limitless giving and great sacrifice, helped me accomplish my study. For every dream she made come true. She has been my inspiration.

To my beloved **brothers** and **sisters**

for all those time they stood by me.

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Abstract

This experiment was conducted to evaluate the response of broiler chicks to diets containing 0.25, 0.50 and 1% Y-MOS. Experimental parameters covered growth performance, slaughter and carcass values, serum metabolites and economical appraisal. The experimental design used was the complete randomized design. A total of (84) day-old, 155 gm initial weight unsexed Ross 308 broiler chicks were used in this experiment. Chicks were divided into four groups (A, B, C and D), each group was divided into three replicates, each of 7 chicks. The first group A fed on control diet without Y-MOS, the other groups of chicks B, C and D were fed on diets supplemented with Y-MOS as 0.25, 0.50 and 1.00% respectively. All diets in this experiment were formulated to be iso-nitrogenous (22.5% CP) and iso-caloric (3100 Kcal/Kg) according to the recommended dietary requirement for broiler *(*NRC, *1994).* All chicks were fed on experimental diets for 6 weeks. The results indicated that addition of Y-MOS improved the performance of broiler chicks, but the differences between treatment groups were not significant ($P \geq 0.05$), while group B (0.25 Y-MOS) had the highest values. The mortality rate was not influenced significantly by the dietary treatment. The results showed that there were no significant differences ($P \geq 0.05$) among all treatment groups in the percentages of giblets, group A (control) recorded the highest mean values; in commercial cuts and carcass dressing, group C (0.50% Y-MOS) achieved the highest values. Economical appraisal values were the profitability ratio (1.16) of group B (0.25% Y-MOS) was the highest of the test groups, whereas profitability (0.81) of group D and control group were the lowest of the test groups.

ملخص االدراسة

تم دراسة تأثير التغذية على مستويات مختلفة من الخميرة Y-MOS (.، 0.25، 0.5، 1%) على أداء كتاكيت التسمين، الصفات الإنطباعية النوعية للحم والتقييم الإقتصادي. أجريت التجربة بإستخدام عدد 84 كتكوت روس 308 غير مجنس عمر يوم، قسمت عشوائيا إلى 4 مجموعات موزعة في 3 مكررات بكل منها 7 كتاكيت. تمت تغذية المجموعة الأولى (A) على عليقة أساسية بدون أي اضافة ، أما المجموعات الأخرى C,B وD فقد تمت تغذيتها على العليقة الأساسية مضافا إليها Y-MOS بمستويات 0.25، 0.5 و 1%، على التوالي. تم تكوين العليقة القياسية لتقابل الإحتياجات الغذائية للدجاج اللاحم الصادرة من (NRC, 1994). تمت التغذية على العلائق التجريبية لمدة 6 أسابيع.

أظهرت النتائج تحسن كل من معدل الزيادة في وزن الجسم وكذلك دليل الأداء الإنتاجي بصورة خاصه في الكتاكيت التي غذيت على 0.25% خميرة (المعاملة الثانية) مقارنة بالكنترول. كما انه لا توجد فروقات معنوية بين كل المجموعات التجريبية. دلت النتائج على عدم وجود أي فروقات معنوية بين المجموعات التجريبية المختلفة في نسب التصافي، الأعضاء الداخلية، القطع التجارية ونسبة اللحم لكل منها، كما أن إضافة الخميرة عند مستوى 0.5% سجل أعلى قيم. اظهر التقييم الإقتصادي ربحية نسبية (1.16) في المجموعة B (0.25% Y-MOS) كانت الأعلى بين مجموعات الإختبار، بينما الربحية النسبية (0.81) لمجموعة الإختبار D والكنترول (1.0) كانت الأدنى بين مجموعات الإختبار.

Chapter One

Introduction

One of the major challenges faced by the poultry industry in the developing countries is about improving efficiency of production. To meet this challenge and maintain the efficiency of feed utilization, series of attempts have been made by researchers. These include incorporation of antimicrobials and other natural products, such as yeasts to animal feeds (Kung et al., 1997; Muihead, 1992).

Yeasts and yeast fermentations have been intimately associated with human history for centuries. The diverse biochemical capabilities of the active yeast cell have been used to process foods and beverages, provide fuels and serve as a rich source of nutrients. In the last two decades, there has been increased interest in using yeast and specific components of yeast cells as feed supplements. These applications have been based on both empirical observations and on new scientific evidence that suggest a significant strategic role for yeast-derived products in modern animal production systems.

Yeast and yeast-derived preparations can provide inexpensive feed supplements that can have major impacts when used in poultry management systems. Researchers shown these preparations can be used to control the composition of the microbial population in the gastrointestinal tract, prevent colonization with pathogens, bind toxins, and modulate the immune system. These activities can directly or indirectly influence animal performance and can be used as tools for improving the efficiency of poultry production systems. Many of these activities provide economic benefits that are comparable to commonly used antimicrobial growth promotant (Dawson, 2001).

Y-MOS is derived from bakery yeast, and is rich in beta-glucans and mannan oligosaccharides. The use of Y-MOS in young animals is recommended to help improve natural resistance against pathogenic

micro-organisms and support the beneficial intestinal flora for a better health leading to improved growth and better feed conversion (Nutrex, 2015), also has immunomodulatory properties (MacDonald, 1995; Savage et al., 1996; Cotter, 1997; Cotter et al., 2002).

In addition, previous reports suggest that Y-MOS supplementation resulted in significant improvement in antibody responses in broiler and layers (Cotter et al., 2000; Raju and Devegowda, 2002).

From this perspective, the objective of our study was to investigate the effects of feeding Y-MOS diets on broiler growth performance, carcass and non-carcass characteristics, serum metabolites and economic appraisal of broiler chicks.

Chapter Two

Literature Review

2.1. Antibiotics

The aim of the intensification of crop and livestock production is satisfy the demand people for food, especially for animal protein. Therefore, the process animal growth must be supported by various feed additives. Until January 2006 ,the most commonly used supplements were antibiotic growth promoters. Antibiotic growth promoters, which gave the positives production result, despite the poor living conditions of animals and restrict certain diseases of the digestive system. Feed antibiotics stabilize the micro flora of the gastrointestinal tract, by limiting the growth of negative microorganisms and their toxins, promote the growth of beneficial bacteria's, reduce the emission of methane and ammonia ,cause better use of phosphorus, whereas in poultry they reduce the risk of coccidiosis. Furthermore, feed antibiotics accelerate growth and extension the weight of meat of animal. The presence of antibiotics growth promoters in animal feed causes thinning of the intestinal wall and better their blood supply. As a result of this increased absorption of nutrients from the intestinal lumen is observed (Roozbeh et al, 2012). However, there a problem possible negative effect of feed additives on the quality of animal products, as well as on human health. Threats to humans and animal have become antibiotics, resistant strain of bacteria that are selected under the influence of use of antibiotics. Susceptible bacteria at the time of contact with the antibiotic are suppressed in growth or destroyed, while the resistant bacteria present in the gut flora can multiply to higher or lower degree suppression of antibiotics. Sensitive bacteria created an opportunity for colonization by resistant bacteria derived from external sources. Frequent use of antibiotics not only conducive to the formation, but also fortification of resistance in bacteria (Dankowiakowska and Marek, 2013).

