

## Water–Environment–Economic nexus analysis of household food waste impacts: A case study of Korean households

Bashir Adelodun\*, Gun Ho Cho\*\*, Sang Hyun Kim\*\*\*, Golden Odey\*\*\*\*, Kyung Sook Choi\*\*\*\*\*

.....

### Abstract

Food waste has increasingly become a global issue of concern among the researchers and policymakers due to its significant environmental and economic impacts, and other associated unsustainable use of resources, including water resources. While food wastage occurs at each stage of the supply chain with food loss at the upstream and food waste at the downstream, the impacts of food waste occurring at the consumption side are enormous due to the accumulated added values.

In this study, the embedded water resources, greenhouse gas emissions, and economic loss of household food waste were investigated. The primary granular data of household food waste was collected through direct sampling from 218 selected households of the Buk-gu community in Daegu, South Korea from July 2019 to May 2020. The water footprint, which was based on the water footprint concept, i.e., indirect water use, and GHG emission potential factor for each of the food items were adopted from the literature, while the retail prices and disposal cost were used to assess the economic cost of wasted food items. The water footprint, GHG emission associated with environmental impacts, and the economic cost of 42 major identified wasted food items were conducted.

The findings showed that an average of  $0.73 \pm 0.06$  kg/household/day edible food waste was generated among the sampled households, with leafy vegetable, watermelon, and rice responsible for 10, 9, and 4%, respectively, of the total weight of the 42 food wasted items. The water footprint and environmental impact of the household food waste resulted in  $0.46 \pm 0.04$  m<sup>3</sup> and  $0.71 \pm 0.05$  kg CO<sub>2</sub>eq, respectively. Beef, pork, poultry, and rice accounted for 52, 9, 5, and 4% of the total water footprint, while beef, pork, rice, tofu/cheese had 52, 8, 6, and 6% of the total emissions, respectively, embedded in the food wasted. Furthermore, the average estimated economic cost associated with wasted food items was  $3855.93 \pm 527.27$  Korean won, with beef, fish, and leafy vegetable responsible for 21, 13, and 10%, respectively, of the total economic cost. A combined assessment using water–environmental–economic nexus indicated that animal-based food had the highest footprint impacts, with beef, pork, and poultry

---

\* Member · Graduate student, Dept. of Agricultural Civil Engineering, Kyungpook national University, Daegu · E-mail : [adbash2008@gmail.com](mailto:adbash2008@gmail.com)

\*\* Member · Graduate student, Dept. of Agricultural Civil Engineering, Kyungpook National University, Daegu

\*\*\* Member · Graduate student, Dept. of Agricultural Civil Engineering, Kyungpook National University, Daegu

\*\*\*\* Member · Graduate student, Dept. of Agricultural Civil Engineering, Kyungpook National University, Daegu

\*\*\*\*\* Professor, Member · Graduate student, Dept. of Agricultural Civil Engineering, Kyungpook National University, Daegu  
[ks.choi@knu.ac.kr](mailto:ks.choi@knu.ac.kr)

indicating high indices of 0.3, 0.08, and 0.06 respectively, on a scale of 0 to 1, compared to corn and lettuce with lowest impacts of 0.02. Other food items had moderate impact values ranging from 0.03 to 0.05. This study, therefore, provides insight into the enormity of environmental and economic implications of household food waste among Korean households.

**Keywords :** Food waste, Household, Environmental impacts, Economic analysis, South Korea