QUALITY CONTROL OF MEAT AND NON-MEAT COMPONENTS IN LOCAL HAMBURGERS

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SUMMARY

Twelve locally processed hamburgers were analysed for meat and non-meat components. Results indicated most hamburgers to contain between 23.5%-71.1% meat content, with soya proteins at 15.5-36.5% and cereal added at 0.9-27.4%. The protein content ranged from 10.8-15.9%, fat; 11.6-28.7%, moisture; 41.9-59.6%, ash; 1.82-2.56% and carbohydrate; 0.7-23.5% respectively. Phosphate ranged from 0.16-0.29% while added water ranged from 7.6-34.8%. In addition of beef, soya protein and cereal (starch) components, other substances such as egg, milk, salt, sugar, MSG, spices, onions and ox-fat are included in local hamburgers formulation.

INTRODUCTION

Demand for fast food and ready to eat food are on the rise in Malaysia. The growth of the processed meat industry is clearly evident in the hamburger and hotdog food items that are seen at the supermarket and fast food outlets. Hamburgers were first introduced in Malaysia in the early seventies by the A&W fastfood chain. To date, there are over twenty brandnames of hamburgers produced locally by the meat manufacturers. However, the quality of local hamburgers are quite different from that of foreign franchised hamburgers such as McDonald's and Wendy's. Many of the local manufacturers paid little attention to the nutritional as well as quality aspects of the products. Quality control in the processed meat industry is lacking. There are also problems encountered in the establishment of minimum standards and specifications for such new products. This paper elaborates the various components found in local hamburgers, their nutritional composition, and the formulations commonly used by the local manufacturers.

MATERIALS AND METHODS

Twelve local brandnames of hamburgers were purchased from various supermarkets in Kuala Lumpur. They were:

1. Fika (Fika Foods Company)
2. Angus (Cold Storage (M) Bhd.)
3. Prince (Yeo Hiap Seng (M) Bhd.)
4. Biffi (Yeo Hiap Seng (M) Bhd.)
5. Amirul (Yeo Hiap Seng (M) Bhd.)
6. Halfomar (Halfomar Sdn. Bhd.)
7. Salam (Fika Foods Company)
8. KB (Kok Weng Brothers)
9. Ramli (Ramli Burger Sdn. Bhd.)
10. Wisma Burger (Wisma Burger)
11. Utama (Syarikat Perniagaan Sri Utama)
12. Mesti Best (Demark Sdn. Bhd.)

The samples were purchased frozen, kept at -10°C in the laboratory freezer and were thawed at 5°C in the chill-room overnight, before further analyses.

Proximate Analyses

Proximate analyses were carried out using the AOAC methods (1980). The conversion factor for meat protein was 6.25 and non meat protein 5.71 respectively. Fat content is determined using the soxhlet extraction

Table I : Proximate analyses of locally processed hamburgers[a] (wet weight basis)

Brandnames	Protein (%)	Fat (%)	Moisture (%)	Ash (%)	Carbohydrate (%)
A	12.6 ± 0.4	22.0 ± 0.3	53.0 ± 0.9	1.98 ± 0.02	8.8 ± 3.0
B	10.8 ± 0.8	19.8 ± 0.4	53.6 ± 1.2	2.56 ± 0.02	13.3 ± 2.4
C	15.9 ± 1.4	21.4 ± 1.6	57.2 ± 0.1	1.82 ± 0.03	4.0 ± 1.4
D	14.2 ± 0.1	18.4 ± 0.8	57.6 ± 0.1	2.00 ± 0.15	7.9 ± 1.1
E	13.8 ± 0.3	15.4 ± 2.5	59.6 ± 0.1	2.15 ± 0.03	9.0 ± 2.7
F	15.1 ± 0.1	14.9 ± 3.8	63.5 ± 1.4	2.30 ± 0.02	4.6 ± 4.6
G	13.4 ± 1.2	23.3 ± 0.3	48.3 ± 1.5	2.37 ± 0.02	12.7 ± 2.2
H	12.1 ± 0.1	15.0 ± 1.0	64.7 ± 0.2	1.89 ± 0.03	6.3 ± 1.0
I	12.7 ± 0.3	19.6 ± 0.7	41.9 ± 0.4	2.37 ± 0.02	23.5 ± 0.1
J	14.3 ± 1.0	11.6 ± 2.4	56.6 ± 2.4	1.90 ± 0.09	15.6 ± 3.9
K	14.3 ± 0.1	28.7 ± 2.4	52.4 ± 1.6	2.30 ± 0.10	2.4 ± 4.0
L	14.4 ± 0.8	27.5 ± 11.2	53.5 ± 0.3	2.30 ± 0.02	0.7 ± 0.6

[a] Mean values derived from 3 samples per treatment.

