



## Analysis of different inputs share and determination of energy Indices in broilers production in Mashhad city

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Received: 13-07-2014

Accepted: 28-10-2015

### Introduction

The high energy consumption is one of the serious problems in poultry industry. The poultry industry consume about five percent of total energy sources in different countries, with consideration of losses, it increases up to 16-20%. In the year 2003 also, the Iranian chicken meat consumption per capita was 13.3 kg, while in the year 2013 it increased to 25.9 kg (FAO, 2014). It shows that in the diet of Iranian people, the chicken meat has become a strategic food. Poultry industry is one of the biggest and most developed industries in Iran. In the past two decays, mainly due to population growth and increase demand of white meats, it is necessary to change and improve energy efficiency in this industry.

Technical efficiency of broiler farms in the central region of Saudi Arabia was analyzed through stochastic frontier approach (Alrwis and Francis, 2003). They reported that many farms under study work lower than their total capacity. In the research, the output was chicken meat weight in the term of the kilogram per one period and the inputs were the number of chicks, feed, the total of all variable expenses and fixed input except chicks and feed and the total cost of fixed inputs including building, equipment and machinery used for the broiler houses. They found that the small and large size broiler farms in the Central Region of Saudi Arabia were produced chicken with mean technical efficiency 83 and 88%, respectively (Alrwis and Francis, 2003). Efficiency measurement of broiler production units in Hamadan province was investigated by Fotros and Solgi (2003). They reported that the minimum, maximum and mean technical efficiency under variable return to scale were 12.7, 100 and 64.4%, respectively. Their results showed that technical efficiency at 16.5 (14 units) and 42.35% (24 units) of farms were more than 90 and 70%, respectively (Fotros and Salgi, 2003).

Khorasan Razavi province after Esfahan and Mazandaran provinces is the third largest producer of broilers in Iran. This research was performed because it is necessary to have energy consumption status; also there is a few data about broiler's energy consumption in Mashhad. In this research, the data of Mashhad's broilers was analyzed by Data Envelopment Analysis Method. The other objectives of this study were to separate efficient and inefficient units to use energy resource efficiently and determine total energy saving.

### Materials and Methods

This study was performed in 2013 in Mashhad, Iran. The data were collected through interviews and questionnaires from 36 poultry farmers for a growing period of April to May. Input energies were the feed, fuel (gas and gas oil), electricity, labor, equipment and chicken, and the output energies were the chicken meat and the manure. The energy consumption for each element was calculated by multiplied amount of inputs/outputs to energy equivalents.

### Results and Discussion

The total of input and output energies were obtained 125.2, 24.9 GJ/1000Birds, respectively. Energy indices such as energy ratio, energy efficiency and specific energy were determined to be 0.2, 0.019 kg/MJ and 52.55 MJ/kg, respectively. The highest share of energy consumption were 50.84 and 42.43%, for fuel (natural gas and diesel fuel) and feed respectively, the lowest share among the input energies were 0.39 and 0.06%, for chicken and labor respectively. Comparison of energy in three levels of farm sizes ( 15000, 15000-30000 and 30000 chicks) showed the energy ratio for large farms were higher than the other levels.

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Data Envelopment Analysis (DEA) was used to evaluate the poultry efficiency. The results showed that 13 poultry units had average technical efficiency (0.93) in the definition of Constant Returns to Scale (CRS), and 21 poultry units had pure technical efficiency (0.99) in the definition of Variable Returns to Scale (VRS).

## Conclusions

The Fuel (natural gas and diesel fuel) consumption energy had the highest shares of energy consumption; it is because of the low efficient heating equipment in poultry houses and low fuel prices in Iran. Energy efficiency of broiler farms in Mashhad was obtained 0.2 that show low energy efficiency. Improvements in energy efficiency could be achieved by increasing yield or reducing inputs energies.

**Keywords:** Data envelopment analysis (DEA), Energy efficiency, Fuel consumption, Technical efficiency