

## **MODERNITY AND CHANGING FOOD HABIT AMONG THE RESIDENTS OF FAISALABAD CITY-PAKISTAN: A GEOGRAPHICAL APPROACH**

MARIAM KAREEM<sup>1</sup> • KASHIF MAHMOOD<sup>1</sup> • KHADIJA SHAKARULLAH<sup>2</sup>

<sup>1</sup>Department of Geography, G.C. University Faisalabad, Pakistan

<sup>2</sup>Forman Christian College (A Chartered University), Lahore-Pakistan

Corresponding author's e-mail: [kashif.mahmood@gcuf.edu.Pk](mailto:kashif.mahmood@gcuf.edu.Pk)

### **ABSTRACT**

The inhabitants of Faisalabad are facing cultural transformation due to the development of modern technologies and globalization. Our research focuses on the spatial distribution and accessibility of processed food in Faisalabad city. The objective of this study is to identify the principal sources of processed foods on the basis of the NOVA classification in Faisalabad city. We classified foods using the NOVA classification into unprocessed or minimally processed foods, culinary processed foods, processed foods and ultra-processed foods available at Faisalabad, Pakistan. Kernel Density Estimation (KDE) and hot spot Getis Ord  $G_i^*$  were used to find the cluster of Processed food sources. 1259 food sources were tagged with GPS (Garmin 64s) and categorized by thematic mapping. The Kernel Density Estimation (KDE) has determined that the maximum of 32 outlets per kilo meter represents the increasingly numerous clusters of outlets for processed foods in the central part of the town of Faisalabad. The Getis Ord  $G_i^*$  hotspots are also spatially significant in the CBD area of the Faisalabad city. A large cluster of ultra-processed foods and advanced food category was available around the CBD, educational and administrative institutes and tourist places while the minimal sources of processed food were very fewer. Food systems are also changing because of the variety of outlets in supermarkets with better quality and security at competitive and convenient prices that attract the consumer

**KEYWORDS:** Food classification, processed food, hotspot, kernel density estimation, Pakistan, Faisalabad

### **1. INTRODUCTION**

Advanced food processing techniques have made food sustainable, convenient, easily accessible and available for everyone in the world (Louzada et al., 2017). The production and consumption of processed food is increasingly due to multitude factors- delicious taste, fully nutritious and diversified products and lower prices (Floros et al., 2010). In past, processed food was only familiar in North America, followed by Europe, Asia Pacific and the rest of the world. Globally, processed food products will generate US\$617.6 billion in income by 2019, up from US\$477.1 billion in 2013 (Bhisey, 2016). Sales of ready-to-use processed food and beverages grew at an annual rate of about 2.8% at global level, or 0.2% in North America, 6.1% in Asia, 1.3% in Western Europe, 3.1% in Latin America, 4.2% in Middle East Africa, 4.3% in Eastern Europe and 1.7% in Australia during 2000 to 2013 ([PAHO & WHO, 2015](#)).

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The usage of processed food increases dramatically with daily energy consumption of 1764 kcal, 30.1% of calories coming from low-processed foods, 4.2% from culinary processed foods, 8.8% from processed food and 56.8% of ultra-processed food in 2008 to 2014 in United Kingdom . These were associated with higher content of fats, sodium, sugar-free, carbohydrates and magnesium ([Rauber et al., 2018](#)). Energy intake from ultra-processed foods have also increased dramatically by 58 per cent in the United States ([Steele et al., 2017](#)); 48% in the Canada ([Moubarac et al., 2017](#)); 35.9% in the France ([Julia et al., 2017](#)) and 20.4 % in the Brazil ([Louzada et al., 2015](#)). The consumption of fructose, sweetener and colour-based non-alcoholic drinks has increased by 500% per capita in the last 50 years around the world. ([Hofmeister et al., 2013](#)). Asia, the most populous region in the world, has also become the fastest victim of processed food intake. Consumption in China increased from 20 kg per capita to 80 kg per capita during the time period of 1999 -2012 whereas in Thailand it increased from 60 kg per capita to 110 kg per capita. Malaysia, the Philippines and Indonesia also have problems with the production and consumption of densely processed food and beverages.

