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COMPARATIVE ANALYSIS OF THE RABBIT MEAT PRODUCTION IN BALKAN COUNTRIES, MEMBERS OF THE EUROPEAN UNION

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Abstract

Data about rabbit meat production are provided from the web site of Food and Agriculture Organization of the United Nations. The mentioned information for the studied three Balkan countries (Bulgaria, Romania and Greece) has been extracted and organized in a created relational database. Different parameter queries have been used for visualization of certain subsets from the indicated database. Subsequently, they have been processed and evaluated. The article presents comparative analysis of the rabbit meat production in these Balkan countries for the period 1984-2018. Hierarchical cluster analysis has also been applied to the considered data. The grouping of the investigated indicator is discussed. The obtained results showed that the rabbit meat production in Romania increased significantly for 1984-1990. The same process was observed in Bulgaria and Greece during 1987-1997 and 1988-1993, respectively. The values of this indicator for Greece and Bulgaria are quite higher in comparison with those ones in Romania for 2006-2018. A decreasing tendency in the rabbit meat production in the listed three countries was established for the last five years of the time interval.

Key words**:** *comparative analysis, clustering, database, queries, rabbit meat production*

INTRODUCTION

Since the 1970s, in some European countries rabbit meat production has progressively become a highly specialized industry, which has made Europe the second (after China) largest rabbit meat producer in the world [2]. However, the industry is currently facing a critical period due to structural weaknesses, progressive and constant reductions in consumption, and raising criticism related to welfare conditions and other ethical issues [2]. Compared to the amount of meats produced from different farm animals, rabbit meat plays a minor role [13]. In many ways, rabbits are more suited for small-scale production than large-scale, industrial production [4].

Recommended by nutritionists over other meats, rabbit meat is valued for its nutritional properties because is lean, rich in proteins of high biological value, low in cholesterol content and high in linolenic acid [10].

The aim of the current article is to present comparative analysis of the rabbit meat production in three Balkan countries (Bulgaria Romania and Greece) for the time interval 1984-2018.

MATERIALS AND METHODS

Data concerning rabbit meat production in the mentioned above countries have been published on the web site of Food and Agriculture Organization of the United Nations [5]. This information has been extracted from the indicated website and structured in a designed relational database containing five table schemes (Fig. 1). They are the following:

- Continents (id_c, continent);
- Countries (id, country, id_c);
- Product (id_product, product, id);
- Product types (id_t, name, id_product);
- Quantities (id_q, quantity, measure, year, id_t).

The relationships between the listed tables are of type one-to-many. The examined time interval includes 35 years period. Searching and finding data from several related tables that meet certain conditions can be quite a difficult task in many cases. In this regard, it is appropriate to create and use parameter queries. Depending on selected criteria, the necessary information is displayed [1], [7]. Subsequently, it can be stored and studied.

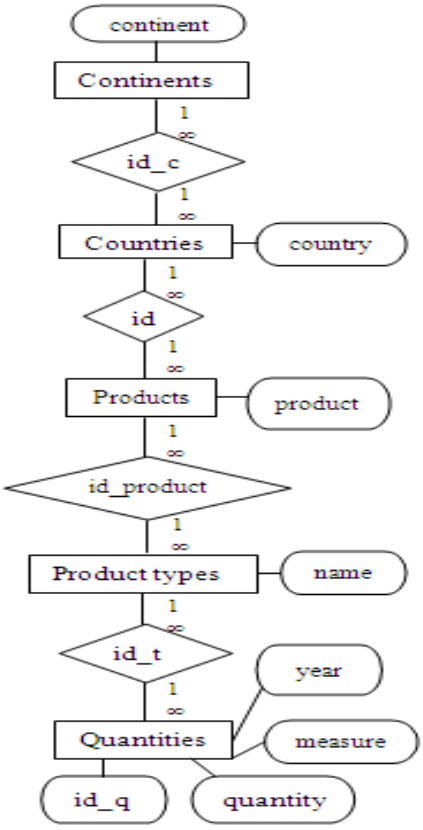

Fig. 1. E/R diagram of the database
Source: Author's conception.