Table 2 : Total pigments, soy protein, cereal and meat contents of hamburgers

Brandnames	1 Total pigments mg/g	2 Soyprotein % conc.	3 Cereal %	4 Meat content %
A	3.10	17.5 ± 0.9	2.8	71.1 ± 1.6
B	2.25	32.5 ± 2.4	1.7	55.4 ± 2.2
C	2.81	17.0 ± 0.5	2.0	65.9 ± 1.8
D	2.72	21.0 ± 2.0	1.3	61.5 ± 2.3
E	0.51	36.5 ± 0.5	2.8	23.5 ± 2.0
F	1.53	33.0 ± 1.8	5.1	35.7 ± 0.2
G	2.10	19.5 ± 2.2	1.8	56.5 ± 2.0
H	1.26	34.5 ± 1.6	1.1	35.0 ± 1.1
I	2.51	29.5 ± 2.4	3.1	59.4 ± 2.3
J	2.83	18.5 ± 0.8	27.4	56.4 ± 3.2
K	1.50	15.5 ± 1.7	0.9	52.5 ± 2.4
L	2.08	26.0 ± 1.5	4.2	60.5 ± 0.4

1-n = 3. based on wet weight (Rickansrud & Henrickson, 1967)

2-n = 3. based on Enzymatic technique (Morrissey et al., 1982)

3-n = 3. based on centrifugation method (AOAC, 1980)

4-n = 3. based on total pigments as an indicator of meat content.

Table 3 : Total nitrogen content, phosphorus pentoxide, added water and Feder number in locally processed hamburgers[1]

Brandnames	Total nitrogen (%)	P O (%)	Added water (%)	Feder No. (%)
A	2.08	0.26	15.7	2.31
B	1.84	0.29	34.8	2.24
C	2.56	0.19	7.6	2.93
D	2.34	0.18	16.5	2.62
E	2.34	0.21	23.9	2.63
F	2.54	0.21	23.0	3.01
G	2.21	0.16	11.7	1.86
H	2.06	0.20	25.0	3.53
I	2.14	0.19	15.7	1.15
J	2.39	0.16	18.8	1.94
K	2.35	0.20	8.8	3.29
L	2.41	-	17.8	3.73

[1] Mean, n = 3, based on wet weight

(AOAC, 1980). The moisture content is determined using the oven drying method (AOAC, 1980). Ash content is also determined using the AOAC method.

Determination of Feder Number

Calculation of Feder Number is derived from proximate analysis data on the hamburger.

$$\text{Feder Number} = \% \text{ moisture} / \% \text{ fat free organic material}$$

where 5 fat free organic material = 100 - (% fat + % moisture + % ash)

For meat products, Feder Number should generally be not more than 4.

Determination of Added Water in Meat Products

Calculation is based of AOAC (1984) for Added Water in Sausages

$$\% \text{ Added Water} = (W - 4P)(1\text{-}0.01W + 0.04P)$$

where W = % Moisture content; P = % protein content in meat = 6.25 x % N (Corrected for presence of the other proteins like cereals and soybean)

Determination of Phosphate

Phosphate content was determined using the method of AOAC (1980). The phosphorus obtained in expressed is the form of phosphorus pentoxide as follows:

$$F = \frac{\text{Molecular Wt. } P_2O_5}{\text{Number of P atom in molecule x P atomic wt.}}$$

$$= 1.109$$

$\therefore$ % phosphorous pentoxide, P_2O_5, = % total phosphorous x 1.109

Determination of total pigment in meat

The method of Rickansrud and Henrickson (1967) was used in the determination of total pigment. This method was also used to indicate the meat content present in local hamburgers. The calculation for total pigment is shown by the formula;

Conc. of total pigment (mg/g wet weight) =

$$\frac{\text{absorbance x K}}{\text{wet weight}}$$

where

$$K = \frac{17{,}000 \text{ x vol aliquot (L) x dilution factor}}{E}$$

Determination of cereal content using gravimetric centrifugation method

The cereal content in local hamburgers was determined using the gravimetric centrifugation method (AOAC, 1980). The percent of cereal was calculated by using formula:-

$$\text{Percent cereal} = \frac{(A - B)(1.45)(100)}{C/2}$$

Determination of soy protein content

Few methods are currently available to determine the soya protein content in meat products. These include the centrifugation method (AOAC, 1980), enzymatic method (Morrissey et al. 1982) and Magnesium content ratio method (Formo et al. 1974). The author decided to use the enzymatic method of Morrissey et al. (1982), which was found to be more reliable than the other two methods (Babji et al. 1985).

