

# Comparative study of the efficiency of induction and gas cook-tops

■ M. KAUR AND J.K. GILL

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■ **ABSTRACT :** The comparison of efficiency of induction cook-top with gas cook-top was done by the selection of 120 respondents randomly from urban area under municipal corporation limits of Ludhiana city. An interview schedule was prepared to collect data from the respondents. The laboratory experiments were conducted to evaluate selected appliances on the basis of efficiency, time and money cost of induction cook-top and gas cook-top. On the basis of the results of household survey, two commonly prepared recipes were cooked on both the appliances. The organoleptic evaluation of the recipes namely: *zeera* rice and potato vegetable was done by a panel of judges. Induction cook-top was 60.18 per cent efficient than gas cook-top (19.07 %) due to hardly any loss of heat. Induction cook-top took more time to cook both the recipes as compared to gas cook-top, while cooking cost was less in induction cook-top in terms of money cost. Organoleptic scores of cooked recipes were statistically non-significant indicating that there were no differences in both the appliances in terms of cooked food. Therefore, it is suggested that the induction cook-top need to be popularized as it is cost effective and efficient than gas cook-top.

■ **KEY WORDS:** Efficiency, Gas cook-top, Induction cook-top

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See end of the paper for authors' affiliations

J.K. GILL

Department of Family Resource  
Management, College of Home  
Science, Punjab Agricultural  
University, LUDHIANA (PUNJAB)  
INDIA

Email : jkg1992@pau.edu

Induction cooking system is a modern electric cook-top which works on the principal of electromagnetic induction to heat vessels. It has a number of benefits over convectional cook-tops (Renseas, 2011). An induction cooking system combines the simplicity and rapid heating quality of electric stoves with responsive temperature control (Irnich and Bernstein, 2005). Induction cooking system has qualities of flexibility, easy cleaning, good efficiency and thermal safety. Fuels play an important role in the cooking process in the kitchen. Availability of all types of cooking fuel is becoming

scarce day by day, In addition to a sky high increase in their prices. These factors have prompted the homemakers as well as the home scientists to make a proper and effective utilization of fuels and to avoid all possible energy losses during cooking. Cookware must be compatible with induction heating; glass and ceramics are unusable, as are solid copper or solid aluminum cookware for most models of cooker. One of the important activities of an Indian housewife is to manage the kitchen in an effective manner with the minimum expense of money (Hydro, 2011). In the modern society,

the role of a woman extends much beyond the home and upbringing of children. She has to perform two challenging roles; one of the housewife and other of a wage earner. Both these roles make demands on her time and energy and she is left with very little time to spare for other things. In terms of time and energy consumption, the efficiency of these cooking units varies from one another. From time immemorial a constant trial has been going on to make a time and energy efficient cooking unit. A modern homemaker prefers to make use of strategies that may enable her in performing the dual duties of home-making as well as outside career (Gopalakrishnan and Parameshwari, 2014). The present study has been undertaken with the objective to compare the efficiency of induction cook-top with gas cook-top.

## ■ RESEARCH METHODS

The experiments were conducted in the equipment laboratory of the department of Family Resource Management to determine the efficiency of induction cook-top and selected cook-top in terms of cost and time taken for preparing standardized recipes. To assess the quality of cooked food, organoleptic evaluation of items cooked on selected cook-tops was done. The gas cook-top was selected on the basis of results of household survey and was compared with induction cook-top for evaluating the quality and to study the time and money cost of selected food items. To compare the efficiencies of induction and LPG cook-top, the experiment was performed by taking 1.5 liters of water which was kept on both of the cook-tops. Initial and final temperature readings were noted down using thermometer. Three repetitions were done on both the appliances. Following formula was used to calculate the efficiency:

$$= \frac{\text{Useful energy gain}}{\text{Actual energy input}} \times 100$$

$$= \frac{m(T_f - T_i)C_p}{E_u \times CF_e} \times 100 \quad (\text{Induction})$$

$$= \frac{m(T_f - T_i)C_p}{LPG_u \times SH_{LPG}} \times 100 \quad (\text{LPG})$$

where,

m = Mass of water

T<sub>f</sub> = Final temperature

T<sub>i</sub> = Initial temperature

C<sub>p</sub> = Specific heat capacity at constant pressure

E<sub>u</sub> = Amount of electricity used

LPG<sub>u</sub> = LPG used

CF<sub>e</sub> = Conversion Factor of electricity

SH<sub>LPG</sub> = Specific Heat of LPG

### Assumptions related to formulae :

- It was assumed that the heat gained by the food product was equivalent to heat gained by the equal amount of water.
- The present formulae were used for calculating the heat gained by the food product for the simplicity.
- The process of cooking food used in both the cases was identical as same food product was cooked in same cooking conditions.