Comparative analysis [12], [6] and hierarchical cluster analysis [14], [3] have been applied in the paper. The share (P_{ji}) of rabbit meat produced for each year in the given country as compared to the total quantity produced during the examined period in that country has also been calculated:

$$P_{ji} = \frac{y_{ji}}{\sum_{i=1}^{n} y_{ji}}.100$$

where y_{ji} - rabbit meat production for i-th year in the considered country; 1<=j<=3; 1<=i<=35; $\sum_{i=1}^{n} y_{ji}$ - rabbit meat production for the whole surveyed period in this country; n=35.

The capabilities of the Microsoft Excel program [8], [9] and software package R Commander [11] have been used for data processing. The obtained results have been summarised and the relevant conclusions have been visualised mainly in graphical form.

RESULTS AND DISCUSSIONS

Data about rabbit meat production have been presented in several fields of different tables in the database (Fig. 2). In order to limit the displayed records, it is necessary to apply a certain set of criteria. It includes the following components:

- Chosen country;
- Selected time period;
- Indicated values of the examined indicator for a given time interval.

As a result, different parameter queries have been created. Practically, the obtained information from them has been processed.

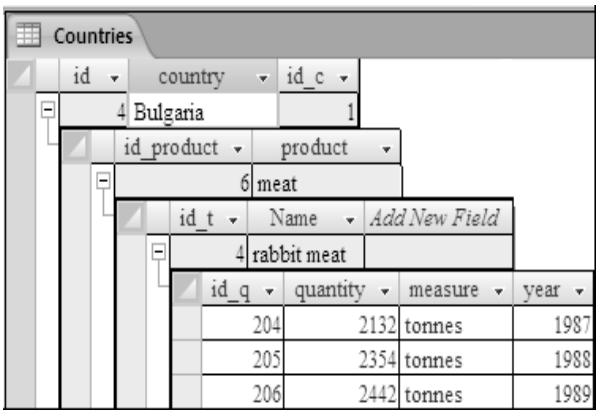

Fig. 2. Information about the studied indicator structured in tables of the created database
Source: Data from Food and Agriculture Organization of the United Nations, FAOSTAT.

The considered data for these three Balkan countries, members of the European Union have been analyzed and evaluated for the period from 1984 to 2018. The results of the calculations showed the following:

- The rabbit meat production in ***Romania*** increased significantly for the first seven years from the examined time interval. In the case, it was about 4.2 times. During 1986, as compared to 1985, this indicator grew by about 53.85%. Quite naturally, the highest value of the variable was registered in 1990. Over the next two years (1991-1992), the reverse process was observed. A decline of about 42.57% was established. The assessment of the data on rabbit meat production in Romania showed a decreasing tendency during 1993-2004. It should be noted that, the values of the surveyed

indicator marked a certain growth in three non-consecutive years - 1999, 2001 and 2003. A significant decline in the rabbit meat production in Romania was registered for the period 2004-2006, as can be seen from the diagram of Figure 3. The values of this variable remained almost the same in the years between 2010 and 2012. The period from 2006 to 2018 is characterized with a steady decrease of the indicator. The lowest value was registered in the last year of the studied interval. The calculated determination coefficient is 0.63. This means that the time explains 63% of the variations in the quantities of the indicated product;

- The situation is quite different for the examined information concerning rabbit meat production in ***Greece.*** The highest value of the indicator was established in 1985. Compared to the year 1984, the surveyed variable increased by 18.99%. A quite big decline in rabbit meat production was observed in the years between 1986 and 1987. It was about 1.5 times. The period covering next five years is characterized with a continuous growth of the indicator with an exception in 1992. An interesting fact should be noted. A significant increase in rabbit meat production in Greece was observed during 1993 (Fig. 3). The value of this variable for the indicated year is very close to that in 1985. A process of almost continuous reduction of the indicator was established from 1994 to 1999. Over the next 5-years the considered variable increased by about 12.65%. A decreasing tendency in the rabbit meat production in Greece was observed for 2005-2018. The decline of the indicator for the mentioned period was quite large. In this case, it was more than 2.4 times. As can be expected, the lowest value was recorded in 2017. The coefficient of determination is 0.52. Therefore, the time explains 52% of the variations in the quantities of this product;

