The 3rd ISTAP, Faculty of Animal Science, Gadjah Mada University, 2002 *ISBN : 979 – 97243 – 2 - 5*

BIOLOGYCAL VALUES: TRUE METABOLIZABLE ENERGY (TME) AND TRUE AMINO ACID AVAILABILITY (TAAA) OF PROTEIN SOURCES DETERMINED IN NEWLY HATCHED BROILER CHICKS

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Abstract

Research of biological values of protein sources determined in newly hatched broiler chick was done aimed to study metabolisability and availability of protein sources in newly hatched broiler chicks. Chick achieve their optimal growth when chicks are provide to meet the nutritional requirement, however, immediately post-hatch the requirement are not well defined. To these True Metabolisable Energy (TME) and True Amino Acid Availability of soybean meal and casein were observed to determine biological value of protein sources in chick aged 1, 3 and 10 days. TME and TAAA were determined based on the methods of Murakami *et al.* (1994) and Yamazaki (1986). Statistically analysis was done by GLM-SAS (SAS Institute, 1982). TME of Soybean meal attained optimum value at 3-days ($p<0.01$), whereas, TME of casein peaked at 1 day ($p<0.01$) with no age dependency. A metabolisability of casein was higher than soybean meal. Availability of amino acid was varying, chicks fed soybean meal low in availability of tyrosine and trypthophan at all ages determined and among the amino acids it was characterized high availability of methionine and cystein. Different to soybean meal, chicks fed casein was characterized by high availability of amino acid at day 1, decreased at day 3 and again increased to day 10.

Key words: Metabolisability, Availability, Protein, Newly hatched chicks.

Introduction

Growth rate of broiler chicks has been increased by approximately 1 day per year during last few decades, resulting in early market weight attainment. This emphasizes the importance of growth during post hatch period, which presently confined approximately 16% of life span of chickens (Gyles, 1989). Vitelline residue still plays a crucial role in energy supply for chickens. The vitelline residue contributes about 22 and 33% of total energy and protein intakes, respectively during 3 days after

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hatched (Akiba and Murakami, 1995). Chamblee *et al.*, (1992) and Nitsan *et al.*, (1991a) noted role of vitelline residue during first few days after hatched, a transition period prior to utilization of exogenous feed. In post-hatched chick, digestive enzyme activity in the small intestine changes to adapt to substrate presented. The activity raised gradually a reached maximum value at 3-4 day. Different from the enzyme in the small intestine, pancreatic enzymes activities reached their maximum value at 4-11 day after hatched (Akiba and Murakami, 1995, Nitsan *et al.* 1991a, Nitsan *et al.*, 1991b). Chicks achieve their optimal growth when chicks are providing to meet the nutritional requirement. However, immediately post-hatch the requirement is not well defined. Therefore, studies of early phase growth in chickens may help in optimising nutritional management of chickens. The experiment was done aimed to study metabolisability and availability of protein sources in newly hatched broiler chicks.

Material and Method

Fertile eggs of broiler were incubated under the standard condition with the hatching time was regularly monitored every 2 hours starting from 20th day of incubation. Newly hatched chicks were reared into electrically heated metabolic cages (2 to 4 birds per cage).

The experiment was carried out based on the Murakami *et al.*, (1994) in the determination of True Metabolisable Energy (TME) in newly hatched chicks. Soybean meal and casein were ground with 0.5 mm sieve, and those were incubated by 5% of B-starch solution-feedstuff blending. Amount of expecting intake of feeds at chickens aged 1, 3 and 10 days are 2.5, 5.0 and 15, 0 g, respectively. Forced feeding was done 3 times during 8 hours following 24 hours feed deprivation with water available. Excreta was collected for 44 hours starting from the first force-feeding and frozen, freeze-dried and weighed. Gross energy (GE) and nitrogen content of feeds and excreta were determined by bomb calorimeter and macro-Kjeldhal (AOAC, 1975), respectively. Amino acid was analysed by Fujimura *et al.*, (1991) in the rapid analysis of amino acid in plasma and feedstuff with several modifications. The TME and True Amino Acid Availability (TAAA) were calculated by Sibbald's formula (1976) and Yamazaki's formula (1986). Data were statistically analysed by General Linear Model of SAS (SAS Institute, 1982).

