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Input Energy Requirements for Processing Convenient Chicken Products

A.K SACHDEVL, RAM GOPAL & RAJVIR SINGH
Central Avian Research Institute,
Izatnagar-243 122 India

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ABSTRAK

Bagi menaksir pengeluaran ekonomi stok ayam yang dimasak dan stok hempedal burung yang dimasak, data ke atas hasil produk, keperluan tenaga input output dan perbezaan kualitatif produk-produk tersebut yang diproses secara manual pada skala eksperimen telah dikumpulkan. Sejumlah lapan ujian termasuk empat replikasi telah dilakukan untuk setiap produk. Penyediaan stok ayam yang dimasak menjadikan 46.24% dan 69.01% untuk daging ayam mentah dan dibuang kulit masing-masing. Sebaliknya pemprosesan stok hempedal burung yang dimasak menghasilkan 36.79% dan 60.05% produk untuk hempedal burung yang mentah dan dibuang lemak. Kajian perintis ke atas keperluan tenaga input mendedahkan keperluan untuk 0.765 MJ tenaga manusia (hE) dan 2.617 MJ input elektrik diperlukan untuk memproses satu kg hempedal burung yang mentah; manakala 1.138 MT adalah tenaga manusia dan 3.148 MJ input elektrik diperlukan untuk memproses satu kg hempedal burung yang mentah Sampel analisis fizik-kimia menunjukkan nilai tekanan ricih yang lebih baik untuk stok hempedal burung yang dimasak tetapi keseluruhannya penerimaan produk tidak secara signifikannya (P<0.05) berbeza. Walau bagaimanapun, lebih output kalori dikira daripada stok hempedal burung yang dimasak (333 Cal/100 g) daripada stok ayam yang dimasak (315 Cal/100 g). Berdasarkan kadar pasaran bahan digunakan yang sedia ada dan keperluan tenaga input, pemprosesan stok hempedal burung yang dimasak didapati berkos efektif (22 Cal/rupee) dibandingkan dengan stok ayam yang dimasak (17 Cal/rupee).

ABSTRACT

In order to assess the economic production of cooked chicken stock and cooked gizzard stock, data were collected on product yield, input output energy requirements and qualitative differences in these products processed manually at experimental scale. A total of eight trials, including four replicates, were done for each product. Preparation of cooked chicken stock rendered 46.24% and 69.01% yield for raw and de-skinned chicken meat respectively, whereas the processing of cooked gizzard stock yielded 36.79% and 60.05% product for raw and de-fatted gizzard respectively. Pilot studies on input energy requirements revealed the need for 0.765 MJ human energy (hE) and 2.617 MJ electrical inputs for processing a kilogram (kg) of dressed chicken; while 1.138 MJ human energy and 3.148 MJ electrical inputs were required to process a kg of raw gizzards. Physico-chemical analysis of samples showed greater shear press value for cooked gizzard stock but overall acceptability of products was insignificantly (P<0.05) different. However, more caloric outputs were calculated from cooked gizzard stock (333 Cal/100 g) than from cooked chicken stock (315 Cal/100 g). Based on the existing market rates of the ingredients used and input energy requirements, the processing of cooked gizzard stock was found to be cost effective (22 Cal/rupee) as compared to cooked chicken stock (17 Cal/rupee).

INTRODUCTION

To a great extent, the growth of fast food industry depends upon the cost of processing which is based on the cost of inputs, including the energy used. In this context many workers (Ostrander 1980; Singh and Dhingra 1987; Sachdevl *et al.* 1995) have published their findings on the application of energy in food processing. In order to facilitate the optimal use of energy through its proper audit during product development/commercial processing, the present study was aimed at standardization of input energy requirements as well as estimation of product yield for cooked gizzard stock and cooked chicken stock where such information collected for the first time may be expected to pave the way for future developments in a food processing economy.

