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## Innovative Solutions to Increase Dietary Diversity of Rural Households

Fotima Jozilovna Saydullaeva<sup>\*</sup>

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### ABSTRACT

Today, it is becoming important to achieve food security in all countries. This article aims to find sustainable and innovative ways to improve household dietary diversity score (HDDS). Analyzes were carried out based on 320 small farms in the Samarkand region using cross-sectional data in 2021. T-test method were applied to find differences in dietary diversity and product diversification of households that prepared food with digital and other innovative patterns and those that did not use them. Culinary special television programs, radio broadcasts are assisted the households' dietary diversity index increased by 2.7 points compared to those who did not follow the program, and the production diversification index showed an increase of 0.18 points in crop diversification and 0.20 points in livestock diversification with high statistical significance. When comparing production and consumption diversification between those who used and those who did not use digital technologies, the diversification index of the crop was 0.12 and livestock diversification was 0.24 points higher. In addition, we observed that HDDS was 2.2 times higher. In particular, those who constantly used Internet resources to learn culinary practices had a crop and livestock diversification 0.03 and 0.16 points higher, HDDS two times greater than those who did not use Internet resources. Therefore, only a small number of 11 respondents mentioned that they participated in culinary courses. Our study also found that the level of farm production diversification was higher with respondents who attended cooking courses than those who did not. It was scientifically proven that HDDS was twice as high as those who did not use online menu programs, and crop and livestock diversification index was 0.15 and 0.19 points higher, respectively. Findings indicated that, proposed innovative objective solutions displayed positive results in increasing the dietary diversity of rural households.

### INTRODUCTION

Today, it is becoming important to achieve food security in all countries. The Food and Agriculture Organization of the United Nations (FAO) defines food security as "All people at all times have access to safe and nutritious food in sufficient quantities to support an active and healthy life based on their nutritional needs and personal preferences" (FAO, 2002). Later, four important pillars of food security, availability, accessibility of food, its use, and sustainability were adopted (FAO, 2009).

According to these four pillars, various strategies are implemented, taking into account the natural-climatic, social-economic, and political situation of different countries. Uzbekistan is located in the middle of Central Asia with a total population of 36 million (Stat. Uz, 2022). The country has high production potential in agriculture. Therefore, one of the main directions of agricultural development strategy is to ensure food security for the population. Agricultural producers in the country include private farmers, small farms (dehkan and tomorka), and as well as new agro clusters that started activities in 2018 (World Bank & The Eurasian Centre for Food Security, 2018). About 70 percent of agri-food products are grown by small farms. In rural areas, almost all households have their own plots of land. Using these land resources effectively to grow more food products will create opportunities to meet future food demand. In the world experience, it has been noted that the

cultivation of agri-food products on small plots leads households to healthy eating and consumption of fresh food products (IFPRI, 2020).

### LITERATURE REVIEW

Diversification of small farm production is considered a key improving households' food security. In the case of many developing countries diversification of agricultural production effected positively on improving dietary diversity (Takeshima *et al.*, 2019; Murendo *et al.*, 2018; Ecker, 2018).

In the case of Uzbekistan few studies on have been conducted related to the diversification of private farm production and its impact on their income (Bobojonov *et al.*, 2013) (Abdulla, 2021). Also, the production efficiency of dehkan and tomorka farms, the effect of state incentives on their efficiency, and cooperative relations in the food chain (Muratov, 2022; Pardaev, 2022) were explored by uzbek scientists. However, although the positive effect of diversifying the production of products by tomorka farms in rural areas has been studied on increasing the variety of food of households (Saydullaeva *et al.*, 2022), and research aimed at improving the quality of food consumption by their family members has not been conducted. In this article, the possibilities of diversifying the production of agricultural food products tomorka farms in rural areas and increasing the diversification of household dietary diversity are studied.

<sup>1</sup> Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, National Research University, Uzbekistan

<sup>\*</sup> Corresponding author's email: [fsaydullayeva@yahoo.com](mailto:fsaydullayeva@yahoo.com)

## MATERIALS AND METHODS

In this paper, we employed a cross-sectional study conducted from January to March 2021 with nine districts (Akdarya, Bulungur, Ishtixan, Jomboy, Kushrabad, Payarik, Pasdargom, Taylak, Urgut) of Samarkand region of Uzbekistan.