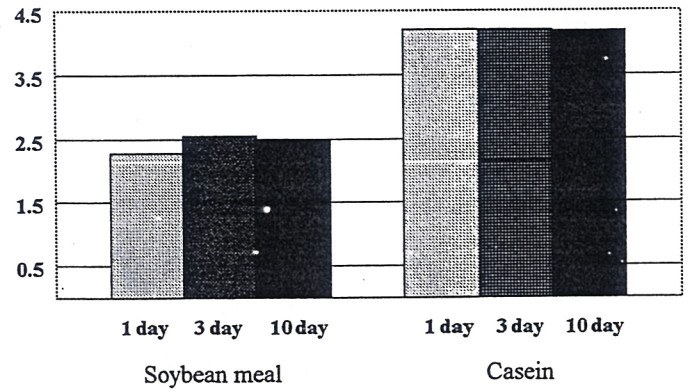
Result and Discussion

TME and metabolisability of soybean meal and casein developed in different ways. The TME value of soybean meal significantly developed with age ($P<0.01$) and The TME and metabolisability attained maximum value at 3 days of age; Whereas no age dependency showed by TME and metabolisability of casein. The TME and metabolisability of casein peaked at 1 day of age and decrease thereafter. In

 ISBN : 979 – 97243 – 2 - 5

general the TME and metabolisability values of casein were higher than those of soybean meal (P<0.01). The metabolisability of casein exceeded 10 % over that of soybean meal, in particular at 1 day of age that 20 % superior in the metabolisability, suggesting that casein is more preferable protein source in newly hatched chicks. It was noted that metabolisability of casein was comparable with those of carbohydrate and fat sources, despite of very high nitrogen content in the casein (Sulistiyanto *et al.*, 1999). Boorman (1976) noted that digestive secretion and proteolytic enzymes were factors to influence the protein utilization. Since casein was indicated to be efficiently utilized than soybean meal, digestive secretion and proteolytic enzymes could be considered not well defined during first 3 days of age, thereby only could enough in digesting milk products which is naturally component of baby's feed.

Figure 1. True Metabolisable Energy of soybean meal and casein



Dietary protein sources were characterized by age dependency in amino acid availability (P<0.01). Dietary soybean meal was characterized by low availability of valine, lysine in 1 day old and tyrosine, trypthophan at all ages determined. The TAAA values of aspartic acid, glutamic acid, proline, glycine, alanine, leucine, phenilalanine and arginine peaked at day 3 of age. The TAAA of serine, histidine and lysine increased with age to day 10th. However, no age dependency was appeared in TAAA of serine and histidine. Threonine, isoleucine and tyrosine reached maximum availability at day 1, and then decreased to day 3. Sulphuric amino acid such as cystine and methionine appeared most available among all amino acid at 1 day of age. Chicks fed casein was characterized by high availability of amino acids at day 1, decreased at day 3 and again increased with age to day 10. Availability of proline and histidine decreased with age and availability of cystine and tripthophane were very low at day 3. Availability of threoninen, serine, proline, glycine, cystine, valine, alanine, leucine, isoleucine, tyrosine, phenilalanine, histidine, lysine and arginine were peaked at day 1. Whereas the maximum availability of aspartic acid, glutamic acid, alanine, methionine and trypthophan at day 10, respectively. Age dependency in

bio availability of amino acids of soybean meal could be assumed to resulting from incompletely development of digestive enzymes in post hatched chicks, because trypsin and chemotrypsin activities have been reported to become the peak after 7 day post-hatching (Nitsan *et al.*, 1991a). High availability of arginine appeared by soybean meal and casein could be explained as a result of amino acid composition of dietary protein, and excretion of endogenous amino acid. Yamazaki (1986) noted that arginine and lysine were excreted in free from depending on the amino acid composition and therefore the amino acid excretion might affect result of assay. Moreover, it has been indicated that amino acid profile of protein associated to feedstuffs was a factor, which affected bioavailability of amino acid in poultry. Therefore, casein, which is profiled by good balance in amino acid, appears most valuable protein source for post-hatched chicks.