### Selection of recipes :

On the basis of results of household survey, two recipes were selected which were commonly cooked by the families and these were: *zeera* rice and potato vegetable.

### Standardization of cooking process :

The procedure for both the selected recipes was standardized before conducting the actual cooking trials. The same procedure was followed on both the appliances (Induction cook-top and gas cook-top) for cooking each recipe.

### Selection of panel of judges :

The evaluation of cooked products was done to see the extent of their acceptability. A panel of five judges for evaluating the cooked food items was randomly selected. This panel consisted of the teachers of the Department of Family Resource Management. Every recipe was served thrice for evaluation to avoid bias and errors. The average of three readings was calculated to see the final acceptability.

### Organoleptic evaluation of cooked food items :

A score card was prepared for organoleptic evaluation of cooked food. Each recipe was cooked thrice on each appliance. Scores were given by the selected panel of judges for each cooked recipe on its quality parameters given in the score card. The judges were served two samples cooked on each appliance. The samples were given the code numbers so that judges did not know the cooking unit of a particular sample. The judges were requested to taste the samples and score

the preparations for five parameters namely appearance, texture, taste, doneness and overall acceptability using a score card specially designed for the purpose.

#### Measurement of time :

Time duration from turning on till turning off the appliance was recorded with the help of stop watch.

The electricity and LPG consumption were calculated as under:

Initial and final readings of LPG cylinder and electric metre was taken to measure the fuel consumption by considering the time, at which the pan was kept and the appliance was turned on till the time food was completely cooked.

The fuel consumption (LPG) was calculated as under:

**Fuel consumption = Initial weight of cylinder - Final weight of cylinder**

The electricity consumption was calculated as under:

**Electricity consumption = Final reading of meter – Initial reading of meter (electricity unit)**

The operational cooking cost was calculated as under:

**Cooking cost in Monetary= Consumption of fuel x Prevailing terms (Rupees) rate of fuel per unit**

For analysing the data, t-test was used to check the efficiency of both the cooking units (induction cook-top and gas cook-top).

### ■ RESEARCH FINDINGS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

#### Water boiling test :

The experiment was performed by taking 1.5 liters

of water which was kept on both of the cook-tops. Initial and final temperature readings were noted down using thermometer. Three repetitions were done on both the appliances. Time taken by LPG cook-top was 10 minutes whereas induction cook-top was 11 minutes. It was found that energy efficiency of induction was 60.18 per cent due to hardly any loss of heat energy and LPG was 19.07 per cent by using the efficiency formula. Thus, induction cook-top was found to be more efficient than gas cook-top. The findings of the study were in conformity with those of (The Middleby Corporation, 2010).

#### Organoleptic evaluation of food cooked on selected appliances :

A household survey was conducted firstly to know the commonly used cook-tops in urban household and secondly to study the awareness and extent of use of induction cooking system. On the basis of the results of household survey, two commonly prepared recipes were cooked on both the appliances. The organoleptic evaluation of the recipes namely: *zeera* rice and potato vegetable was done by a panel of judges.

#### Organoleptic scores of rice cooked on selected appliances :

Table 1 deals with the organoleptic scores of rice cooked on selected appliances that were gas cook-top and induction cook top. The data reveal the average score for appearance of cooked rice was 3.40 for rice cooked on gas cook-top. Slightly high score of (3.53) appearance of rice cooked on induction cook top suggests that the appearance was a little more appealing to the eye. The average score for texture was 3.13 for gas cook-top and 3.27 for rice cooked on induction cook-top. As far as taste was concerned, rice cooked on gas cook-top obtained scores (3.20), whereas rice cooked on induction cook-top obtained scores (3.27), doneness scores for gas cook-top were (3.20) and for induction cook-top these

**Table 1: Organoleptic scores of rice cooked on selected appliances**

Parameters	Gas (Sample A)	Induction (Sample B)	t-value*
Appearance	3.40	3.53	0.65
Texture	3.13	3.27	0.65
Taste	3.20	3.27	0.32
Doneness	3.20	3.33	0.38
Overall acceptability	3.40	3.54	0.80

\*Degree of freedom = 4

were (3.33). Overall acceptability of rice cooked on gas cook-top was (3.40) as compared to rice cooked on induction cook-top it was slightly higher at (3.54). The calculated values were less than critical value (2.776) of the t-Distribution at 5 per cent level of significance. Therefore, the differences in mean scores for all the selected parameters were found to be statistically non-significant indicating that there were no differences in both the appliances in terms of sensory evaluation of cooked rice.