Total of 320 rural households was randomly selected and face-to-face interviewed to collect data on agricultural production diversification, dietary diversity and food preparation patterns. T-test method were applied in order to find differences in dietary diversity and product diversification of households that prepared food with digital and other innovative patterns and those that did not use them (Bevans, 2022). Statistical analyzes were performed using the STATA-15 software package. One of the attractive household dietary diversity score (HDDS) is used to indicate household food access. Swindale and Bilinsky proposed using 24-hour recall data on food intakes categorized into 12 different food groups (Swindale & Bilinsky, 2006). The HDDS is a count variable that includes 12 food groups from 0 to 12. The food groups took in cereals, roots and tubers, vegetables, greens, fruits, nuts and pulses, meat, eggs, milk and dairy products, sugar, beverages, oil, and fat. Methodological usage and calculation of the DDS were developed by the international organization Food and Agriculture (FAO) in 2010 on the framework Food and Nutrition Technical Assistance (FANTA) project (Swindale & Bilinsky, 2006). According to the guidelines, there are several crucial points and requirements in order to get correct data during a survey. Thus, we constructed and conducted this research under the following requirements.

1. We took into consideration to measure of DDS at the household level, information given from a respondent covers a period previous 24 hours. As a result of the conducted research, the most optimal period of 24 hours was highlighted, due to the reduction of incorrect answers by the respondents and the ease of recall (Kennedy *et al.*, 2007).

2. It is important to focus on consumption patterns when creating HDDS. We took into account the usual daily food consumption in household, unusual days, such as holidays, weddings, and Ramadan, did not coincide with periods that affect food patterns.

3. In addition, it is essential to categorize food intakes. Swindale and Bilinsky proposed using data on food intakes categorized into 12 different food groups (Swindale & Bilinsky, 2006). The DDS is a count variable that include 12 food groups from 0 to 12. Paper food groups are categorized into cereals, roots and tubers, vegetables, greens, fruits, nuts and pulses, meat, eggs, milk and dairy products, sugar, beverages, oil and fat.

4. When calculating the index of dietary diversity in rural areas, it is appropriate to take a survey in each season, paying attention to seasonality. Thus, we conducted the survey during the lean season cause of there is a difficulties winter time to ensure food security.

5. We did not considered amount of food consumed.

This is because the score is designed to reflect the economic access of food, and therefore even a small amount of a food item reflects the ability to purchase that item.

6. At the household level, the interviewer was chosen the person responsible for preparing food for the household on the previous day. The respondent was asked about all the meals eaten at home by each member of the household during the day and night.

Agricultural production diversification. There are many statistical tools of measuring diversification. In this paper, Herfindahl-Hirschman index was used to measure the extent of agricultural diversification (Mulwa & Visser, 2020). The index was calculated using the equation:

$$HHI = \sum_{i=1}^N (P_i)^2 \quad (1)$$

$P_i$  is the share of  $i$ -crop in total cropped area. For the livestock diversification index, the different types of livestock kept and the number of each is used to construct a common measure of livestock ownership, total livestock number, which is then used to calculate the diversification index. This index is bound between zero and one value. Higher is the value of the index, the smaller is the degree of diversification. The index provides only the magnitude of diversification, and not its nature or direction.

Mass media, digital technologies, social infrastructure, culinary courses, and dietary plan was considered innovative ways of improving agricultural and dietary diversity of rural households. All these variables were captured dummy variables whether household applied=1, did not applied=0.

## RESULTS AND DISCUSSIONS

Mass media. Culinary special television programs, radio broadcasts, websites and resources, and newspapers and magazines are recognized as tools that communicate and publish successful practices and results that promote family culinary experiences, productive use of the home, and healthy consumption. At the same time, these tools encourage housewives to try again at home.