- The production of rabbit meat in ***Bulgaria*** for the first three consecutive years reduced more than 13.32%. Quite naturally, the lowest indicator value was registered in 1986. The analysis of this studied data showed a clearly-expressed increasing tendency in the period from 1987 to 1997 (Fig. 3). In the first six years of the mentioned subinterval the rabbit meat production grew about 1.8 times. The highest value was recorded in 1997. Compared to the year 1996, the rabbit meat production increased by 93.22%. A quite big decline of the variable was observed in 1998. In this case, it was about 59%. The subintervals 1999-2000 and 2004-2006 are characterized with a growth of the indicator values. This variable remained almost the same during 2007-2009. A significant decrease was calculated in 2012. The production of rabbit meat changed at a relatively slower pace over the next six years, but there has been some reduction for most of this subinterval. The determination coefficient is 0.48. Therefore, the time explains 48% of the variations in the production of the considered product.

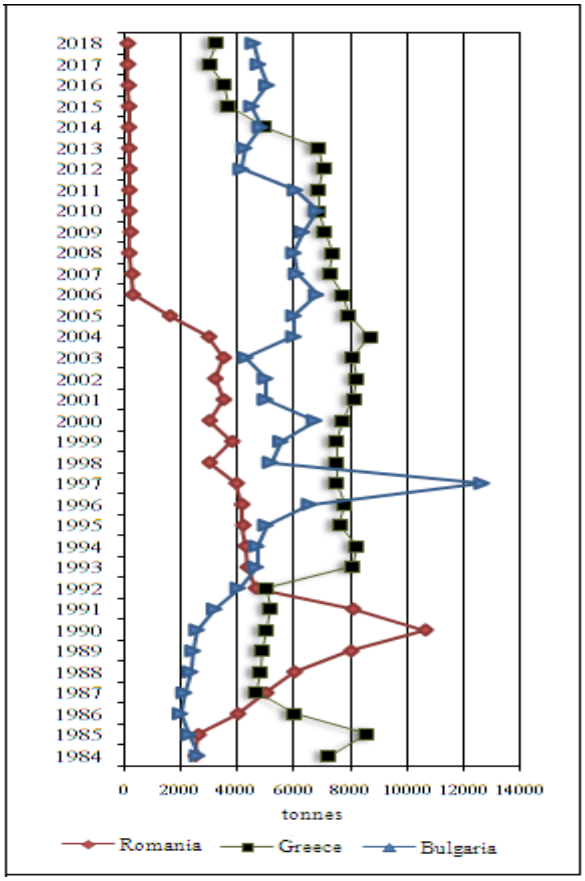

Fig. 3. Data analysis of the rabbit meat production
Source: Data from Food and Agriculture Organization of the United Nations, FAOSTAT.

Analyzing the presented results (Fig. 3), it can be summarized that the values of the studied indicator for two of the considered countries (Greece and Bulgaria) are quite higher in

comparison with those ones in Romania for the period from 2006 to 2018. A decreasing tendency in the rabbit meat production in the listed three countries is observed for the last five years of the time interval.

The relative share (P_{ji}) of rabbit meat produced for each year in the given country as compared to the total quantity produced during the studied period in that country was calculated. Approximately equal percentages are obtained for seven years (2010-2016) for Romania. A similar situation with the variable was established for 2017-2018. Therefore, the production of the indicated product changed insignificantly. For the other years of the period there are certain differences. The indicator (P_{ji}) varies in range between 0.10%-10.72% for Romania, while for Greece and Bulgaria - between 1.33%-3.78% and 1.16%-7.39%, respectively. The obtained percentage values for Bulgaria are almost the same during 1993-1994, as well as in 2001-2002 and 2004-2005. A similar case was observed in Greece for two subintervals. The first contains three consecutive years from 1997 to 1999 and the other includes 2010-2011.