RESULTS AND DISCUSSION

The results of proximate analyses (protein, fat, moisture, ash and carbohydrate) are shown in Table I. The protein content of local hamburgers ranged from 10.8 to 15.9%. Common figures of protein content in ground beef containing less than 30% fat (maximum allowed under the present Food Law 1985) is between 18 to 22%. It is clearly evidenced that none of the local beef burgers contained 100% beef meat. Earlier studies by Babji et al. (1985) reported protein content ranging from 15.5%-18.0% in a similar type of product. Sharifuddin (1983) did some proximate analyses in local beef burgers and reported protein content ranging between 15.0 to 30%. The trend indicated that more non meat substitutes are replacing meat in local hamburgers. Present Food Law and Regulations (1985) stated that the meat content of such products such as hamburgers should contain not less than 65% meat. This aspect should be monitored by the authority. It is also surprising to observe this trend of less meat content in such product as hamburgers because of the high import of cheap Indian beef into Malaysia over the last few years. It is anticipated that with current low prices of Indian beef available, the local meat processors, would increase the meat content, at least to meet the minimum level stipulated by the Food Law (1985).

The fat contents ranged from 11.6% to 28.7%. The maximum level of fat allowed by the regulation is 30%, thus indicating the hamburgers fulfill the requirement for fat content, not exceeding the 30% limit. The researchers observed that during processing, ox-fat is added to the minced Indian beef. This is because Indian beef as purchased is lean and by itself will result in poor textured beef patty. It is also interesting to mention the use of

Table 4 : Local Brandnames of hamburgers, manufacturers and ingredient

Brandname	Manufacturers	Ingredient[1]
FIKA	Fika Foods Company	Beef, spice, veg. protein, sugar and salt
ANGUS	Cold Storage (M) Bhd.	Beef, soya, salt and spices
PRINCE	Yeo Hiap Seng (M) Bhd.	Beef, oxfat, bread crumbs, salt, and spices
HALFOMAR	Halformar Sdn. Bhd.	Meat, veg. protein, salt, starch, spices and flavourings
UTAMA	Syarikat Perniagaan Sri Utama	Beef, soyabean, egg, breed, salt and spices
KB	Kok Weng Brothers	Beef, egg, spices, ground nut, butter, starch, bread, salt
AMIRUL	Syarikat Amirul	Beef, fat, starch, bread, salt and spices
MESTI-BEST	Denmark Sdn. Bhd.	Beef, bread starch, salt and spices
WISMA BURGER	Wisma Burger	Meat, flavourings, soya bean, spices, protein, egg.
BIFFI	Yeo Hiap Seng (M) Bhd.	Beef, soya bean protein, onion, corn starch, sodum chloride, polyfosfat, MSG, sugar,
RAMLY	Perusahaan Burger Ramly Mokni Sdn. Bhd.	Beef, ox fat, soya bean protein, onion, salt and spices
SALAM	Fika Foods Company	Beef, ox fat, soya protein, spices, sugar and salt

[1] Ingredient as printed on the packaging material.

chicken fat as the fat source in the manufacture of hamburgers.

The percent carbohydrate in hamburgers range from 0.7% to 23.5%. The carbohydrate content is calculated by difference after analyses for the other food components. The wide range in values suggested the extensive and liberal use of carbohydrate fillers in meat products. Babji et al. (1985) in an earlier study reported lower amount of carbohydrate being used in such products.

Hamburgers contained moisture content ranging from 41.9% up to 64.7%. Moisture contents for many cuts of been normally ranged between 74-78%. The lower moisture content found in the local hamburgers can be due to fillers such as breadcrumbs, flours, ground nuts and other substances that are commonly formulated into such product.

Ash contents ranged from 1.82-2.56%. Spices and salts are commonly added into hamburgers formulation.

Table 2 showed the quantification of meat content (using total pigments as an indicator) the concentration of soy protein concentrate and the percentage of cereal component in local hamburgers. Total pigment was taken as the best indicator of meat content in comparison to other methods used in current analyses (Babji et al. 1987). Total pigment ranged from as low as 0.51 mg/g to as high as 3.10 mg/g of meat. Correspondingly, calculated meat content ranged from 23.5% to 71.1%, respectively. This showed the range in addition of actual meat in local hamburger formulations. Using the minimum requirement of meat content at 65% meat, all, except two brandnames of hamburgers contained less than 65% meat content.

Soy protein concentration ranged from 15.4% to 36.5%. Again the method used in quantifying soy protein was taken as the best method currently available for detecting the amount of Soy protein (Babji et al. 1987). It is interesting to observe that burgers with low meat content tend to have more soya protein and cereal added in the formulation.

Cereal content in hamburgers ranged from 0.9 to 5.1%, except for one brandname that contained as high as 27.4% cereal. From these results, it is obvious that locally processed hamburgers differ significantly in the contents of major components such as meat, soya protein and cereal added in the formulations.