According to the results of the survey, due to housewives following these programs, their dietary diversity index increased by 2.7 points compared to those who did not follow the program, and the production diversification index showed an increase of 0.18 points in crop diversification and 0.20 points in livestock diversification with high statistical accuracy.

Today, the use of digital technologies to manage the technical side of the system in almost all aspects is becoming more effective and safer. Digital technology includes digital devices, systems and resources that are driven by digital data and help make human life easier. These technologies are widely used in households to manage communication, perform household chores and services, manage a number of other processes in the household, and improve the experience of housewives. At the same time, digital technologies also enable the collection, storage, tracking and analysis of productive

experiences for housewives in the economy. The role of digital technologies in food consumption diversification is significant, and in many studies conducted in this regard, the use of smartphones has

had a significant positive effect on the dietary diversity of the rural population. It has been shown that the dietary diversity index of rural residents who use smartphones, tablets

**Table 1:** Results of the impact of innovative approaches to increase the diversification of product production in homesteads.

Indicators		Mass media		Digital Technologies		Social Infrastructures		Culinary Courses		Dietary plan	
		1	0	1	0	1	0	1	0	1	0
Number of Responds		66	254	7	313	64	256	11	309	6	314
Herfindahl Hirschman index(HHI)	Crop	0,21*	0,39	0,30*	0,48	0,28*	0,31	0,24*	0,31	0,28*	0,43
	Livestock	0,66***	0,86	0,55*	0,81	0,65***	0,81	0,72*	0,79	0,62**	0,81
Household dietary diversity score(HDDS)		5,6***	2,9	6,6**	3,0	5,7***	2,8	5,0**	3,4	7,0**	3,4

Source: Authors' calculations based on the results of the 2021 nutrition survey in Samarkand region.

T-test was used to find difference between groups. \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

computers and smart TVs for housewives to access the Internet is several times higher than those who do not use digital technologies(Jin & Li, 2022),Singh *et al.*, 2022) (D, n.d.)(D, n.d.)

According to the study area - in the Samarkand region, it was found that almost all housewives are using modern smartphones today. So, it was found that they have the opportunity to access the Internet, use online cooking and planting courses get extracts from Internet information. However, when asked if they used online programs to increase food diversity, only 7 of them did.

On the contrary, when comparing production and consumption diversification between those who used and those who did not use digital technologies, the diversification index of crop was 0.12 and livestock diversification was 0.24 points higher. In addition, we observed that HDDS was 2.2 times higher.

Social infrastructures. The use of digital technologies is being implemented directly by connecting to the Internet. At the same time, practical experiences are applied, repeated and positive results are achieved from the experiences learned from online resources. The results of the analysis carried out in our study showed that the effectiveness of Internet is high. In particular, those who constantly used Internet resources to learn culinary practices had a crop and livestock diversification 0.03 and 0.16 points higher, HDDS two times greater than those who did not use Internet resources.