In the European Union antibiotic growth promoters have been withdrawn on 1 January 2006, in accordance with Directive No A5.0373/2002. This prohibition is a challenge for farmers and feed producers, and leads to look for new nutritional solutions and the application of such supplements that are safe for animal of food production. Modern methods and farming and animal nutrition entails numerous of threats which previously were eliminated by antibiotic growth promoters. Several categories of alternative growth promoters have emerged that, to varying extents, have the necessary attributes of safety, efficacy, and economy. Alternative to antibiotics may constitute a probiotics and prebiotics, which stabilize the gut micro flora and control the multiplication of pathogens. This property is the basis for the mechanism of "competitive exclusion" (Elijah and Ruth, 2012).

2.2. Beneficial effects of probiotics and prebiotics:

Pathogens have to overcome numerous obstacles in order to colonize the intestinal tract and cause an infection. In addition to the physical restraints of low gastric H and rapid transit time in the small intestine, pathogens have to overcome the inhibitory effects of the intestinal microbiota, the physical barrier of the response of host immune tissues. The concept that epithelium, and cross-talk between these systems and between pathogens and the epithelium occurs is well established. Recent data demonstrate that at least some species of non-pathogenic Intestinal microbiota also communicate with the epithelium and immune system, modulating tissue physiology and ability to respond to infection. Probiotics and prebiotics alter the intestinal microbiota and immune system to reduce colonization by pathogens in certain conditions. As with growth promotant antibiotics, environmental and stress status influence efficacy of prebiotics and probiotics. These products show promise as alternatives for antibiotics as pressure to eliminate growth promotant antibiotic use increases. Defining conditions under which they show efficacy and determining mechanisms of action under these conditions is

important for the effective use prebiotics and probiotics in the future (Hajati and Rezaei, 2010).

2.2.1. Probiotics:

Probiotics, a name which means for life, has been defined in several ways. In the beginning it was defined as those substances produced by microbes that stimulate one another (Lilly and Stillwell, 1965 and Hounidonougbo et al, 2011) but later this term was used for animal supplements which produce beneficial effects on the host animal (Parker, 1974 and Saleh and Hayashi, 2011). Later still the definition was refined to live microbial cultures beneficially affect the host by improving its intestinal microbial balance (Fuller, 1989). The experts of the joint Food and Agriculture Organization of the United States /World Health organization (FAW/WHO) define Probiotics as, live microorganism which, when administered in adequate amounts, confer health benefit to the host (Anonymous, 2001). Today it is well recognized that probiotics are strain–specific living microbial cultures that produce beneficial effects on the host's body (O'Dea et al., 2006). These living organisms may be bacteria, fungi or yeasts (Fox, 1988). They are isolated from the gut of a healthy adult animal typical of the same species to which the probiotics will be given (O'Dea et al., 2006).

2.2.2. Prebiotics:

Prebiotics are defined as a non- digestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon (Gibson and Roberfroid, 1995). In other words, prebiotics are meant to provide a substrate for beneficial gastrointestinal microbes. Large amounts of bacteria present in the monogastric small intestine and are potentially capable of utilizing these indigestible carbohydrate sources for energy. Recently, some researches (Houdijk et al., 1997 and Hillman, 2001) have been conducted to manipulate beneficial bacteria in Gastrointestinal Tract. Bezkorovainy (2001) suggested that the use of prebiotics is a promising approach for enhancing the role of endogenous

beneficial organisms in the gut. They can be used as potential alternatives to growth promoting antibiotics (Hatemink, 1995). The European Union has banned all in-feed use of antibiotics from 2006 and the use of antibiotics in feed is being considered for elimination (or intense regulation) in other parts of the world. This perspective has stimulated nutritionists and feed manufacturers to search for new and safe alternatives. The primary alternatives studied include; acidification of the feed by organic acids, feeding probiotic organisms and feeding prebiotic compounds. In the ’l980’s the possible potential effects of prebiotics in animal feeds was already recognized. Since then the interest in the use of prebiotics in animal feed and pet food has resulted in a high research activity. The use of prebiotics in diets for farm animals and pets has been documented by Mul and Perry (1994) farm and pet animals, (Houdijk et al., 1997; lji and Tivey, 1998; I999; Flickinger and Fahey, 2002 and Patterson and Burkholder, 2003). The non-digestible inulin-type fructans are found widely in many vegetable feed and food ingredients and are perhaps the most well studied and documented prebiotics in domesticated animals (Flickinger et al., 2003). The use of prebiotics or fermentable sugars instead of antibiotics is going to be popular in birds in order to improve the useful microbial population of the Gastrointestinal tract (Kermanshahi and Rostami, 2006).

2.2.2.1. Advantages of prebiotic supplementation:

Favorable effects of addition of prebiotics reflect in presence of antagonism towards pathogens, competition with pathogens, promotion of enzyme reaction, reduction of ammonia and phenol Products and increase of resistance to colonization.

- Improve gut health (improvement intestinal microbial balance).

- Improve performance.

- Enhance nutrient utilization (e.g., amino acids and proteins).

- Decrease environmental pollution.

- Decrease production cost (Peric et al., 2009; Khksar et al., 2008 and Ghiyasi et al., 2007).

2.2.2.2. Characteristics of prebiotic:

- Should be neither hydrolyzed nor absorbed in the upper part of the gastrointestinal tract.

- Be a selective substrate for one or limited number of bacteria commensal to caecum/colon, which are stimulated to grow or metabolically activated.

- Able to alter the colonic flora in favor of a healthier composition.

- Induce systemic effects that are beneficial to the host's health.

-Should have known structure ،which can be document.

-Should be palatable as feed ingredient and large scale processing most be easy.(Hajati and Rezaei (2010)

2.2.2.3. Substances used as prebiotic:

Non-digestible carbohydrates (oligo and polysaccharides), some Peptides, proteins and certain lipids (both ester and ethers) are candidate prebiotic. Lactose is a disaccharide consists of glucose and galactose, which has prebiotic effect in chickens. Since chickens does not have lactase enzyme, lactose enters to the lower segment of the intestine and caeca, where hydrolyzed by microbial activity. The dominant prebiotics are fructo- oligosaccharide products (FOS, oligufroctose, inulin); gluco-oligosaccharides, stachyose, malto-oligosaccharides and oligochitosan have also been investigated in broiler chickens (Jiang et al., 2006 and Huang et al., 2007).

2.3. Application of Yeast Extracts:

Yeast extracts are used primarily in the fermentation industry as growth substrates or in the food industry as flavor enhancers. They are valued for their ability to enhance flavors and to mask sour and bitter tastes and are used in a wide variety of familiar applications, including the flavor base of food products such as soups, gravies, and sauces, as well as microbial growth medium in microbiology (Dawson, 2001).

Y-MOS is derived from bakery yeast, and is rich in beta-glucans and mannan oligosaccharides.The use of Y-MOS in young animals is recommended to help improve natural resistance against pathogenic micro-organisms and support the beneficial intestinal flora for a better health leading to improved growth and better feed conversion.