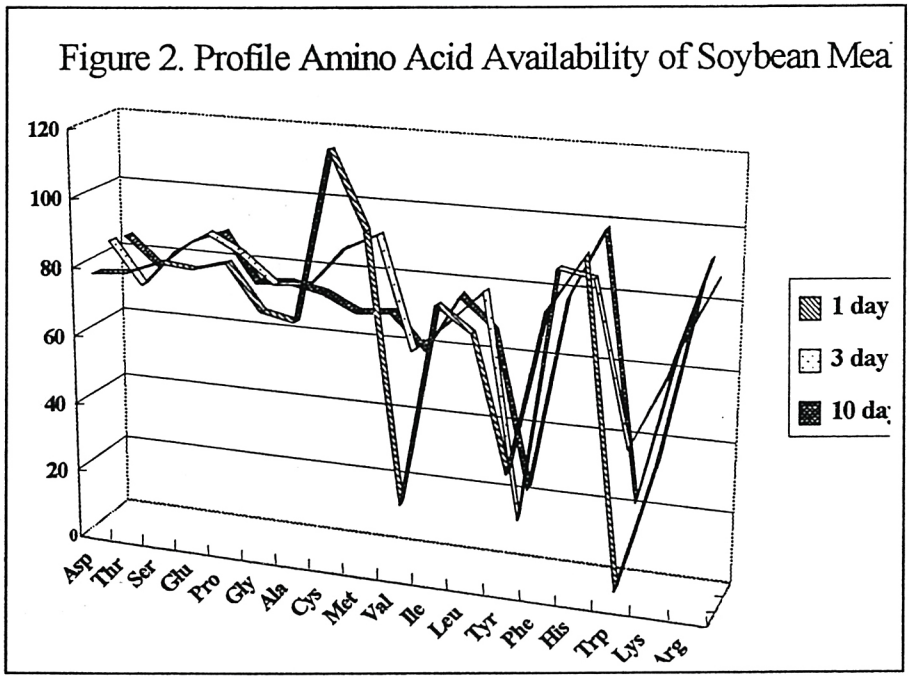
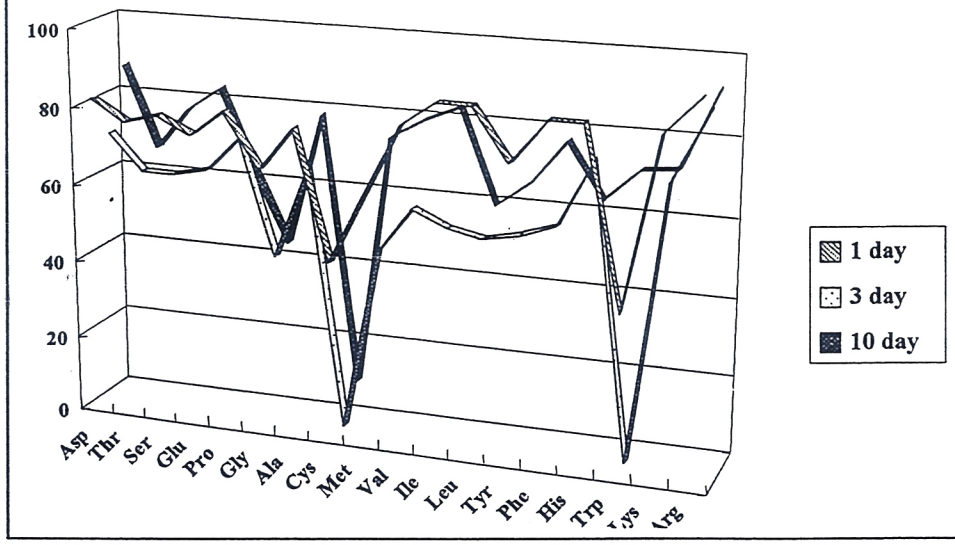


Figure 3. Profile Amino Acid Available of Casein



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