#### Organoleptic scores of potato vegetable cooked on selected appliances :

Table 2 deals with organoleptic scores of potato vegetable cooked on selected appliances the data incorporated show the average score for appearance of potato vegetable cooked on gas cook-top was 3.80 and then score was same for potato vegetable cooked on induction cook-top. The average score for texture of potato vegetable cooked on gas cook-top was 3.60 and slightly high (3.80) for potato vegetable cooked on induction cook-top. Further, the average score for taste was 3.80 for potato vegetable cooked on gas cook-top and 4.40 for potato vegetable cooked on induction cook-top. As far as doneness was concerned, the average score for potato vegetable cooked on gas cook-top was 4.00 and the score was same for potato vegetable cooked on induction cook-top. The data further deal with the overall acceptability for both the appliances. The average score of overall acceptability for potato vegetable cooked on gas cook-top was 3.80 and the same for potato vegetable cooked on induction cook-top. The calculated values were less than critical value (2.776) of the t-Distribution

at 5 per cent level of significance. Therefore, the differences in mean scores for all the selected parameters were found to be statistically non-significant indicating that there were no differences in both the appliances in terms of sensory evaluation (Kuse *et al.*, 2000).

#### Time and money cost of cooked recipes :

To compare the time and money cost of two selected appliances *viz.*, gas cook-top and induction cook-top, *zeera* rice and potato vegetable were prepared on both the appliances using standardized recipes.

Data incorporated in Table 3 compares the time and cost spent on cooking *zeera* rice and potato vegetable on induction and gas cook-top.

The price of LPG was Rs. 30.63 per kg and of electricity was Rs. 6.98 per unit. The average amount of LPG consumed was 128 gm and the average units of electricity consumed was 0.4 K/J. Mean time spent on cooking *zeera* rice on gas cook top was 20 min with average cost of Rs. 3.92. However time spent by induction cooking was 25 minutes with average cost of Rs. 2.80. Data further indicate that time and cost spent on cooking potato vegetable on gas cook-top was 25 minutes with average cost of Rs. 4.90 while through induction cooking it was 30 minutes and Rs. 3.50. It has a number of benefits over convectional cook-tops. An induction cooking system combines the simplicity and rapid heating quality of electric stoves with responsive temperature control. Induction cooking system has qualities of flexibility, easy cleaning, good efficiency and thermal safety. Therefore, it is suggested that the induction cook-top need to be popularized as it is cost effective and efficient than gas cook-top (The Induction

**Table 2: Organoleptic scores of potato vegetable on selected appliances**

Parameters	Gas (Sample A)	Induction (Sample B)	t-value*
Appearance	3.80	3.80	0.00
Texture	3.60	3.80	0.93
Taste	3.80	4.40	1.21
Doneness	4.00	4.00	0.00
Overall acceptability	3.80	3.80	0.00

\*Degree of freedom = 4

**Table 3 : Time and money cost of cooked recipes**

Name of appliance	Time (in minutes)		Cost (in rupee)	
	<i>Zeera</i> rice	Potato Vegetable	<i>Zeera</i> rice	Potato vegetable
Gas cook-top	20	25	3.92	4.90
Induction cook-top	25	30	2.80	3.50

Site, 2010).

### Conclusion:

Induction cook-top was 60.18 per cent efficient than gas cook-top (19.07 %) due to hardly any loss of heat. Induction cook-top took more time to cook both the recipes as compared to gas cook-top, while cooking cost was less in induction cook-top in terms of money cost. Organoleptic scores of cooked recipes were statistically non-significant indicating that there were no differences in both the appliances in terms of cooked food.

Authors' affiliations:

**M. KAUR**, Department of Family Resource Management, College of Home Science, Punjab Agricultural University, LUDHIANA (PUNJAB) INDIA  
Email : manu90pau@gmail.com

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