

Chemical and nutritional assessment of heifers omasum flour

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SUMMARY. The chemical and nutritional properties of flour from total calf omasum are assessed with the purpose of considering the utilization of a waste product from the meat industry as animal food. The results of the chemical percent analysis showed a high protein content of 78,6 g/100 g, a total lipid amount of 3,70 g/100 g and a cholesterol concentration of 0,14 g/100g. From the study of the total saturated fatty acid composition it is deduced that palmitic acid prevails with a value of 28,4 %. Unsaturated fatty acids show a value of 75 % for oleic acid, this being the highest concentration.

The values found for lipid composition are similar a fat bovine. Biological techniques were used to evaluate nitrogen utilization: Net Protein Utilization (NPU), true Digestibility (tD) and Biological Value (BV); a proof with casein as reference was simultaneously performed.

The NPU, tD and the BV values found were: 58±7,0; 87±8,5 and 67 respectively. These results demonstrate that the assayed meat by-product had the adequate nutritive elements for its industrialization as porcine balanced food.

RESUMEN. Evaluación química y nutricional de harina de librillo de vaquillona. Se sometió a estudio la harina de librillo de vaquillona (omasum) con el objeto de caracterizarlo químicamente y nutricionalmente a fin de considerar la utilización de un desecho de la industria cárnica. Los resultados del análisis químico porcentual mostraron un alto contenido en proteínas, 78,6 g/100 g, un tenor de lípidos totales de 3,7 g/100 g y una concentración de colesterol de 0,14 g/100 g.

Del análisis de la composición de ácidos grasos, se desprende que del total de ácidos grasos saturados, la mayor concentración corresponde al ácido palmítico con un valor de 28,4 %. Con respecto a los ácidos grasos no saturados el mayor porcentaje, 75 % corresponde al ácido oleico. Estos contenidos son similares a los promedios informados para grasa vacuna.

Para estimar el aprovechamiento nitrogenado, la siguiente metodología biológica fue llevada a cabo: utilización proteica neta (UPN), digestibilidad verdadera (Dv) y valor biológico (VB), simultáneamente se realizó una experiencia control con caseína. Los valores encontrados para UPN, Dv y VB fueron: 58±7,0; 87±8,5 y 67 respectivamente.

Mediante estos resultados se demuestra que el subproducto cárnico evaluado posee los elementos nutritivos adecuados para su industrialización bajo la forma de balanceado para porcinos.

INTRODUCTION

The nutritional value of meat by-product for animal feeding has been widely studied (1,2,3) since they usually contain the necessary nutrients to obtain high nutritional quality products, and on the other hand, they constitute an additional low-cost source of proteins for human and animal consumption. The aim of the present study was to assess the chemical and nutritional properties of the omasum, which is removed from the rest of the digestive tract during animal evisceration.

MATERIALS AND METHODS

The material used in this study was provided by a local slaughter house, Río Seco S.A. The stomach was prepared in the following way: After evisceration the rumen content was eliminated by means of a cold water stream, then a lavage treatment was performed in an «uncrusting» machine which operates by a centrifugal mechanism using hot water at 80 °C during 10 minutes in order to remove the clusters. Then, the material was placed on a table where the residual fat and cutings were removed. Thereafter, a bleaching step was

performed which consisted of a treatment with 2 % oxygenated water at 65 °C for 10 minutes for the removal of the undesirable colouring substances such as the pasture carotenoids.

Next, previous cutting, the stomach was dried on stainless steel trays in a forced-air oven for 48 h at 95 °C; finally a flour was obtained by grinding.

Chemical analysis

Humidity, ether extract, and ashes were determined according to the technique described by AOAC (4); proteins by the Kjeldhal method modified by Winkler (5); sodium, potassium, iron and calcium were measured by atomic absorption using a spectrophotometer (Instrumentaion Laboratory a/ae model 751), phosphorus was spectrophotometrically determined (6). Cholesterol and total lipids were determined according to Zak (7). The fatty acids were extracted from an omasum tissue homogenate with a methanol chloroform mixture (8). The fatty acid evaluation as methyl ethers was performed by gaseous chromatography.

- Chromatograph: Varian 3300
- Columns: 10 % SP-2330
- Outer diameter (OD): 1/8¹¹
- Injection temperature: 250 °C
- Detector: Flame ionization detector (FID): 250 °C
- Oven temperature: T= 185 °C
- Chromatograph range: 10⁻¹¹

1 Laboratorio de Ensayo y Valoración de Medicamentos

2 Laboratorio de Alimentos

In the derivative treatment, diazomethane in ethyl ether as methylating reagent was used (9). The following methodology was applied; the obtained dry extracts from samples were dissolved in 2 ml of ethylic ether and then the methylating agent was added dropwise until a permanent light yellow colour was obtained, letting at rest for 1h.

