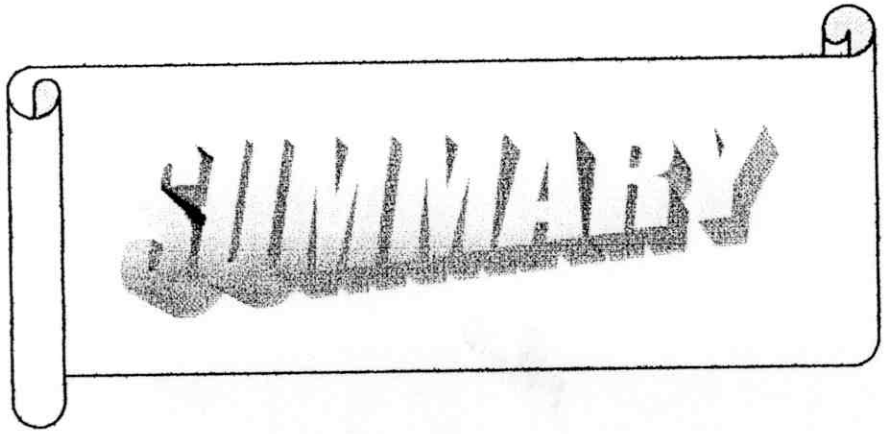
SUMMARY

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The foodservice industry continues to evaluate new ingredients and technologies for producing low-fat ground meat and beefburger. The primary ingredient currently being used in these products is carrageenan, but not everyone is satisfied with its performance, availability, or price. Protein, starch, fiber and gum suppliers are formulating low-fat meat products for the retail and fast-food markets. To be successful, low fat ground beef patties must be organoleptically, nutritionally, and functionally acceptable to consumers. Ready ingredient availability, processing flexibility, and pricing are also important considerations. This work describes a fermented cake soybean ingredient which was developed to be used in the formulation of low-fat ground beef patties. This ingredient is known as tempeh.

1. Minced meat:

low fat minced meat was prepared at laboratory by mixing it with 0, 5, 10, 15, 20 and 25% tempeh. Two local market minced meat samples were included for comparison purpose. Chemical composition was carried out for all laboratory and local market samples.

1.1.Chemical composition:

- The highest moisture content of tempeh was 72.68%. However, laboratory prepared minced meat samples had

moisture content ranged from 72.14-72.40%. But, samples A and B from local market had lower moisture content were 63.96 and 64.83%, respectively.

- The protein content in tempeh was lower than that of raw minced meat (control). Protein content in the laboratory prepared samples was decreased with increasing tempeh level from 5-25%. While protein content in raw minced meat (control) was 72.64% reached in laboratory sample that contain 25% tempeh to 65.89% on dry weight basis. But, protein content in local minced meat samples was lower than all other laboratory prepared samples.
- Ether extract content in tempeh was lower 6.08% on dry weight basis. The ether extract content in fresh minced meat (control) was lower also (20.66% on dry weight basis) compared with local minced meat samples A and B (39.01 & 35.14%, on dry weight basis). Ether extract content in laboratory prepared samples was reduced with increasing tempeh level addition, it reached to 16.98% on dry weight basis.
- Ash and total carbohydrate content was highest (4.25 and 37.55%, on dry weight basis, respectively). On the other hand, ash content in raw minced meat (control) was 3.55%, while in local minced meat samples A and B was 3.19 and 3.47%, on dry basis, respectively. Ash content in laboratory samples was increased with increasing tempeh level.

- Energy content in tempeh was low (420.90 K cal/g). While, energy content in fresh raw minced meat (control) was 489.76 K cal./g. Energy content in laboratory prepared samples was decreased with increasing tempeh level.

1.2. Freshness tests:

- Total volatile nitrogen content (TVN) in local minced meat was higher than other all samples prepared in laboratory, whereas it were 14.67 and 15.44 mg/100g (on wet basis) in samples A and B, respectively. Total volatile nitrogen content in tempeh was 12.32 mg/100 g sample, while in raw fresh minced meat (control) was 11.76 mg/100 g. Total volatile nitrogen in laboratory samples was increased with increasing tempeh levels addition from 5 to 25%, it reached to 11.90 mg/100 g on wet basis.
- Trimethylamine (TMA) content in local minced samples A and B was high with comparing with laboratory prepared samples, they were 2.40 and 2.88 mg/100 g in local samples A and B, respectively. Trimethylamine in tempeh was 1.17 mg/100 g, while in raw fresh minced meat (control) was 0.82 mg/100 g. Trimethylamine content in laboratory samples was increased with increasing tempeh level addition from 5 to 25%, it reached to 0.92 mg/100 g.
- Thiobarbituric acid content (TBA) in local minced samples was higher than all laboratory prepared samples,

whereas it was 0.85 and 0.66 mg malonaldhyde/kg sample in local samples A and B, respectively. Thiobarbituric acid content in tempeh was 0.43 mg/kg, while in raw fresh minced meat (control) was 0.23 mg/kg. Thiobarbituric acid content in all laboratory prepared samples was increased with increasing tempeh levels addition from 5 to 25%, it reached to 0.28 mg/kg.