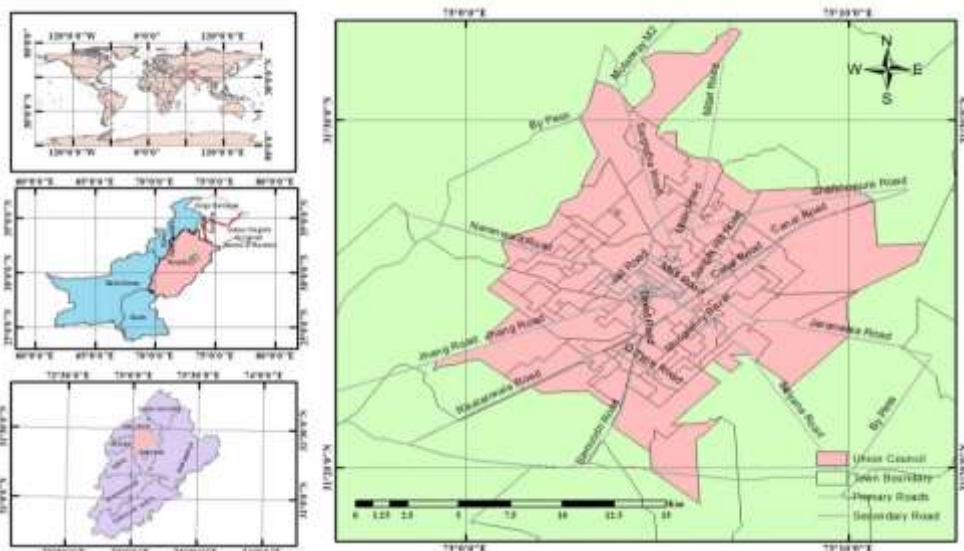
Moreover, the ratio of processed food consumption is higher in more developed countries and Japan is among the highly developed countries of Asia that has demanded a great transaction of processed food products since 1990. Thailand and China, in the medium-developed countries, also have the fastest growth in the use of processed fatty foods ([Rosenberg & Bogl, 1987](#)). Demand of fast food consumption is increasing among Pakistanis and easily available at every corner of streets, schools, malls, airports, local shopping malls, and in hospitals. Pakistan has the second largest growing fast food industry among manufacturing industries and the eighth largest business in the world. 180 million people ate fast-food meals daily ([Memon, 2016](#)). Females were more reliant than males, 42% of females and 33% of males in McDonald's; 21% of women and 12% of men interviewed in Nando loved to eat processed foods ([Memon, 2016](#)). In Pakistan, the fast food industry has increased its demand and the sale of junk food due to the busy schedule of Pakistanis ([Yahya et al., 2013](#)).

In Lahore and Faisalabad, the use of processed food was also common as 89% of the population used prefabricated fast food products rather than homemade foods because of their taste, lower price, perfect services and convenience. ([Baig & Saeed, 2012](#)). 83% population loves to drink soft drinks -Coca Cola and Pepsi due to its refreshing taste in Pakistan ([Paracha et al., 2012](#)). This research work has been conducted to gather the information related to consumption of processed food products in Faisalabad. The study has been acquitted to highlight the motivational and attractive factors which influence the consumers to consume processed food products in Faisalabad. An effort has been done to understand the popularity and usage of processed food products. At present, processed food products are easily available in each and every corner of Faisalabad. People prefer to eat tasteful yummy food and visit food outlets, restaurants twice or more in a

week. Moreover, urbanization has also played an important role in using and adopting this trend. Processed food are fully ingredients with artificial sweetener, colouring agents, preservations, salt, fats, harmful substances, trans fats, artificial colours and synthetic chemical pesticides which demolished the natural beneficial agents and nutrients of foods. Trends of consuming processed food products are not only increasing among consumers but also suffering population into different non- communicable diseases.