The solution was evaporated to dryness with a N₂ stream, the residue, depending on the case, then was dissolved in 1 or 2 ml of acetone and injected in the chromatograph. The corresponding controls were run and the fatty acids were identified, and their percent was calculated on the basis of the areas obtained by the chromatogram.

Biological Assays: In order to evaluate the protein biological quality, the NPU and tD nitrogen utilization was carried out according to Miller and Bender (10), and then the BV was obtained by the NPU/tD ratio. Four groups of Wistar 30 day-old rats were used, one group for the non-protein diet, two for the test material and the other control.

Each group consisted of 6 animals (weight differences of $\pm 0,5$ g), water and food was supplied «ad libitum» for 10 days. Food intake and weight gain was recorded. The diets were prepared as reported by Sambucetti et al (11).

In the experimental diet, the protein comes from the omasum flour. The theoretical composition of nutrients expressed in g/100 g of diet was the following:

Omasum flour (contribute 10g of protein)	12,72
Corn oil	12,79
Salts mixture	5,00
Hydrosoluble vitamins	0,25
Liposoluble vitamins	0,50
Choline (as citrate)	0,15
Dextrin	100,00

The salt mixture of hydrosoluble and liposoluble vitamins was prepared according to Harper (12). Concomitantly, an experiment was carried out with a protein contribution of 10% provided by casein. In the apoprotein diet dextrin substitutes for the protein. The experimental conditions have been previously detailed (13). A record of the food intake and weight gain was kept.

RESULTS AND DISCUSSION

It is observed (Table 1) that the mean protein value is lower than that reported for beef (82,71 %) by others (14).

TABLE 1
Omasum flour general chemical composition
(in 100g of sample)

Humidity g	3,10
Protein (Nx6.25) g	78,59
Ashes g	4,84
Ether extract (petroleum ether) g	9,81
Total lipids g	3,70
Cholesterol g	0,14
Calcium (as Ca) mg	98,50
Total phosphorus (as P) mg	176,00
Sodium mg	68,00
Potassium mg	187,00
Iron mg	1,90

The total lipid concentration (3,70%) is superior to the integral shark flour (2,4 %) (15) and superior to that of fish (1,30%) (16); the value for cholesterol (0,14 %) is higher than that reported for beef (0,07%) and similar to that reported for meat (0,15%) (17).

The calcium value was 98,50, and if they are compared to the blood flour value (280 mg %) our results are remarkably low (14).

The phosphorus, sodium and iron concentration values found were similar to those for beef. Observing the fatty acid composition determined as methyl esters by GLC (Table 2), it can be deduced that the percent of saturated fatty acids (C₁₄, C₁₆, C₁₈) constitute the 48,8 % of the total fatty acids examined, prevailing the palmitic acid. The unsaturated fatty acids represent 51% of total, oleic acid presenting the highest concentration (75 %). Comparing the fatty acid content of bovine fat (14) with the present results it can be inferred that no significative differences are observed among the saturated acids. For the unsaturated acids, high values were found for linoleic and arachidonic acid, reporting values of 2 and 0,1% respectively.

TABLE 2
Mean percentages of mayor fatty acids in heifers omasum flour

Fatty acid	Acid (common name)	Relative Percent ⁽¹⁾
14:0	myristic	2,6
16:0	palmitic	28,4
18:0	stearic	17,8
18:1	oleic	38,4
18:2	linoleic	6,5
20:4	arachidonic	6,1

(1) Percent of the total peak area of the fatty acid listed

The biological protein data are detailed in Table 3. From the analysis of these values it can be observed that NPU, tD and BV values were 13 %, 12% and 10% lower than those reported respectively, for beef (17). This analysis allows us to infer that the nitrogen utilization of the calf omasum flour is lower to that for beef. An intake of 95 g was recorded during the 10 days of treatment, which was superior to the casein diet (85 g).

TABLE 3
Biological quality evaluation

Determination	Experimental Diet Omasum Flour	Control Diet Casein
NPU	58 \pm 7,0 ⁽¹⁾	72 \pm 6,5 ⁽²⁾
tD	87 \pm 8,5	95 \pm 10,0
BV	67	76
I	95 \pm 12,3	85 \pm 11,3
Δ p	28 \pm 4,3	30 \pm 3,9

(1): Mean \pm standard deviation

NPU = Net Protein Utilization

tD = True Digestibility

BV = Biological Value

I = Intake, expressed in g during 10 days of treatment

Δ p = Corporal weigh gain expressed in g.

(2) $p < 0,001$ versus controls at Student's T test (n=6).

Considering the weight gain in this time period, an average value of 28 was obtained, which is similar to the control (30 g). The integral result of this study shows that the meat by-product assessed here increases the availability of protein sources, since it has the adequate nutrients for the obtention of products with excellent useful nutritional qualities, mainly for the elaboration of balanced foods for human and swine species consumption at a low production cost.

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Recibido: 01-09-1995

Aceptado: 07-05-1996