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Canola meal in poultry nutrition; solubility test to determine its protein quality

Muhammad Waseem Birmani[1], Aamir Nawab, Muhammad Waseem Ghani, Gaowen, Wenchao Liu, Mei Xiao[1], Lilong An*

*3 Corresponding Author: Lilong An Email; waseema@gmail.com

Department of Animal Science, Agricultural College, Guangdong Ocean University, Zhanjiang 524088, Guangdong, China

Address: Haida Road, Mazhang District, Zhanjiang 524088, Guangdong, China

Abstract: **The present study was conducted to examined the quality of commercially available canola meals (CM) using potassium hydroxide (KOH) solubility test. A total number of 30 samples from different traders were obtained over a period of one year and analyzed for chemical composition and KOH solubility. It was observed that mean CP content and KOH soluble protein was 35.39 and 74.41%, respectively. Moreover, 10% of the samples unsuccessful to fulfill acceptable KOH soluble protein range of 70-85% thus indicating excess or under heat treatment. This cautions for ensuring strict quality control of CM before incorporating into compound feeds for monogestric especially for poultry.**

Keywords: **Canola meal, potassium hydro-oxide, protein solubility, quality.**

1. INTRODUCTION

Canola meal (CM) is second largest protein meal traded in feed industry after soybean meal (USDA, 2010). In Pakistan soybean meal use in poultry diet is limited due to its high cost, dependency on import, import duties and rates, with no quality guarantee and anti-nutritional factors and presence of complex polysaccharides [1]. To cope with the formulation cost nutritionists have focused on the exploration and efficient use of alternative feedstuffs. CM is a by-product of canola oil extraction having high protein level. Although CM have less protein (35-40%) as compared to SBM but due to its low price than SBM, animal feed formulators using this. CM have high content of vitamins, minerals and well balanced amino acids profile [2]. It have higher level of methionine and cystine and also has highest protein efficiency ratio among all plant based protein [3].

However, due to the presence of glucosinolates incriminating factors, CM is commonly subjected to heat treatment and the extent of heating has a direct implication on its nutritive value. Heat treatments were reported to eliminate the incriminating factors of CM [4]. Khattab & Arntfield 2009 studied that applying the high temperature destroyed the glucosinolates and enhanced the canola meal quality. Whereas, suboptimal processing leaves antinutritional factors undestroyed, excess heat can negatively affect protein quality of meal [5].

The quality of the meal can be both enhanced and diminished by altering the processing conditions in the crushing plant. Minimum processing temperatures are needed in order to deactivate the myrosinase enzyme which, if not destroyed, will break down glucosinolates into their toxic metabolites in the animal's digestive tract [5], [6]. In some countries like Pakistan, there can be significant difference in temperatures used during canola processing. As well, some of the by-products of canola processing are sometimes add-on back into the canola meal. In the case of added gums and soap stocks, these oil rich constituents will increase the energy content of the CM. In the case of added screenings and external material, the meal quality may decline [7]. In these cases, it is important for canola meal users to regularly measure the protein quality of the meal or inspection and approve suppliers.

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Plant proteins are normally soluble in weak alkali solution. However, if these proteins are heat-treated, as normally occurs during processing of many ingredients, the solubility of protein will decline [8]. Of the several quality control tests performed by feed manufacturer (glucosinolates determination test), protein soluble in 0.2% (w/v) potassium hydroxide (KOH solubility test) have been documented as essential and reliable approaches for assessing protein quality in CM, as performed in SBM for poultry [9]. KOH solubility test is effective in distinguishing overheated CM from under heated as well as optimally processed ones, because KOH solubility of CM protein generally decreases as the degree of heat treatment increases. Though, it is a simple and quick test, the published reports on KOH solubility test are limited for determining quality of commercial CM available in Pakistan. So, the present study was conducted to determine CM samples protein solubility in KOH solution which is traded in Pakistan market as a quick quality control measure.