2.4. Y-MOS Structure defines function:

In the yeast cell wall, mannan oligosaccharides are present in complex molecules that are linked to the protein moiety. There are two main locations of mannan oligosaccharides in the surface area of Saccharomyces cerevisiae cell wall Stewart and Russell (1998). They can be attached to the cell wall proteins(Lesage and Bussey (2006) as part of –O and –N glycosyl groups and also constitute elements of large α-D-mannanose polysaccharides(Kath et al., 1999) (α-D-Mannans), which are built of α-(1,2)- and α-(1,3)- D-mannose branches (from 1 to 5 rings long), which are attached to long α-(1,6)-D-mannose chains (Vinogradov et al., 1998). This specific combination of various functionalities involves mannanoligosacharides-protein conjugates and highly hydrophilic and structurally variable 'brush-like' mannan oligosaccharides structures that can fit to various receptors of animal digestive tracts,(Mansour et al., 2003) and to the receptors on the surface of bacterial membranes(Wellens et al., 2008)impacts these molecules bioactivity. Mannanoligosacharides-protein conjugates are involved in interactions with the animal's immune system and as result enhance immune system activity (Wismar et al ., 2010). They also play a role in animal antioxidant and antimutagenic defense.(Krizkova et al., 2006)

2.4.1.Mannanoligosaccharide (MOS) based nutritional supplements:

Supplements are widely used in nutrition as a natural additive. MOS has been shown to improve gastrointestinal health as well as overall health, thus improving wellbeing, energy levels and performance. Most MOS products, particularly those that have been scientifically reviewed, derive from the cell wall of the yeast, Saccharomyces cerevisiae.

The initial interest in using MOS to protect gastrointestinal health originated from work done in the late 1980s. At this time researchers looked at the ability of mannose, the pure version of the complex sugar in MOS, to inhibit salmonella infections. Different studies showed that salmonella can bind via type-1-fimbriae (finger-like projections) to mannose. The binding to mannose reduces the risk of pathogen colonization in the intestinal tract(Oyofo et al., 1989) .Different forms of mannose-type sugars interact differently with type-1-fimbriae. The form present in the cell wall of Saccharomyces cerevisiae (α-1,3 and α-1,6 branched mannans; for more details see Structure defines function) is particularly effective at binding pathogens (Firon et al., 1987). Based on those facts, Newman et al., (1993) investigated the effect of MOS in calves and reported improved performance.

The gut is home to billions of microorganisms. Nutrition must not only provide the necessary nutrients, it must also support a balanced microflora. In recent years consumers and the media have placed an ever greater emphasis on wellness, energy levels and overall well-being. MOS as a natural nutritional supplement offers a novel approach to support the microflora and thus improve overall health and well-being.

Experiments with rats have indicated that D-mannoheptulose injections created an aversion to carbohydrates (Langhans and Scharrer, 1983). Glucomannan supplementation reputedly promotes weight loss in overweight persons as a result of fiber-filling and reduced fat uptake (Keithley and Swanson, 2005). But although a high fat diet

supplemented with mannan oligosaccharide in mice reduced food intake, there was no significant effect on body weight, total fat, or visceral fat (Smith et al., 2004).

In farmed animals, gut health has an additional dimension, as a healthy gut enables more efficient use of feed, called the feed conversion ratio. Over many decades antibiotic drugs have been added to the diet of farmed animals at non-therapeutic levels in the absence of disease, in order to enhance the feed conversion ratio, accelerate growth and protect the animal's health, therefore increasing profitability for producers. Today, however, there is a global push to reduce the use of medically important antibiotics as feed additives for farm animals, due to concerns about this practice promoting the emergence of antibiotic resistant micro-organisms. This trend has fueled interest in natural nutritional concepts. Based on a large body of research MOS has established itself as one of the more important natural additives in farm animal production. The effect of MOS on animal performance was analysed in several meta-analyses(statistical analyses of final reports from trials that essentially contain the same experimental treatments) for poultry (Hooge, 2004 and Rosen, 2007), pigs (Miguel et al., 2004) and calves. These analyses reported improvements in performance with MOS.

2.4.2. Effects of Y-MOS on the intestinal microflora:

As mentioned earlier MOS affects bacterial attachment in the intestinal tract. In controlled studies with chickens, a reduction in the prevalence and concentration of different strains of salmonella, as well as E. coli, was reported (Spring et al., 2000). Reductions in E. coli were also reported by several other researchers (Jacque, and Newman, 1994). Salmonella is a zoonoses, therefore an efficient control system, which includes dietary measures is critical in order to produce safe food. Further research has shown a reduction in clostridia, another common intestinal pathogen (Biggs et al., 2007 and Sims et al., 2004). The effects of MOS at controlling E. coli and salmonella are quite consistent. However, reported effects on promoting beneficial bacteria, such

as lactobacilli and bifidobacteria are more variable (Spring et al., 2000; Sims et al., 2004 and Baurhoo et al., 2007). The application of molecular techniques allows us to study the composition of the intestinal microflora, giving us a more detailed picture of the complex changes following MOS supplementation (Horgan, 2010 and Corrigan and Horgan, 2010).

2.4.3. Effects of Y-MOS on intestinal structure and function:

A large surface area is key for optimal digestive function; therefore the surface of the small intestine should be covered with long healthy villi.Yang et al.(2008) reported better energy digestion when including MOS in broilers. Several studies with MOS in poultry have looked at the intestinal structure and discovered longer villi and a more shallow crypt (Baurhoo et al., 2009; Paul et al., 2001 and Yang et al., 2008). Comparable changes in intestinal structure have also been reported in fish. In rainbow trout, supplementing the diet with 0.2% level of MOS resulted in an increase in gut surface area, microvilli length and density, and altered microbial populations (Dimitroglou et al., 2009).

A shallow crypt is a good indicator for an efficient small intestine, which requires fewer nutrients for renewal. With a low renewal rate the intestinal cells become more mature, allowing for more efficient digestive enzyme production and nutrient absorption. Research has shown increased production of enzymes such as; maltase, leucine aminopeptidase, and alkaline phosphatase with MOS (Yang et al., 2008 and Ferket, 2002).

To protect the villi and intestinal surface, the gut produces protecting mucus. This mucus is produced in specific cells called goblet cells. In general the number of goblet cells is an indicator of mucus production. Researchers found that goblet cell numbers were increased with MOS (Baurhoo et al., 2007 and 2009).The importance of those changes for animal health is still being debated by scientists.

2.4.4. Y-MOS as a nutritional supplement for animals:

Spring et al, (2015) reported MOS is included in diets for horses, dogs, cats, rabbits and birds by feed manufacturers, mainly due to its benefits for their health. MOS as a nutritional supplement offers a natural approach to support the microflora and thus improve overall health, well-being and longevity.

Mannan oligosaccharides have been widely evaluated in feeding trials. As animal health and performance are influenced by many factors other than nutrition, the responses to a feed additive will vary between production systems. Therefore, a concept such as MOS should not be evaluated based on single trials. A meta-analyses, which summarizes a large number of published research trials allows for a more comprehensive overview

Part of a successful start into a piglet's life is the consumption of sufficient colostrum (milk from the sow the first day after birth). Colostrum contains high levels of immunoglobulins, which protect the piglet from harmful diseases in the first weeks of its life. Several studies have looked at supplementing sow diets with MOS with the aim of improving the health of the sows. A healthy sow produces good quality colostrum and spreads less harmful bacteria in the environment where she gives birth and raises the piglets. Several researchers have reported a significant increase in colostrum production and colostrum quality with MOS. Those changes in colostrum quality and quantity likely explain a reduced pre-weaning mortality and a higher litter size and litter weight at weaning and can thereby help to better protect the piglet from disease, thus improving piglet survival. A recent review of published literature showed that the mortality of young piglets was reduced when MOS was supplemented in the diets of the sow. keeping the mortality of young piglets to a minimum is important from an economical as well as from an animal welfare point of view.