MATERIALS AND METHODS

A total of eight replicates including 4 trials for each product were undertaken for which 50 kg of dressed chicken and 45 kg of gizzard were collected from pilot poultry processing plants in the Division of Post Harvest Technology of Central Avian Research Institute, Izatnagar. Cooked chicken stock and cooked gizzard stock were prepared after de-skinning of dressed chicken/removal of adipose tissue from gizzard and utilizing recipe/formulation methodology of Sachdevl *et al.* (1996). The percent product yield was defined as –

Product yield (%) = (weight of product x 100)/ weight of dressed chicken or gizzard

Estimation of Input Energy

Quantification of human energy (hE) and electrical inputs (EI) utilized in preparation of cooked chicken stock as well as cooked gizzard stock was done through recording of time consumed at particular steps of processing such as cleaning and cutting of meat/gizzard, weighing, frying of condiments and pressure cooking, etc. Observations on electrical inputs were based on preparation of products with the help of a 1500 watt hot plate. Pressure-cooking was performed at 1.1 kg/sq. cm for 10 ± 2 min. Calculation of hE and EI was done as stated below:

Man hours/kg = Average time taken in the processing Average quantity of organ used x 60

1 man hour/kg = 1.96 MJ (Panesa and Bhatnagar 1987)

E1 (kWh) = Watt x Time (min/(1000 x 60)

EI/kg chicken for gizzard = EI (kWh/Average quantity (kg) of chicken or gizzard processed

1 kWh/kg = 11.93 MJ (Panesar and Bhatnagar 1987)

Physico-chemical and Sensory Traits

Proximate characters including pH, percent – moisture, crude protein (CP) and ether extract (EE) were analyzed as per standard methods of AOAC (1990). Shear force value was determined in kg/sq. cm by using Warner Bratzler Shear Press (Model 13806). A minimum of three samples was taken for recording the observations of each trait. Sensory characteristics including colour, flavor, juiciness, tenderness, texture and overall acceptability of cooked chicken stock and cooked gizzard stock were estimated on a 10 point Hedonic Scale (1= extremely poor, 10=excellent) by a minimum of 7 panelists randomly taken from the professional staff of this institute.

Output Energy

The nutritional energy (Cal/100 g) of these products was determined using the formula of Shackleford *et al.* (1989).

Statistical techniques (Snedecor and Cochran 1967) aiming at determination of means, standard error and Duncan's multiple range test have been applied to check and confirm the validity of the findings and the obtained database has been presented in the tabular form.

RESULTS AND DISCUSSION

Yield and Product Quality

Means of percent product yield (Table 1) showed higher recoveries from dressed chicken as compared to that from gizzards. In fact, this effect is caused by the amount of inedible proportion of tissues present over the gizzard, which is generally formed by the superficial fat and other inedible materials. In spite of lower gains from raw gizzards, the economic aspects of processing were eminent due to its cheaper cost as being the less preferred organ in India. Percent product yield determines the commercial viability of the food products developed, hence these observations formed the basis for further efforts to improve upon the product yield.

Physico-chemical and sensory traits, generally, did not reveal significant differences ($P<0.05$) in the quality of experimental products (Table 1).

TABLE 1
Mean observations of product yield, physico-chemical and sensory characteristics

Parameters	Cooked stock	
	Chicken	Gizzard
Weight(kg) of raw organ/dressed meat percent	50.00	45.00
Product yield		
c) on raw organ weight	46.24±1.23[a]	36.79±0.98[b]
d) on cleaned organ weight	69.01±2.01[a]	60.05±1.67[b]
pH	5.86±0.87[a]	5.45±0.18[a]
Shear force value (1b/s. inch)	0.23±0.05[a]	0.30±0.04[b]
Moisture (%)	52.19±1.78[a]	54.51±3.07[a]
Crude protein(%)	31.83±1.96[a]	30.21±2.27[a]
Ether extract (%)	9.21±0.34[a]	11.84±0.93[b]
Colour	8.31±0.77[a]	7.93±0.48[a]
Flavor	7.57±0.29[a]	7.66±0.19[a]
Juiciness	7.56±0.45[a]	7.46±0.33[a]
Tenderness	7.52±0.31[a]	7.05±0.18[a]
Texture	7.96±0.66[a]	7.58±0.27[a]
Overall acceptability	8.20±0.73[a]	7.66±0.59[b]

N=8
Figures bearing identical superscripts did not differ significantly (P<0.05) between columns

TABLE 2
Energy consumption profile for processing cooked chicken stock

A. Human

Parameter	Time Taken Minutes	(%)	Man Hours/ kg dressed Chicken	Energy(MJ)/ kg dressed chicken
1. De-skinning	130	32.50	0.127	0.248
2. Washing	15	3.75	0.015	0.029
3. Peeling garlic and ginger	35	8.75	0.034	0.066
4. Weighing condiments	30	7.50	0.029	0.057
5. Frying condiments	20	5.00	0.020	0.039
6. Grinding garlic and ginger	15	3.75	0.015	0.029
7. Pressure cooking of meat	45	11.25	0.044	0.086
8. Enrobing	10	2.50	0.009	0.019
9. Oven treatment	55	13.75	0.054	0.106
10. Packing	45	11.25	0.044	0.086
Total	400	100.00	0.291	0.765

