Chapter V

DISCUSSION

Concerning the preparation of dry brewery yeast, it was intended to wash beer and ingredients used in beer-making out of yeast before drying. But due to lack of appropriate equipments, washing procedure in this study was not quite satisfied as traces of beer flavor remained after washing step. However, the flavor disappeared after drying process because alcohol and some other volatile compounds were evaporated out. Drying temperature at about 60° c was chosen as the dry yeast is more prone to browning reaction upon drying at higher temperatures and causes decrease in nutritive value as described in the experimental part. Drying at this temperature in the tray dryer took about three hours to reduce moisture content of yeast to 5 - 6 per cent. The dry brewery yeast was light brown in color and rather mild in odor. Taste of the brewery yeast was rather bitter due to some bitter substances contributed by hops which composed of resins, essential oils and tannic acid. The brewery yeast should be debittered before use in feed meal unless it was not prefered by the broilers (Prescott and Dunn 1959). However in this study, the brewery yeast was used at rather low percentages in feed meal so these problems were minimized.

The intial concentration of yeast in the waste solution was compared with dry brewery yeast product after preparation step (Table 22). It is evident that there is some loss during preparation step especially at filtering process. From calculation, the percentage of loss varies from 10 to 40 %. There are also some variations in the initial concentration of yeast in the waste solutions. This might due mainly to the yeast solutions were not taken from the same depth in fermenter tank of the Thai Amarit Brewery Plant. Generally, the yeast concentration at the top part of the tank is lower than at the bottom part. Yeast at the top part is largely at young state whereas older yeast is located at the bottom of the tank. The highest difference of the initial yeast concentration obtained in this study is about 100 % . To obtain yeast with consistent chemical composition it it necessary to take the yeast at similar growth state. Yeast at different growth states has different chemical properties especially protein and nucleic acids (Mateles and Tannanbaum, 1968).

Results from chemical analysis of dry brewery yeast showed that yeast contains protein as high as fish meal, but contains lower fat, calcium and phosphorus than fish meal. Therefore, if high volume of yeast is used to replace fish meal; fat, calcium andphosphorus must be added to meet broiler's requirement (Table 8). In general, if fat is needed in the feed meal it can be obtained from meat and bone meal. Calcium and phosphorus can be supplied in the form of oyster shell or calcium diphosphate. The fiber content in yeast is higher than fish meal but it is lower than soybean meal. Hence, the use of yeast to replace fish meal can slightly lower the quantity of soybean meal in the ration. This is due to yeast contains more but less fiber than soybean meal. On the other hand, the use of high amount of yeast to replace soybean meal would not be so desirable as far as fiber content is concerned. The present feed formulation yields most of fiber content from soybean meal which is rather low in yeast as well as in corn. Diet that contains too low fiber content will not be considered as birds will be hungry more often, consequently more feed will be consumed without correspondingly gain in weight.

The purpose of adding yeast in feed meal was to utilize the waste brewery yeast as another source of protein. As yeast contained high concentration of vitamin B complex (Table 6), hence the addition of those vitamins is minimized. The brewery yeast used in the present study contained high concentration of lysine but low concentration of sulfur-containing amino acids, i.e., methionine and cystine (Table 26). This is agreeable to other types of yeast (Prescott and Dunn, 1959). The concentration of various essential amino acids in brewery yeast obtained in this study is not quite similar to those reported by Wasserman (1962). The variations may mainly arise from the different growth condition (Wasserman, 1961).

Results of the first feeding trial showed that replacing fish meal at 12.5 and 25% with the brewery yeast was satisfactory. The number of alive broilers fed with feed meal containing brewery yeast at 12.5 and 25% compared well with that of the control group (Table 27). Though the number of dead broilers of 12.5% yeast group was higher than that of the control and 25% yeast groups, most of the death was high during the first feeding period. This was due to transportation of these one-day old birds to the research farm caused them in stress condition and exhausted. The number of dead broilers in the following weeks was low and similar to other groups. Feed consumption, broiler's body weight and growth rate of broilers in all groups were comparable to each other. The final body weight of broiler of control group was slightly higher than that of the two groups, as well as overall protein efficiency. This indicates that nutritive value of control ration was higher than of feed meal containing yeast replaced fish meal. This can be seen from amino acid composition (Table 26). The concentration of essential amino acids especially lysine isoleucine, leucine and value of control feed meal was higher than the meal containing yeast replaced fish meal.