The next critical phase in a piglet’s life is the time of weaning, when it is separated from the sow.The change from milk to solid feed

leads to changes in the intestinal microflora and structure and thus presents a higher risk of intestinal problems. Two meta-analyses involving a total of 123 comparison,(Miguel et al., 2004 and Rosen, 2007) concluded that performance was better in piglets fed MOS-supplemented feed. The data also indicated that piglets, which were particularly challenged during this transition phase (showing a slower growth rate due to the challenge), responded particularly well to MOS supplements. Positive performance effects with MOS were also reported in later production phases, however, those effects appear to be smaller than in the very young animals (Rosen, 2007).

Newman et al., (1993) noted the first trial ever reported with Y-MOS was with young bull calves improved intake and subsequently better growth rates. The health status of young calves is one of the most important factors contributing to growth and performance. Diarrhoea in young calves is a major issue in the dairy sector. The cause can be viral or bacterial, however, E.coli is often involved. As MOS can bind E. coli, it can modify and help to improve the composition of the intestinal microflora. This resulted in a reduction in faecal E. coli counts and improvements in faecal score in calves fed MOS (Lazarevic et al., 2010). These improvements were coupled with an increase in concentrate (dry feed) intake and better performance (Heinrichs et al., 2003; Sellars et al., 1997; Dvorak et al.,1997 and Quigley,1996). In addition to the changes in the gut, several authors also noticed improvements in respiratory health, which can also contribute to better performance (Sellars et al.,1997 and Newman et al., 1993). Conversely, one trial reported no effects on live weight gain despite increased feed intake (Terre et al., 2007). Higher live weight gain, similar to that gained with the use of antibiotics, has been achieved following supplementation of milk replacer with MOS (Morrison et al., 2010).

Dairy cows fed MOS had better immune protection against rotavirus and were able to pass some of this protection on to their calves (Franklin et al., 2005). The transfer of immunity from the cow to the calves is critical

in order to protect the calf from many different diseases (Morrison et al., 2010).

2.5. Y-MOS for poultry:

The first study testing MOS in poultry showing an improvement in performance was peer-reviewed published in 2001(Paul et al., 2001) It showed an improvement in feed conversion, indicating that birds are converting feed more efficiently into body tissue. An efficient feed conversion ratio (FCR) is important for the overall efficiency and thus is a key contributing factor to sustainable poultry production. In addition, it is of great economic importance to the producer. Over the years, a series of papers looking at performance effects under different production conditions were published. Hooge, (2004) summarized 44 comparisons in a meta-analyses where MOS was fed between 0.5 to 2 kg /tonne of feed. He concluded that on average MOS led to 1.6% improvements in body weight, 2.0% improvement in FCR and lower bird mortality. Rosen,(2007) in his review of 82 comparisons, reported similar effects. After broilers (meat-producing chicken), turkey is the second most important source of poultry meat globally. In turkeys 76 comparisons have shown similar responses to MOS as in broilers (Hooge, 2004 and Rosen, 2007). Several studies also suggest that MOS, when added to poultry diets, allows the birds to perform at a similar level as when fed a diet supplemented with antibiotic growth promoters (AGPs) (Sims et al., 2004; Parks et al., 2001 and 2005). It may also have benefits for broilers during sub-optimal environmental conditions (Pourabedin et al., 2013).

Yalçın, (2013) reported that broilers fed the diets containing 1, 2, 3, and 4 g/kg of yeast autolysate were significantly higher than those of the control group ($P< 0.01$). Feed conversion during the starter period was improved by yeast autolysate supplementation at the levels of 1, 2, 3, and 4 g/kg ($P< 0.001$). Cumulative feed conversion was improved ($P < 0.05$) by yeast autolysate supplementation at the levels of 2 and 3 g/kg. This improvement could be due to the yeast reducing the pathogenic bacterial load in the intestine as reported by (Haldar et al. 2011). Zhang et al. (2005) reported that the live weight gains by broilers

fed whole yeast and cell walls were greater than those of the control broilers from 4 to 5 weeks of age and from 0 to 5 weeks of age.

Haldar et al. (2011) showed higher live weight gain during 1 to 21 day and 22 to 35 day and improved feed efficiency when the yeast and the yeast protein-concentrate additives were supplemented to the broiler diets compared with the control group. The best results in performance of broilers fed yeast cell wall–supplemented diets might be due to the improvement of the intestinal lumen health, thereby increasing the absorption and utilization of the dietary nutrients (Crumplen et al., 1989 and Santin et al., 2001).

Live weight gain (Owenes and McCracken, 2007 and Morales et al., 2009), feed intake; Haldar et al., 2011; Zhang et al., 2005 and Morales et al., 2009), and feed conversion (**Owens** and McCracken, 2007) were not affected by using yeast and yeast products in some studies. The differences in animal response may be related to differences in yeast products such as active dried yeast, live yeast culture, yeast cell wall, mannan oligosaccharide (MOS), β-glucan, fermented yeast culture, or yeast autolysate. Some researchers; Haldar et al., (2011); Ghosh et al., (2012) and Morales et al., (2009) reported that dietary supplementation of yeast or yeast products had no effect on mortality.

Yalçın, (2013) showed No significant differences in the carcass yield and the relative weight of gizzard, liver, heart, spleen, and bursa of fabricius were observed among groups. By contrast, the relative abdominal fat weight was significantly lower ($P< 0.001$) in birds fed with diets containing yeast autolysate than in birds fed with the control diet. Different yeast products had no significant effect on gizzard weight (Owenes and McCracken, 2007), relative spleen weight (Morales et al., 2009), and relative weight of bursa of fabricius (Morales et al., 2009). Corduk et al.,(2008) reported that MOS (BioMos) supplementation did not significantly affect carcass yield and the relative weights of abdominal fat and gizzard.

2.5.1. Effect of mannan oligosaccharides (MOS) with antimicrobial growth promotants:

Several groups have recently compared the effects of yeast-derived marinanohgosaccharide preparations (Bio.Mos) with those of specific growth-promoting antimicrobial supplements in poultry. Some studies focus on the production advantages of yeast cell wall preparations and their potential roles as alternatives to large amounts of antimicrobials used in poultry diets.

Sims and Sefton (1999) reared tom turkeys to 18 weeks of age on used turkey liner and fed diets with bacitracin methylene disalycylate, a yeast cell wall preparation (Bio-Mos), or in combination of these supplements, along with a control diet. There were no significant differences in the body weights of the birds at 6 or 12 weeks of age. However, at both 15 and 18 weeks of age, turkeys fed bacitracin methylene disalycylate plus Bio-Mos were heavier ($P<0.05$) than birds fed the control diet, while the birds fed either of the feed additives alone were intermediate in body weight. At 18 weeks of age, birds fed Bio-Mos or BMD alone were heavier than control birds but were not as heavy as those fed Bio-Mos and BMD in combination. Changes in body weight were reflected to some extent in feed conversion, since it was also improved at 18 weeks of age for those birds fed Bio Mos plus BM.D compared to control fed birds, while those fed either Bio-Mos or BMD alone were intermediate in their feed efficiency.