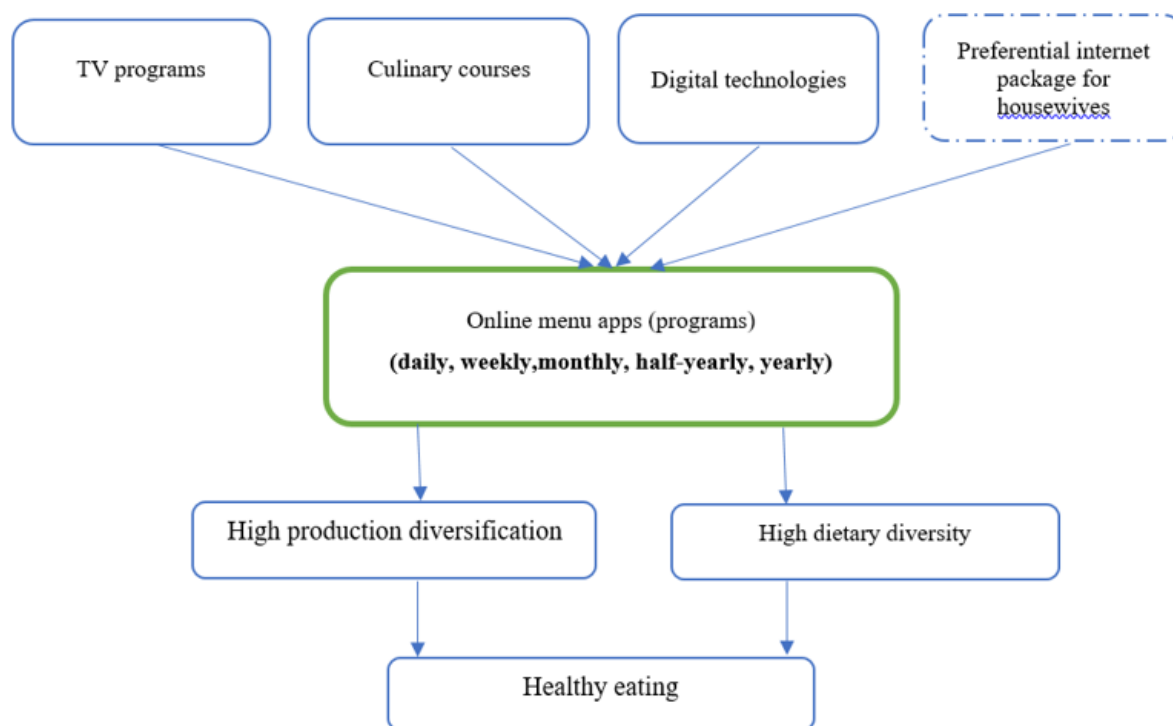
Cooking courses. These courses involve more time-duration training sessions that teach housewives how to prepare a variety of dishes. In the classes, modern methods of food preparation, various recipes are introduced and direct practical skills are formed. Such courses teach not only methods of food preparation, but also the selection of food products and the effective use of various products, taking into account their richness in macro-micro nutrients. But culinary training courses are usually paid for, as well as require transportation and

other expenses. Therefore, only a small number of 11 respondents mentioned that they participated in such training courses. In our study, it was also found that the level of farm production diversification was higher with respondents who attended cooking courses than those who did not.

Popularize the digital menu of food consumption in the family. Adequate and healthy nutrition is important at every stage of human life. These include eating a variety of fruits, vegetables, grains and legumes, protein foods, and dairy products. When making decisions about what to eat or what to drink for your family's daily intake, it's important to choose nutrient-dense options. Making such a decision, despite being simple, is also one of the most difficult tasks. However, the decision causes the health and physical development of family members.

In our study, as an innovative solution to the problem, the introduction and popularization of digital technologies in the preparation of the family's consumption menu (daily, weekly, monthly and annual menu) and its implementation mechanism were proposed. It is convenient for housewives to make a menu (recipe) of food prepared using digital programs, calculate the unit of energy (kJ) in them, and divide them according to meal times. At the same time, it has a direct effect on increasing the diversification index of food consumption, and indirectly on increasing the diversification of farm production. The structure of the daily, weekly, monthly and annual meal plan encourages the diversification of consumption and household production, a direct questionnaire was taken from the housewives. According to the results, it was scientifically proven that the HDDS indicator was twice as high as those who did not use it, and crop and livestock diversification index was 0.15 and 0.19 points higher, respectively.

Figure 1 shows how to include various forms of (offline and online) cooking courses in syllabus plans and use such platforms in mass media to educate and adapt housewives



**Figure 1:** An innovative optimal solution chain to small farm (tomorka) production diversification and dietary diversification

to use digital menu programs as external drivers for increasing farm production and food consumption diversification. the feasibility of offering additional infrastructure options (special internet packages for women) is mentioned.

## CONCLUSION

This study investigated role of behavior change communication intervention on HDDS and agricultural production diversification in Samarkand region. Therefore, proposed innovative objective solutions displayed positive results to increase dietary diversity of the rural households. Additional TV and radio broadcasts for housewives, preferential internet packages for women, introduction of online menu programs to the syllabuses of cooking courses (offline and online) and dissemination online menu programs for Uzbek people serve to increase both agricultural production and dietary diversification.

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