In studying meat and non meat components in hamburgers, a few other parameters like total nitrogen, phosphorus content, added water content and Feder Number were estimated. Table 3 showed the respective parameters for the twelve hamburgers. The Food Act (1983) and the Food Law (1985) stated that processed meat should not contain less than 1.7% nitrogen in the organic form. Analysis of total nitrogen using the Kjeldahl Method (AOAC, 1980) showed values ranging from 1.84% to 2.56%. Thus from a regulation standpoint it would seem that all local hamburgers contained more than enough total nitrogen. But it must be pointed out that soy protein is also contributing significantly to the total nitrogen. This will raise some problems if one just used total nitrogen to satisfy the requirement for regulation of processed meat. It must be complemented with other requirements for processed meat, such as the meat content being not less than 65% as stated in the food law and regulations.

Malaysia allows the use of phosphates in its meat products not exceeding 0.3% of the total weight of the product. Analyses of phosphates calculated in the form of phosphorus pentoxide showed values ranging from 0.16% to 0.29%, which is within 0.3% maximum limit set by the regulation. The use of phosphates is prohibited in hamburgers and ground beef in most foreign countries. Phosphates are known to increase water binding capacity and increase the juiciness and textural properties of the meat products. Table 3 also showed % added water in

the local hamburgers. During processing and chopping of meat, ice water or crushed ice are added to reduce temperature build up and also be absorbed by the carbohydrate fillers. Added water ranged from 8.8% - 34.8%. It is interesting to note that as the content of soy protein increased (Table 2), the percent added water also increased. It is common knowledge that textured soy protein is an excellent material for water binding. This is another aspect that the regulatory agency should be aware of when making rules, regulations and specifications with regards to processed meat products containing non-meat proteins.

Feder number ranged from 1.15 to 3.73%. It is strongly correlated to the moisture content derived from proximate analyses. Feder number is used to give a picture of meat quality in relation to its moisture content. For meat products the value is usually less than 4.

The types of non-meat substances added in hamburgers are shown in Table 4. The brandnames shown are those commonly found in supermarkets, minimarkets and roadside stalls. The ingredients are as stated on the labels of the packaging materials from each manufacturer. Salt, sugar and spices are present in most local formulation. In addition, non-meat proteins such as soy protein, egg and wheat protein are also included beside carbohydrate fillers such as breadcrumbs, starch and wheat flour.

Ingredients information provides the consumer an opportunity to know what is formulated in hamburgers. Unfortunately many producers took advantage of the vagueness of present food regulations to use as little meat component in this so called meat product as possible. It was observed that out of twelve brandnames, (Table 2) only two producers used more than 65% meat in their formulation. The regulating agency is confronted with lack of technical expertise to handle laboratory procedures for monitoring such parameters. Problems of quantifying soy protein, meat content, lean to fat ratio, use of other non-meat proteins, and lately, the use of mechanically deboned meat and organ meats are new problems facing regulating agencies in Malaysia.

CONCLUSIONS

Most hamburgers produced locally contained less than 65% meat, which violated the present food regulation. Many products showed wide variation in their proximate composition, indicating lack of uniformity and poor standard and specification for such processed products. The content of cereal based materials ranged from 1.1-27.4%, soy protein between 15.5-36.5% and meat content 23.5-71.1%. Malaysian processed hamburgers are therefore quite different in nutritional quality, proximate composition and food components ingredient compared to hamburgers from overseas such as McDonald's, Burger King or Wendy's.

REFERENCES

AOAC (1980) Official Methods of Analysis. 13 th Ed. Assn. of Official Analytical Chemists. Washington, D.C.

Babji, A.S., Adanan, A., and Aminah, A. (1984). *Pertanika* **7(3)**:1.

Babji, A.S. (1985). Nutritional Evaluation and the use of food additives in local meat products in ASEAN cities. ISEAS, Singapore Field Report.

Babji, A.S., Hock, O.P and Aminah, A. (1987). Determination of meat content in processed meats using currently available method. (In preparation).

Babji, A.S., Hock, O.P., Aminah, A. (1987). Comparison of methodologies used in determining soya protein in meat products. (In preparation).

Formo, M.W., Hanold, G.R. and Maclean D.B. (1974). *J. Ass. Off. Analyt. Chem* **57**(4):841.

Morrisey, P.A., Olbrantz, K. and Greaser, M.L. (1982). *Meat Science* **6**:109.

Pearson, D. (1975). *Analyst* **100**(1187):73.

Rickansrud, D.A. and Henrickson, R.L. (1967). *J. Food Sci.* **32**:57.

Sharifuddin, O. (1983). Proximate Composition of local meat products. B.Sc thesis in Fd Sc & Tech. UPM. Serdang Malaysia.