The comparative effects of Bio-Mos and flavomycin on the growth of poults have also been examined (Fairchild et al., 1999). In birds that had been challenged with E. coil, both Bio-Mos and Flavomycin improved poultry growth during the first week. Cumulative three-week body weight gains for unchallenged poults were improved by both Bio-Mos and Flavomycin ($P<0.05$). These studies suggested that dietary Bio-Mos and Flavomycm were most effective in poults faced with an E. coil challenge during the first few weeks of life.

In general, these production studies indicate that the yeast-derived mannanoligosaccharide preparations (Bio-Mos) can provide many of the same production advantages that have been long associated with the use of antimicrobial growth promotants in poultry, and that these materials may serve as useful alternatives to antimicrobial supplements in many production systems. However, since the responses to the combination of yeast cell wall preparations and antimicrobials are often greater than those associated with either supplement alone, it appears that the mechanisms that explain the overall effects of yeast preparations may differ from those used to describe the growth-promoting activities of antibiotics. In many cases, beneficial production responses to mannan oligosaccharides can be obtained both in the presence and absence of antimicrobial growth promotants (Shashidhara and Devegowda, 2003).

Until recently, use of yeast extracts as sources for biopeptides for animal feeds was cost-prohibitive. However, today the increased demand for yeast cell wall-based products has increased the availability of yeast extracts and will result in decreased costs. Preliminary studies with broiler chicks have shown that yeast-based biopeptides improved the efficiency during the first week of age, but that supplementation over a longer period did not provide any long-term advantages. Such studies suggest a strategic role for yeast extract-derived biopeptides during the starter phase of chicken development (Dawson, 2001).

Chapter three

Materials and Methods

This experiment carried out during (9^{th} September –21^{th} October 2014). The ambient temperature average 30ºC – 38ºC (appendix1) during the experimental period (6weeks).

3.1Experimental Chicks:

A total number of 84 day–old commercial unsexed broiler chicks of Ross 308 strain were purchased from (Arab Poultry Breeders Company**,** Ommat-Sudan), and transported to the student poultry premises, College of Agricultural Studies, Sudan University of Science and Technology, Shambat.

The chicks were adapted to the premises and fed over 7 days before the start of experiment. At the end of adaptation period, all chicks were weighed with an average initial weight of 155g. The chicks were then assigned randomly into four dietary treatment groups (A, B, C and D) in completely randomized design (CRD), each group was divided into three replicates, each of 7 chicks. Ground brooding/rearing system was adopted for 6 weeks experimental period. Chicks were bought vaccinated against Gumboro disease at 11 days of age through drinking water and Newcastle disease at 22 days of age using Lasota strain. Soluble multi-vitamin compounds (Pantominovit-pantex Holland B.V. 5525 ZG Duizel-Holland) given before 3 days of vaccination and 3 days after vaccinations in order to guard against stress.

3.2. Housing:

Open wire mesh-side poultry house was used. The house was constructed on a concrete floor with corrugated metal sheets roof and a solid brick western-eastern wall up to 3 meters the eaves and 4-5 meters for apex. 20 pens, $1m^2$ each, inside the house, were prepared using wire mesh partitioning. Each pen was equipped with one feeder and drinker to allow

ad.libitum consumption of feed and water. Light was provided approximately 24 hours in a form of natural light during the day and artificial light during the night. Five bulbs (60 watt) were used for this purpose. The house was cleaned and well disinfected before the commencement of the experiment.

3.3. Experimental Diets:

The chicks were fed on 4 dietary treatments. The first group A fed on basal diet as (control) without Y-MOS. The other groups B, C and D were fed on the basal diet supplemented with Y-MOS at levels 0.25, 0.50 and 1.00% respectively. The basal diet was formulated to meet the nutrients requirements of broiler chicks according to the (NRC, 1994).

The ingredients percent composition and the calculated chemical analysis of the experimental diet were presented in Table (1, 2). Experimental diets were fed for 6 weeks.

3.4. Data Collected:

3.4.1 Performance data:

Average body weight, weight gain and feed intake (g) for each group were determined weekly throughout experimental period. Health of the experimental stock and mortalities were closely observed and recoded daily.

3.4.2 Slaughter Procedure:

At the end of the experiment period, the birds prevented from feed all the night and weighted individually, then they were slaughtered by severing the right and left carotid with jugular vessels, trachea and esophagus. After bleeding they were scalded in hot water, hand-plucked and washed. The head was removed closed to skull, feet and shanks were removed at the hock joint.

Evisceration was accomplished by posterior ventral cut to completely remove the visceral organs. The hot carcass was weighed for calculation dressing percentage. The legs were separated from each carcass then they were deboned, the meat was frozen and stored for sensory evaluation.

3.4.3 The taste panel:

Frozen deboned legs cuts were thawed before cooking for sensory evaluation. The meat was trapped in aluminum foil, placed in roast pan and cooked at 176.7 ºC in conventional preheated electrical oven to about 80 ºC internal muscle temperature. The cooked meat was allowed to cool to room temperature for about 10 minutes. The samples were kept warm until served. Trained panelists were instructed to eat crackers, drink water between samples providing to clear the plate and pause for 20 seconds between all samples evaluated; following recommended procedure *(*Hawrysh *et al.*, 1980). The sensory panel evaluated the chops for tenderness, flavor, colour and juiciness using an eight-point scale (Appendix2).

3.5. Experimental Design and Statistical Data Analysis:

Completely randomized design was used in this experiment. The data were tabulated and subjected to One-way Analysis of variance (ANOVA), followed by Duncan test in case of significant effect by using the SAS computer program (SAS, 2004). All values were presented as means and standard error. The level of significantly set up $P< 0.05$.

Table1. Percent inclusion rates of dietary ingredients used in the experiment

Ingredient	0% A	0.25% B	0.50% C	1.00% D
Sorghum	64.14	64.14	64.14	64.14
Groundnut cake	14.00	14.00	14.00	14.00
Sesame cake	15.00	15.00	15.00	15.00
Super concentrate	5.00	5.00	5.00	5.00
Oyster shell	0.49	0.49	0.49	0.49
D.C.P	0.62	0.62	0.62	0.62
Salt	0.25	0.25	0.25	0.25
lysine	0.34	0.34	0.34	0.34
Methionine	0.16	0.16	0.16	0.16

*ME (Metabolizable energy): calculated by the following equation by (Lodhi et al., 1976)

ME_p : 1.549 + 0.0102 (CP) + 0.0275 (EE) - 0.0148 (NFE) – 0.0034 (CF).

*Super concente: crude protein 40%, ME 2000 Kcal/kg, crude fiber 3% ; calcium 8%, lysine 12 %, Methionine 3% , available phosphorus 8%,

*Vitamins: vit. A 2500 I.U/Kg ; D3 2500 I.U/Kg ; E 25 mg/Kg ; C 400 mg/Kg ; B2 100 mg/Kg .