- The same Table showed that pH values in tempeh was 6.25, while in raw fresh minced meat was 5.90. Also, pH values in all laboratory prepared samples were increased with increasing tempeh level addition from 5 to 25%. pH values in local minced samples A and B were 5.95 and 5.88, respectively.

1.3. Microbiological analysis:

- Total bacterial count, moulds and yeasts in tempeh, minced meat prepared in laboratory with addition of tempeh levels and local minced meat, A and B samples were carried out. Tempeh had low total bacterial count $2.4x10^2$ cfu/g, while in raw fresh minced meat (control) was $1.4x10^5$ cfu/g. The total bacterial count for minced meat prepared in laboratory with addition of tempeh levels ranged from $2.8x10^6$ to $5.7x10^6$ cfu/g, but in local minced meat samples A and B were $2.5x10^6$ and $3.6x10^6$ cfu/g, respectively. Moulds and yeasts were nil in all samples.

1.4. Sensory evaluation:

- Sensory evaluation indicated that sample prepared by addition 25% tempeh was the best from all samples. Also, overall acceptability were increased with increasing level addition of tempeh.

2. Beefburger:

2.1. Chemical composition:

- The addition of spices blends, garlic, onion and sodium chloride to fresh raw minced meat lead to reduce moisture, protein, ether extract and energy content, while ash and total carbohydrate were increased in prepared beefburger (control) sample.
- The highest moisture content of tempeh was (72.68%). Moisture content in raw minced meat and beefburger was ranged from 69.98-70.75%, while in local beefburger samples A and B was 61.33 and 59.62%, respectively.
- Protein content in raw minced meat was 68.75% on dry weight basis. On the other hand, the protein content in laboratory samples prepared was decreased with increasing tempeh level addition. Besides, the local beefburger samples had lower protein content than laboratory prepared samples. Protein content in local beefburger samples A and B was 35.01 and 35.79%, on dry weight basis, respectively.
- Ether extract content in laboratory prepared beefburger had lower than control. But local beefburger samples A

and B had higher content of ether extract (45.00 and 41.21%, on dry weight basis, respectively). Also, showed that the ether extract content had higher than protein content.

- Ash and total carbohydrate content were increased with increasing tempeh level addition in beefburger samples prepared in laboratory, but was lower than from local beefburger samples.
- Energy content in local beefburger samples had higher than laboratory prepared samples because local samples was high in ether extract content.

2.2. Freshness tests:

- Total volatile nitrogen content (TVN) in local beefburger was higher than other all samples prepared in laboratory, whereas it were 14.67 and 14.22 mg/100g (on wet basis) in samples A and B, respectively. Total volatile nitrogen content in tempeh was 12.32 mg/100 g sample, while in raw fresh minced meat was 12.12 mg/100 g, but in control beefburger (0%) was 12.38 mg/100 g. Total volatile nitrogen in laboratory samples was increased with increasing tempeh levels addition from 5 to 25%.
- Trimethylamine (TMA) content in local beefburger samples A and B were high with comparing for laboratory prepared samples, it was 2.95 and 3.25 mg/100 g in local samples A and B, respectively. Trimethylamine in tempeh was 1.17 mg/100 g, while in raw fresh minced meat was

0.96 mg/100 g, but in control beefburger was 0.98 mg/100 g. Trimethylamine content in laboratory samples was increased with increasing tempeh level addition from 5 to 25%.

- Thiobarbituric acid content (TBA) in local beefburger samples was higher than all laboratory prepared samples, whereas it was 0.98 and 0.96 mg malonaldhyde/kg sample in local samples A and B, respectively. Thiobarbituric acid content in tempeh was 0.43 mg/kg, while in raw fresh minced meat was 0.26 mg/kg, but in control beefburger was 0.30 mg/kg. Thiobarbituric acid content in all laboratory preparing samples were increased with increasing tempeh levels addition from 5 to 25%.
- pH values in tempeh was 6.25, while in raw fresh minced meat was 5.92, but in control beefburger was 6.28. Also, pH values in all laboratory prepared samples were increased with increasing tempeh level addition from 5 to 25%. pH values in local beefburger samples A and B were 6.00 and 6.20, respectively.

2.3. Microbiological analysis:

- Total bacterial count, moulds and yeasts in tempeh, raw fresh minced meat, beefburger prepared in laboratory and local beefburger A and B samples were carried out. Tempeh had low total bacterial count $2.4x10^2$ cfu/g, while in raw fresh minced meat and control beefburger (0%) were $1.8x10^5$ and $2.6x10^5$ cfu/g, respectively. The total