The considered countries were grouped according to the values of rabbit meat produced in them. Hierarchical cluster analysis was applied to these surveyed data.

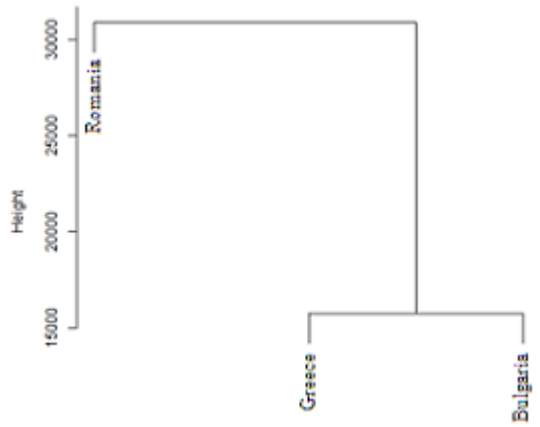

Fig. 4. Clustering the countries according to the values of rabbit meat produced in them
Source: Own calculation on the basis of data from FAOSTAT.

As can be seen from the dendrogram in Figure 4, the obtained results showed the following:

- Romania forms a separate cluster;
- Greece and Bulgaria are presented in one cluster. They are characterized by relatively similar values of the quantities of rabbit meat produced in them.

The current study also visualizes grouping the years according to the values of this indicator (produced quantities of rabbit meat) in each country. The results of the data processing for Romania displayed four clusters (Fig. 5). The first contains the years from 2006 to 2018. The second includes 2000-2005, 1984-1985, as well as 1998. The years 1989 and 1991 formed the next cluster. Subsequently, 1990 joined to it on relatively small distance. In this interval the values of the produced quantities of rabbit meat are the highest. The fourth cluster includes 1986-1988, 1992-1997 and 1999.

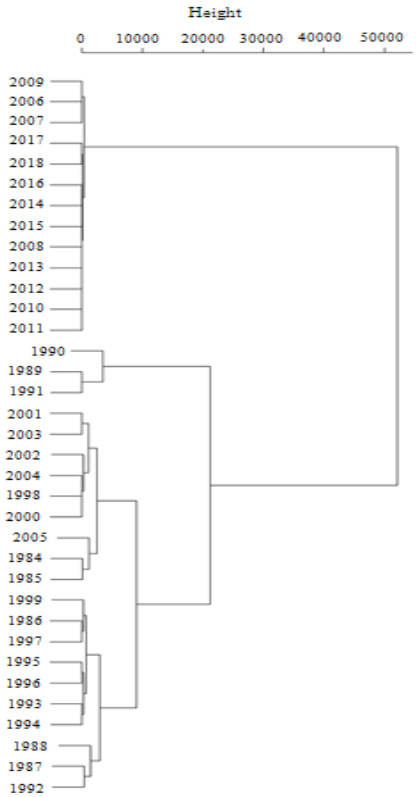

Fig. 5. Presentation of the results for Romania
Source: Own calculation on the basis of data from FAOSTAT.

The evaluation of the data about Greece presented the following three clusters (Fig. 6). The years 2001-2005, 1993-1994 as well as 1985 formed a separate cluster. The largest production of the indicated product was realized during this period. The next cluster

contains two sub-clusters. The first of them includes the years 1995-2000, 2006 and 2008, while the second contains 1984, 1986, 2007 and 2009-2013. The third cluster is formed by two sub-clusters. The years between 1987-1992, as well as 2014-2018 are presented in it.