In the second feeding trial with feed meal containing brewery yeast replaced soy bean meal, the protein content in feed meal containing 24% yeast replaced soy bean meal was a little higher than protein content in control ration feed meal.

Number of alive broilers in each group was not different. The feed consumption, broiler body weight, and growth rate of each group were comparable. The body weight of broiler fed with yeast-containing diet was higher than that of control group while the protein efficiency of the yeast-containing feed meal was lower than that of the control feed meal. Final body weight of broiler of control group was lower than that of feed meal containing yeast groups. The overall protein efficiency of control ration was a little higher than the overall protein efficiency of feed meal containing 24% yeast replace soybean meal. One of the reasons for the difference is that the lysine content of control diet is slightly higher than the other (Table 26).

When the two feeding trials were compared, there appeared no differences in number of alive broilers. Feed consumption of the first feeding trial was about 4.10 kg. per bird. This was higher than feed used by broilers of the second feeding trial (about 3.70 kg. per bird). The final body weight of broilers of the first feeding trial was also higher than the other (1.7 and 1.6 kg. per bird respectively). The overall protein efficiency of feed meal of the first trial had increased to about 2.3 at the final week. For the second feeding trial the overall protein efficiency had increased to 2.2 at the final week. The difference could have been caused by climate condition. This is why the date of each feeding trial was recorded in this study. It has been observed that broilers fed during cold season consumed more food and gained more weight than broilers fed during warm season (Boonmun, personal communication). The first feeding trial was carried out during Nov 6, 74 to Jan 1, 75 and the second feeding trial was performed during Jan 8, 75 to March 8, 75. During the first trial, the climate was more cooler than the second one. In addition, the broilers in each feeding trial were not come from the same lot, this caused differences in feeding results.

It appeared that the brewery yeast could replace fish meal or soy bean meal in such percentages. The final body weight and overall protein efficiency are compared well with those carry out at Charoen Pokphand Feed mill Co., Ltd. (Chiaravanon, personal communication). Generaly, the final body weight of broilers fed with commercial feed meal are 1.5-1.8 kg per bird; and the overall protein efficiency of that feed meal is around 2.0 - 2.4.

More accurate nutritional evaluation of any protein source should be obtained if protein efficiency ratio (PER), net protein utilization (NPU) and biological value (BV) are determined (Bender, 1958; Kakade, et. al,. 1972). In this study, feeding trial was carried out and nutritional evaluation of feed meal containing brewery yeast as an other protein source was determined by protein efficiency. The protein efficiency indicates how much feed consumed in order to obtain one kilogram of body weight. This parameter relate with feed consumption and broiler body weight. If the final body weight is high while protein efficiency is low compared with control ration, indicating that nutritional quality of that feed meal is higher than the control ration. This method of assessment is widely used in commercial study.

Apart from nutritional consideration, evaluation of the safety of new formulation should also be performed. During feeding experiments, the animals are observed for various characteristics during growth, i.e., physical appearances, behavior such as changes in posture or locomotion, and appearances of excreta. This external manifestation frequently provides important evidences of harmful effects (Oser, 1968; Abrahamssom, et. al 1971).

Yeast contained rather high nucleic acid as compared with others (Table 32). There is a limitation on the amount of nucleic acid which should be introduced in human diet (Protein Advisory Group, 1971). The limit of nucleic acid in take should less than 2 mg. per day for human (Bender 1958). This is because nucleic acid purines are excreted as uric acid. In susceptible individual, elevated serum levels of uric acid increases in the risk of gout, and the increased urinary concentration of uric acid may result in the formation of uric acid stones in kidney. But for broilers, the problem of nucleic acid content in diet has not been evaluated.