*Iron 800mg/ kg, folic acid 30 mg/Kg, choline 1000 mg/Kg, Carcass 21%.

Table (2). Determined chemical composition of the experimental diets.

Component %	Experimental diets			
	A	B	C	D
Crude Protein **CP**	27.07	25.82	26.63	23.77
: crude Fiber **CF**	11.40	14.80	11.60	13.60
Ether Extract **EE**	5.00	5.40	5.40	5.40
Dry Mater **DM**	93.20	93.50	93.70	93.40
Ash	7.09	7.27	7.69	7.50

Chapter four

Results

4.1. Performance

The effect of commercial (Y-MOS) yeast on the performance of broiler chicks is shown in **Table 3**. Initially all groups started at similar body weight (155 g). Treatment effect on final body weight, weight gain, feed intake and feed conversion ratio (FCR) are not significant ($p > 0.05$). However, chicks in group B had the highest values compared with other treatment groups. Feed conversion ratio values are closely similar in all treatment groups. No mortality was detected in all treatment groups all throughout the experimental period.

Table 3. **The effect of commercial (Y-MOS) yeast on the performance of broiler chicks**

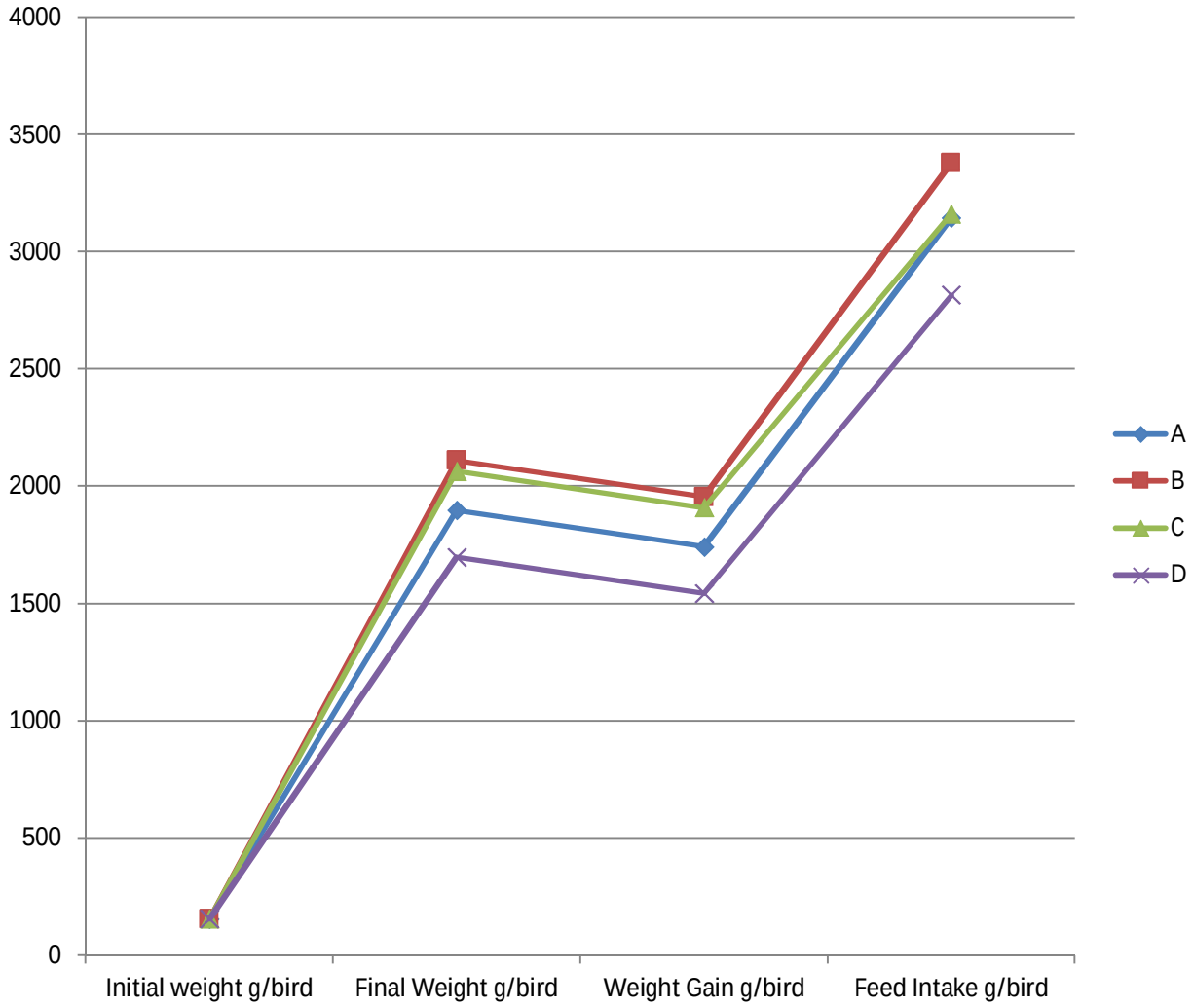
Items	SE±	sig	Groups			
			A	**B**	**C**	**D**
Initial weight g/bird	0.60	0.990	155	155	155	155
Final Weight g/bird	74.77	0.195	1898	**2111**	2064	1698
Weight Gain g/bird	74.71	0.195	1743	**1956**	1909	1543
Feed Intake g/bird	78.30	0.051	3147	**3380**	3162	2816
Feed Conversion Ratio	0.04	0.629	1.8	**1.7**	**1.7**	1.8
Mortality%	0.35	-	0.15	0.00	0.05	0.00

Rows bearing on letter showed no single cant (p>70.05)

sig = significant difference

SE ± = standard error
A = controlled group
B = Y-MOS yeast (0.25%)
C =Y-MOS yeast (0.50%)
D = Y-MOS yeast (1.00%)

Figure (1):The effect of commercial (Y-MOS) yeast on the performance of broiler chicks



A = controlled group

B = Y-MOS yeast (0.25%)

C =Y-MOS yeast (0.50%)

D = Y-MOS yeast (1.00%)

4..2. Carcass Measurements:-

4.2.1.Non carcass yield:

The effect of commercial (Y-MOS) yeast on the percent values of the giblets (liver, gizzard and heart) of broiler chicks is shown in **Table 4**. The result showed that the treatment effect on the percent of all giblet parts was not significant ($p>0.05$). Group A recorded the highest mean values in all traits.

4.2.2. Carcass and measurements:

4.2.2.1. Carcass dressing and commercial cuts

The results indicated no significant differences ($p>0.05$) between all treatment groups in carcass dressing and commercial cuts percentages as shown in **Table 5**. Group C recorded the highest mean values in all traits, except breast that with highest values in group A.

4.2.2.2. Meat expressed from total weight of commercial cuts

The values of meat expressed as percentage from total weight of selected commercial cuts are given in **Table 6**. In the three selected cuts (breast, thigh and drumstick) meat percentage are similar ($p>0.05$) between treatment groups, with group C recorded highest mean values in all traits except breast muscle that with highest values in group A.