B. Electrical inputs

Parameters	kWh	%kWh	kWh/kg	MJ/kg
Frying condiments	0.417	9.74	0.002	0.024
Grinding garlic, etc.	0.113	2.68	0.006	0.007
Pressure cooking	0.938	22.24	0.055	0.656
Oven treatment	2.750	65.19	0.162	1.932
Total	4.217	99.85	0.225	2.619

MJ=Mega joule

Input Energy

Table 2 revealed utilization of most of hE for de-skinning and oven treatment. Similarly, higher amounts of electrical inputs were also used for oven treatment and pressure-cooking. Since no other report is available on this product regarding such parameters, the finding could not be compared and are deemed to be the pioneer work in this direction. However, such findings are an indication of basic norms to be foxed for cost effective production of convenient poultry products.

Observations on input energy requirements for cooked gizzard stock (Table 3) indicated the maximum use of hE in cleaning and cutting of gizzards followed by packaging. Greater utilization of electrical inputs was recorded for oven treatment and frying of condiments.

This information on quantification of input energy requirements for preparing cooked chicken stock and cooked gizzard stock paved way for optimization of such important components determining the cost of production. While studying input energy needs for processing gizzard pickle, similar trends on higher requirements of hE for cleaning and cutting of gizzards followed by pressure cooking have earlier been reported (Sachdevl *et al.* 1995).

Output Energy

Calculation revealed comparatively higher caloric yields from cooked gizzard stock (333 cal/100 g) than from cooked chicken stock (315 cal/100 g) obviously due to slightly higher fat content in this product.

Cost of Production

Based on the existing market rates of inputs including cost of energy, the cost of producing cooked chicken stock at laboratory scale was determined to be higher (Rs. 184/kg) as compared to that of cooked gizzard stock (Rs. 150/kg). Caloric yields per Indian rupee were found beneficial in the case of gizzard stock (22 cal/rupee) over cooked chicken stock (17 cal/rupee). These products have the convenience of reconstitution through boiling in ordinary drinking water for about 1 to 2 min to get instant curried chicken or curried gizzard which adds to their cost effectiveness.

CONCLUSION

Observations were recorded on input requirements for processing cooked chicken stock and cooked gizzard stock. Due to lesser requirements of hE for de-skinning of meat as compared to cleaning and cutting of gizzards, the processing of cooked chicken stock utilized lesser amounts of human energy. Similarly, the lesser time needed for frying of the necessary quantity of condiments rendered lower

TABLE 3
Energy consumption profile for processing cooked gizzard stock

A. Human

Parameter	Time Taken Min	(%)	Man Hours/ kg gizzard	Energy(MJ)/ kg gizzard
1. Cleaning and cutting of gizzard	220	41.90	0.244	0.478
2. Weighing of gizzards	10	1.90	0.011	0.021
3. Peeling & slicing of ginger and garlic	50	9.52	0.055	0.108
4. Weighing condiments	30	5.72	0.033	0.065
5. Frying condiments	45	8.58	0.050	0.098
6. Grinding ginger and garlic	10	1.90	0.011	0.022
7. Pressure cooking of gizzard	40	7.62	0.044	0.086
8. Enrobing	10	1.90	0.011	0.022
9. Oven treatment	50	9.53	0.055	0.108
10. Packaging	60	11.43	0.066	0.129
Total	525	100.00	0.580	1.138

B. Electrical inputs

Parameters	kWh	%kWh	kWh/kg	MJ/kg
Frying condiments	0.938	21.58	0.063	0.752
Grinding garlic etc.	0.075	1.73	0.001	0.006
Pressure cooking	0.833	19.16	0.056	0.668
Oven treatment	2.500	57.53	0.167	1.992
Total	4.436	100.00	0.287	3.418

MJ=Mega joule

requirements for electrical inputs for processing cooked chicken stock. However, the lower initial cost of gizzard and insignificant differences between quality of these products determined the better cost effectiveness of producing cooked gizzard stock.

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