2. MATERIALS AND METHODS

The CM used in this study was provided by different traders of CM in all over Pakistan supplying meals to feed manufacturers. Around 800-1000 g of CM was sampled randomly from about 70 bags with a grain sampler (stainless steel probe) which were composited, placed into zip lock bag and transferred to laboratory. Over a period of one year (January to December, 2018) a total of 30 such composite samples were drawn from compound feed manufacturing units located at Multan and Rahim Yar Khan, Punjab, Pakistan. Because Multan is feed manufacturing hub in Punjab having about 25 feed mills in the territory of Multan. Proximate analysis as well as KOH solubility were determined according to the instruction given by AOAC (Association of Official Analytical Chemists) after thorough check of instrument and by placing unground samples of CM in the large sample beaker at 25°C [10]. The KOH solubility test is based on the principle of determining the CP percentage in 1.5 g of CM that is solubilized in 0.2% (w/v) 75 ml solution of KOH (having normality of solution 0.36 while pH was 12.5) when at room temperature stirred for 20 minutes at 8500 rpm [11]. Soluble proteins was in the liquid phase and so a portion of the centrifuged liquid was assayed for CP, and CP content relative to the original sample of 1.5 g was calculated accordingly. By knowing the CP content of the original sample of CM, percentage solubility was measured [8], [11].

The chemical composition and KOH solubility of CM have been given in table 1.

Table. 1. Chemical composition and KOH soluble protein (% CP) in CM samples

Parameters	Dry matter %	Ash %	Fat %	CP %	KOH %	Fiber %
Average	91.823	6.426667	2.394333	35.39533	74.41	10.16033
Standard Deviation	0.94485	0.578019	0.713542	1.55577	6.031766	0.829335
Standard Error	0.172505	0.105531	0.130274	0.284043	1.101245	0.151415
Min.	88.93	3.5	1.2	33.36	68.3	8.97
Max.	93.27	6.89	3.41	37.93	86.4	11.4

STATISTICAL ANALYSIS

Standard mean and error method was used as descriptive statistical tools of Microsoft Office Excel to compile results.

3. RESULTS AND DISCUSSION

It was confirmed that all the samples were of solvent extracted type and therefore presented relatively low ether extract values (1.2-3.41%). Likewise, CP contents were different in a narrow range of around (33.36-37.93%). Moreover, dry matter level averaged 91.82% while crude fiber level ranged from 8.97-11.4%. Nevertheless, the composition is broadly comparable with the previously published values for CM [12]. The KOH soluble protein ranged from 68.3 to 86.4% across the samples representing much changeability in the quality. The reports on KOH solubility of commercial CM in Pakistan market are scarce to compare our results. Out of 30 different samples analyzed, 25 samples could be graded to contain good quality protein since a KOH solubility range of 72-83% is generally regarded as ideal for normal CM reflecting good quality of protein. It is significant here that KOH solubility is best suited to judge over cooked or undercooked CM and therefore it is reasonable that the 5 samples with <70% and >85% KOH solubility might have undergone excessive and under heat treatment respectively that minimized or enhanced their solubility. In this direction, Newkirk 2009 revealed that cooking CM at 80 and 105°C for 15-20 minutes is optimum for obtaining good quality meal. While cooking at 120ºC can negatively affect meal protein quality and also decreased in KOH solubility below 70%. Which in turn could cause growth depression in chicks due to destruction of digestible lysine.

Furthermore, study told that KOH solubility test could serve as a simple in vitro test evaluating in vivo protein quality for monogestric [13]. On the disagreeing, it was stated that high KOH solubility showing under processing also has negative effect on chick weight gain [9]. On interpretation of variability in KOH solubility found in commercial samples of CM traded in Pakistan markets, it could be concluded that due caution may be exerted during commercial procurement of the same by feed manufacturing industry for preferred nutrient utilization.

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CONFLICT OF INTEREST

Author declare no conflict of interest

AUTHOR'S CONTRIBUTION:

The work is a product of the cerebral environment of our whole team; and all the fellows have added in various degrees in designing the study, developing the methodology, performing the analysis and writing the manuscript.

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