Table 4.**The effect of commercial (Y-MOS) yeast on the percent of giblets (liver, gizzard and heart) of broiler chicks**

Items	SE±	Sig	Groups			
			A	**B**	**C**	**D**
Heart	0.197	0.004	2.20	0.83	0.50	1.00
Liver	0.194	0.226	3.73	2.83	2.67	3.00
Gizzard	0.234	0.106	5.00	4.70	3.83	3.50

Rows bearing on letter showed no single cant (p>70.05)

sig = significant difference

SE ± = standard error

A = controlled group

B = Y-MOS yeast (0.25%)

C =Y-MOS yeast (0.50%)

D = Y-MOS yeast (1.00%)

Table 5.**The effect of commercial (Y-MOS) yeast on the carcass dressing, commercial cuts (breast, drumstick and thigh) percentages of broiler chicks**

Items	SE±	sig	Groups			
			A	**B**	**C**	**D**
Dressing%	4.278	0.015	80.33	77.33	87.67	55.33
Drumstick	0.562	0.090	14.00	12.67	14.00	10.67
Thigh	0.468	0.560	10.33	10.67	11.33	9.33
Breast	1.062	0.164	32.00	28.00	28.67	25.33
Wings	0.345	0.284	7.67	8.67	9.00	7.33

Rows bearing on letter showed no single cant (p>70.05)

sig = significant difference

SE ± = standard error

A = controlled group

B = Y-MOS yeast (0.25%)

C =Y-MOS yeast (0.50%)

D = Y-MOS yeast (1.00%)

Table 6.**The effect of commercial (Y-MOS) yeast on the percent of meat expressed from total weight of commercial cuts of broiler chicks**

Items	SE±	sig	Groups			
			A	**B**	**C**	**D**
Drumstick meat	4.229	0.089	66.67	77.67	85.67	68.33
Thigh meat	0.680	0.629	80.00	82.33	84.00	79.67
Breast meat	1.618	0.050	86.00	83.01	88.67	81.68

Rows bearing on letter showed no single cant (p>70.05)

sig = significant difference

SE ± = standard error

A = controlled group

B = Y-MOS yeast (0.25%)

C =Y-MOS yeast (0.50%)

D = Y-MOS yeast (1.00%)

4.3. Panel test (subjective meat attributes)

The effect of treatment on subjective meat attributes is shown in **Table 7**. The average subjective meat quality score values of colour, tenderness, juiciness and flavor of leg cuts (thigh and drumstick) did not differ significantly ($p>0.05$) among the dietary treatment and scores given for all attributes are above moderate acceptability level.

Table 7.**The effect of commercial (Y-MOS) yeast on the meat subjective values of broiler chicks**

Items	SE±	sig	Groups			
			A	**B**	**C**	**D**
Tenderness	0.163	0.183	6.92	5.92	6.31	6.31
Flavor	0.209	0.878	6.00	6.23	6.15	5.77
Colour	0.196	0.178	5.77	6.62	6.38	5.54
Juiciness	0.212	0.573	6.00	5.23	5.85	5.92

Rows bearing on letter showed no single cant (p>70.05)

sig = significant difference

SE ± = standard error

A = controlled group

B = Y-MOS yeast (0.25%)

C =Y-MOS yeast (0.50%)

D = Y-MOS yeast (1.00%)

4.4. Economic appraisal

The total cost, returns and profitability ratio per head of broiler chicks Y-MOS for 6 weeks are shown in **Table 8**. Chicks purchase, feed, management cost values (SDG) were the major inputs considered. The total selling values of meat of the total revenues obtained. Profitability ratio (1.16) of test group B (0.25% Y-MOS) was the highest of the test groups.

Table 11. **The effect of dietary fresh groundnut oil and its fried oil on economic appraisal/bird (SDG)**

Items	Groups			
	Control	**0.25%**	**0.5%**	**1%**
Cost				
Chick purchase	4.5	4.5	4.5	4.5
Total Feed cost	13.168	14.487	13.895	12.965
Management	2.00	2.00	2.00	2.00
Total cost of production	19.668	20.987	20.395	19.465
Revenue				
Carcass weight	1.743	1.956	1.909	1.543
Price/ Kg of bird	28	28	28	28
Total Revenue	48.804	54.768	53.452	43.204
Total Profit	29.136	33.781	33.057	23.739
Profitability Ratio	1	1.16	1.13	0.81

⁂*Total cost calculated according to 2014.*

The price meat (by) for lolled revenuer calculated according to

Discussion:

Mannan oligosaccharides have been shown quite widely to have positive effects on bird performance characteristics including live weight gains, feed conversion efficiencies and feed consumption (Blake. et al., 2005; Eseceli, et al., 2010; Midilli, et al., 2008, Parks, et al., 2005; Sims et al., 2004 and Yang, et al., 2008). The present study showed there was an improvement in performance as a result of dietary supplementation with MOS. No significant differences were noted on broiler performance when live weight gains, feed consumptions or feed conversion efficiencies were compared. Similar results for broilers have also been noted in previous studies where such supplementation failed to convey a growth promoting effect either through increased weight gains or improved feed efficiencies (Waldroup, et al., 2003 and Yang, et al., 2008).

The well established growth promoter effect of dietary MOS was frequently attributed its pathogenic bacteria binding ability described as strongly binding and decoying pathogens away from the intestinal lining (Oyofo,1989; Newman, 1994; Funicane et al.,1999; Shane,2001).Thus, more nutrient is available in the intestinal lumen for absorption to convert body mass. The overall main effect of MOS was to increase weight gain when compared to control group, also the body weight of male broilers given MOS added wheat based diets was significantly higher than those AGP and control treatments (Bozkurt et al., 2009). Hooge (2004) reported that MOS addition to diet increased body weight gain compared with negative control diets. Different from the results of those studies, it was reported that MOS feeding program gave statistically equivalent body weight compared to diets containing subtherapeutic levels of antibiotics (Parks et al.,2001; Hooge et al., 2003b; Ceylan et al.,2003; Waldroup et al.,2003a, b). From a general point of view, numerous scientific results have been reported for growth promoter effect of MOS compared to unsupplemented control program

even under different management procedures (Kumprecht et al.,1997; Sims and Sefton, 1999; Shafey et al.,2001; Ceylan et al.,2003; Hooge et al.,2003 b; Bozkurt et al., 2005a, b).

As a consequence, performance enhancer feed additives MOS is well established working mechanism via promoting growth and improving feed efficiency in the present study. Note worthingly, MOS feeding program was in a tendency of stimulating the feed consumption of birds, these results are in agreement with Iji et al. (2001) found that dietary MOS supplementation (1 g/kg) led to increased cumulative feed intake and FCR compared to the control group. Contrary to our results, it was reported that feed intake was not affected by dietary MOS and probiotic addition in bronze turkeys (Zduńczyk et al., 2005; Stanczuk et al., 2005), or broilers (Shafey et al., 2001; Sarica et al., 2005; Yalçınkaya et al., 2008). As a matter of fact, even if the feed intake was considerably increased by feeding MOS, the greater increase in weight gain resulted of an improvement in feed conversion ratio compared to broilers given control program. However, it should be take into consideration that little information is available in the scientific literature still with regard to dietary supplementative effects of oligosaccharides on feed consumption traits of all poultry species. In agreement with the results of numerous earlier studies (Kumprecht et al.,1997; Sims and Sefton, 1999; Parks et al.,2001; Shafey et al.,2001; Hooge,2003 a, b; Sinovec et al.,2005; Bozkurt et al., 2005a,b), the present experiment also showed that dietary MOS treatments improved feed conversion ratio compared with the control. Confirming evidences was arose from another study (Hooge, 2004) who pointed out that MOS feeding programs more benefited (1.99%) than that control program. Contrary to those results, no improvement effect on feed conversion ratio was observed (Küçükyilmaz et al.,2005).