Estimation of the cost of feed meal containing brewery yeast and the control feed meal were shown in Table 33 and 34. Cost of the initial and final feeding periods were 385.32 and 365.02 baht per 100 kilogram for the control meal. When brewery yeast was used to replace fish meal at 12.5% the cost was reduced to 376.90 and 356.66 baht per 100 kilogram for the initial and the final feeding periods respectively. Similarly, when yeast was utilized to replace fish meal at 25% the cost was decreased to 368.64 and 348.34 baht for 100 kilogram. And when yeast was used to replace soy bean meal at 24%, the cost was decreased to 357.33 and 337.03 baht per 100 kilogram of initial and final feeding periods respectively. These estimated cost is based on the fact that yeast is a by-product of beer production. Hence, the cost ispractically zero. However, expense on the processing steps for brewery yeast to be used in feed meal is existed and should not be higher than the difference between the price of the control meal and the one containing yeast in the diet. If that so, the replacement of fish meal and soybean meal would have potential to develop in commercial scale. By using this basis, the overall expenses of the 12.5 and 25% yeast group for both initial and final feeding periods should not be more than 8.36

Table 32

Nucleic acid content of foods and microorganisms.

Materials	Protein	Nucleic Acid
	(% dry wt)	
Liver	65.6	2.6
Sardine	64.2	1.4
Fish roe	70.3	4.1
S aureus	75.5	11.6
B. anthracis	58.1	4.4
E. coli	78.5	12.8
Brewery yeast	54-56*	15-16*

* Taken from Table 23

Reference - Mateles, R.I and tannanbuam, S.R. 1968. Single Cell Protein, The M.I.T. Press, Massachusettes Institute of Technology, Cambridge, Massachusettes, and London, England.

Table 33

Cost of feed meal containing brewery yeast replaced fish meal at 12.5 and 25%. Values are expressed in baht per 100 kilogram feeds.

	Price	Initial Feeding Period			Final Feeding Period		
	(฿ / kg)	Control	12.5% Yeast	25%Yeast	Control	12.5% yeast	25%Yeast
Corn	2.67	165.54	165.54	165.54	186.90	186.90	186.90
Fish meal#2	5.56	66.72	58.06	50.04	55.60	47.26	38.92
Soy bean meal	5.09	117.07	117.07	117.07	86.53	86.53	86.53
Brewery yeast	-	-	-	-	-	-	-
Oyster shell	0.35	0.26	0.26	0.26	0.26	0.26	0.26
Calcium Di phosphate	3.50	2.63	2.63	2.63	2.63	2.63	2.63
Salt	0.40	0.20	0.20	0.20	0.20	0.20	0.20
Enrichment	32.90	32.90	32.90	32.90	32.90	32.90	32.90
		385.32	376.90	368.64	365.02	356.66	348.34

Table 34

Cost of feed meal containing brewery yeast replace soy bean meal at 24 %. Values are expressed in baht per 100 kilogram feeds

		Initial Feeding Period		Final Feeding Period	
	Price (฿/Kg.)	Control	24% Yeast	Control	24 % Yeast
Corn	2.67	165.54	165.54	186.90	186.90
Fish meal # 2	5.56	66.72	66.72	55.60	55.60
Soy bean meal	5.09	117.07	89.08	86.53	58.54
Brewery yeast	-	-	-	-	-
Oyster shell	3.35	0.26	0.26	0.26	0.26
Calcium diphasphate	3.50	2.63	2.63	2.63	2.63
Salt	0.40	0.20	0.20	0.20	0.20
Enrichment	32.90	32.90	32.90	32.90	32.90
		385.32	357.33	365.02	337.03

and 16.68 Bath per 100 Kg. feed. Similarly, the highest expenses of the 24% yeast group for both initial and feeding periods should not be higher than 27.99 Baht per 100 Kg. feed.