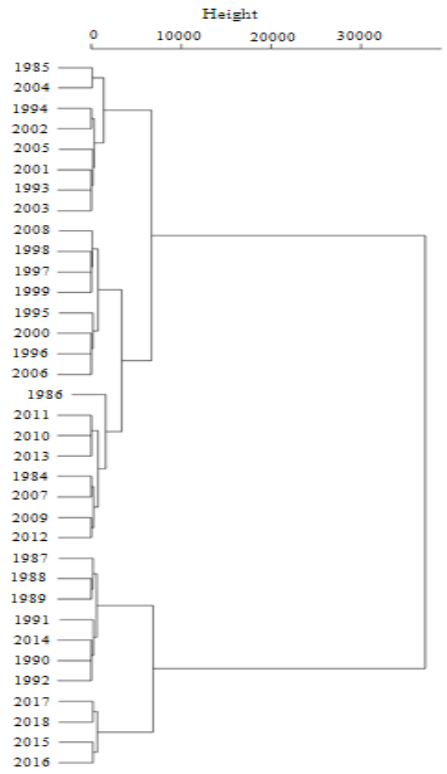

Fig. 6. Grouping the years according to the values of the studied indicator for Greece
Source: Own calculation on the basis of data from FAOSTAT.

The results of the indicated analysis for Bulgaria showed also four clusters (Fig. 7). The years 1984-1991 formed one cluster. The period is characterized by the lowest values of the produced quantities of rabbit meat. The second cluster contains two sub-clusters, which joined on relatively small distance. The years 1992-1995, 1998-1999, 2001-2003 and the interval from 2012 to 2018 are included in it. 1997 is presented in a separate cluster. The last cluster consists of two sub-clusters, which include 2004-2008, 2011, as well as 1996, 2000, 2009-2010.

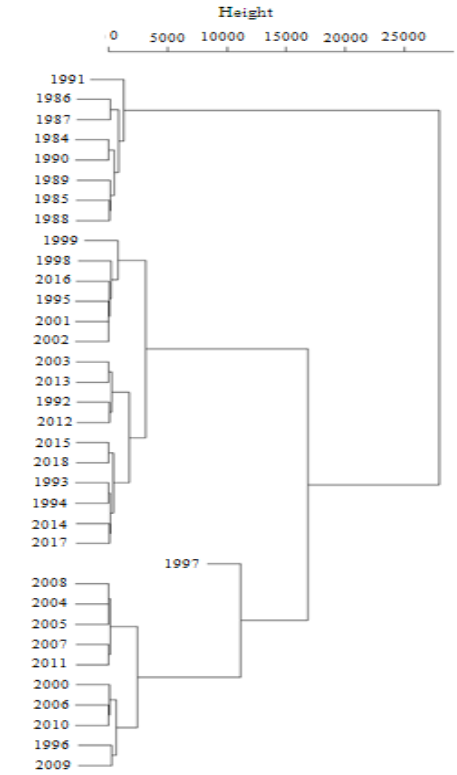

Fig. 7. Results of the cluster analysis for Bulgaria
Source: Own calculation on the basis of data from FAOSTAT.

CONCLUSIONS

The information about rabbit meat production has been published on the web site of Food and Agriculture Organization of the United Nations. These data concerning three Balkan countries (Bulgaria, Romania and Greece) have been extracted and presented in a built relational database. The parameter queries have been used for visualization of the deferent subsets from the database. The obtained information has been processed and accessed. The share of rabbit meat produced for each year in the given country as compared to the total quantity produced during the examined period in that country has also been calculated. Comparative analysis and hierarchical cluster analysis have been applied in the article. As a result of this study the following conclusions can be drawn:
- The rabbit meat production in Romania increased significantly in 1984-1990. The same process was observed in Bulgaria and Greece during 1987-1997 and 1988-1993, respectively. The values of the indicator for two of the considered countries (Greece and

Bulgaria) are quite higher in comparison with those ones in Romania for 2006-2018. A decreasing tendency in the rabbit meat production for the indicated three countries was established for the last five years of the studied period;

- The grouping of the countries according to the values of rabbit meat produced in them led to the formation of two clusters. The current article also visualizes grouping the years according to the values of this indicator (produced quantities of rabbit meat) in each country. The evaluation of the data about Romania and Bulgaria showed four clusters, while for Greece the presented clusters were three.

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