Carcass and cut yields products such as breast, drumstick, thigh and wings, in this results concerning MOS are in agreement with (Loddi et al., 2000; Pelicano et al., 2003; Alçiçek et al., 2004; Karaoğlu and Durdağ, 2005; An et al., 2008) who reported that MOS supplementation

to broiler diets had no significant effect on carcass traits. It is predictable that better health status of the intestinal mucosa due to feeding MOS diets may improve carcass yield of broilers. On the other hand, research pertaining to the effects of dietary MOS on slaughter characteristics and carcass yield is lacking. It was hypothesized that a decrease in intestinal pathogen challenge provided by MOS would result in improvement nutrient utilization and allocation leading to benefits in lean muscle gain (Ferket, 2004). In consistent with that prediction, study suggested significantly improvement for breast yield in terms of MOS feeding (Clementino dos Santos et al.,2002), whereas no benefit was determined for carcass yield in other trials (Ceylan et al.,2003; Waldroup et al.,2003a, b; Bozkurt et al.,2005a, b).

Unfortunately, little scientific report is available regarding to intestinal organ weights of broilers in terms of feeding with MOS added diets. The results of this study showed that MOS supplementation did not affect empty gizzard and intestinal weights of birds in agreement with the findings of (Bozkurtet al.,2005b). Consistent with our results, Hernandez et al. (2004) and Sarica et al.(2005) found no differences in liver and pancreas weight of broiler chickens fed diets supplemented with an antibiotic. A similar observation was reported by Alçiçek et al.(2004) and Waldroup et al.(2003a, b). They concluded that abdominal fat pad weight was not affected by antibiotic or antibiotic plus MOS treatment compared to control diet. The results concerning intestinal weight are consistent with Denli et al. (2004), who reported that mixed probiotic supplementation did not affect intestinal traits. Also, it was previously reported that dietary MOS and probiotic (lactobacillus) had no effect on gizzard weights of broilers (Karaoğlu and Durdağ, 2005; Brzóska et al., 2007; Owens and McCracken, 2007). In the current study, internal organ weights and proportions, as percentages of carcass weight, were not influenced by dietary MOS. These results confirmed those of Karaoğlu and Durdağ (2005), Denli et al. (2004), Pelicano et al. (2004) and Loddi et al. (2000). In contrast, Yang et al. (2007) reported that dietary MOS supplementation decreased intestine and liver weight in broilers.

The average subjective meat quality score values of colour, tenderness, juiciness and flavor of leg cuts (thigh and drumstick) did not differ significantly ($p>0.05$) among the dietary treatment and score given for all attributes are above moderate acceptability level. This result in agreement with Konca et al. (2009), that reported the average of breast and thigh colour were not influenced by dietary MOS and SC supplementation ($p>0.05$). These results are in agreement with some previous studies which investigated the same effect in broilers (Loddi et al., 2000; Pelicano et al., 2003; Karaoğlu et al., 2004; Pelicano et al., 2005). However, Karaoğlu et al. (2004) revealed that dietary SC supplementation decreased lightness and redness values but increased yellowness values in broilers. Similarly Pelicano et al. (2003), in the latter of two experiments, showed that dietary probiotic addition increased lightness value but did not influence redness and yellowness values.

Yalçın (1993) reported the differences among dietary treatments in colour, tenderness and juiciness of thigh meat were not statistically significant the flavour of meat was significantly different ($P<0.05$) among the treatments. Meat containing 5 % yeast was the most desirable one according to the flavour. Also, Paryad and mahmoudi (2008), reported there are trials showing that enrichment of diets with yeast could favorably improve the quality of edible meat from broilers. For example, edible meats from broiler chicks fed a diet containing chromium-enriched yeast (Saccharomyces cerevisiae) exhibited increased tenderness (Bonomi et al., 1999) and increased water holding capacity (Lee et al., 2002). No data are available in the literature that is pertinent to the effect of yeast Y-MOS on subjective meat qua1ity of broiler meat.

The results of economical evaluation of experimental diets showed that addition of Y-MOS improved the performance of broiler chicks and reduced the mortality therefore reducing the total cost of the feed and

resulted economic benefits. The profitability ratio (1.16) of the group fed (0.25% Y-MOS) was the highest of the test groups. Similar results were reported by (Khair Alla, 2014), who indicated that, the dietary groups B, C and D gained more net profit than that of group A. but the value of profitability ratio (1.50) of group D (1500 g/ ton, symbiotic) was the highest of the tasted groups, and this result was agreed with (Ashayerizadehet al 2011).

Conclusion and Recommendations

Conclusion:

- Adding Y-MOS was promoting to the performance of broiler chicks.
- Using Y-MOS in the diet made no changes in carcass yield and meat quality.
- Adding Y-MOS the broiler diets resulted in economical benefits.

Recommendations:

- Y-MOS used in this experiment can successfully be added at the level of 0.25 and 0.5% in the diet to promote broiler growth without any adverse effect either on health or carcass yield and meat quality of the broiler chicks.
- All levels of Y-MOS added to the broiler diets according to their frequent number of used were recommended.
- Levels of 0.25% and 0.50% (Y-MOS) added to the broiler diet in this study is recommended economic wise , but the level of (0.25%) is more profitable.

Suggestion for future research:

- More experiments needed to be run to determine the effect of different Y-MOS used at different levels.

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APPENDIXES

Appendix (1):

Weekly maximum and minimum experimental pen temperature during the period

September19th – November29th 2014

Weeks	Temperature ºC	
	Maximum	Minimum
1	36	31
2	35	30
3	34	30
4	38	31
5	34	30
6	34	31
Average	35	30.5

www.wunderground.com (2014).

Appendix (2):

Card used for judgment of subjective meat Quality attributes.

Sensory evaluation card

Evaluate these sample for color, flavor juiciness tend mess. For each sample, use the appropriate scale to show your attitude by checking at the point that dest describes your felling about the sample. If you have any question please ask. Thanks your cooperation.

Name: ……. **Date:** ……..

Tenderness	Flavor	colour	Juiciness
8-Extremely tender	8-Extremely intense	8-Extremely desirable	8-Extremely juicy
7-Very tender	7-Very intense	7-Very desirable	7-Very juicy
6-Moderatly tender	6-Moderately intense	6-Moderatly desirable	6-Moderatly juicy
5-Slightly tender	5- slightly bland	5-Slightly desirable	5-Slightly juicy
4- Slightly tough	4- slightly bland	4-Slightly desirable	4-Slightly dry
3-Moderatly tough	3-Moderatly bland	3-Moderatly desirable	3-Moderatly dry
2-Very tough	2-Very bland	2-Very undesirable	2-Very dry
1-Extremely tough	1-Extremely bland	Extremely undesirable	1-Extremely dry

Serial	Sample cod	Tenderness	Flavor	Colour	Juiciness	Comments
1						
2						
3						
4						
5						