## 2. METHODOLOGY

Our study area is Faisalabad city and it is the third largest city of Pakistan. Figure 1 illustrates the location of the study area - town of Faisalabad. It is situated in the eastern part of the Punjabi province bounded by Gujranwala, Sheikhpura districts, Jhang, Sheikhpura, Sahiwal districts, Sahiwal and Toba Tek Singh districts. Faisalabad area is 5,856 square kilometres and ranged from 30° 42' to 31° 47' north latitude and 72° 40' to 73° 40' east longitudinal (Figure 1 & (GOP, 2020)). It is located in the upper lowland of the Punjab Indus at an average height of 184 Meters above sea level. Its Tehsil covers an area of 168 sq. Km, Faisalabad's soil consists of alluvial deposits mixed with loess with limestone characteristics. The city has been flourishing in textile units for more than four decades because of its cotton and textile industry. Nowadays, Faisalabad benefits from a strong industrialized base, containing factories producing textiles, domestic products, fashion industry and food supplies (GOP, 2015, 2017).



**Figure 1: Location Map of Study Area- Faisalabad city**

This research is primarily based on primary data. The global positioning system (GPS) was used to map all processed food companies and potential food sources in Faisalabad. A convenience and cluster-based sampling technique was used to

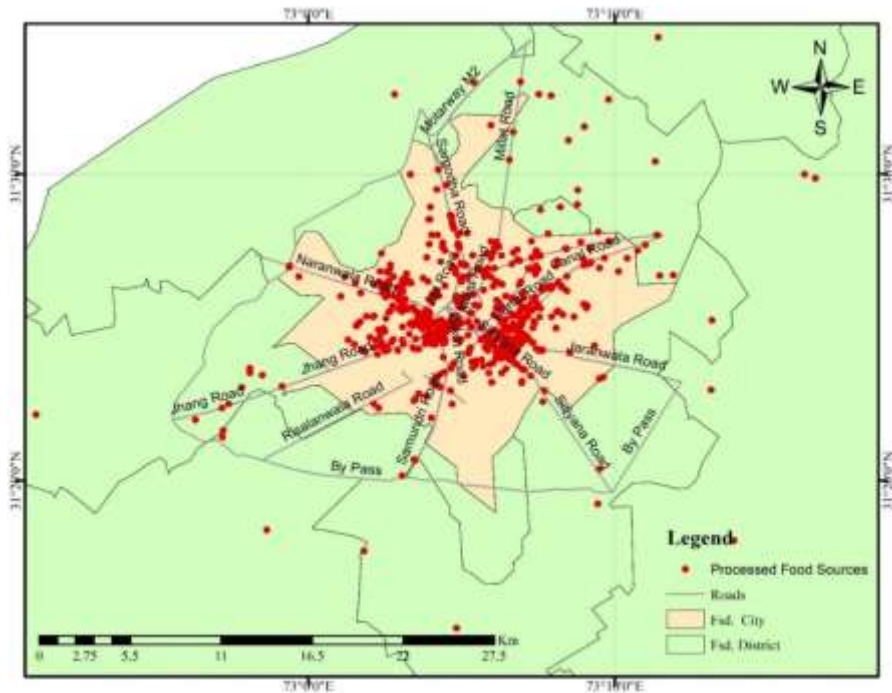
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examine the availability of food sources in urban and rural Faisalabad by utilizing the common attributes of the NOVA food classification system. The Brazilian municipality has also developed the classification of NOVA foods in the framework of the Brazilian food directives and a similar classification published by the Pan American Health Organization and the United Nations Food and Agricultural Organization ([Monteiro et al., 2018](#)). 1259 sites have been labeled and classified into four groups of the NOVA Processed Food Classification System: minimally processed foods, culinary processed foods, processed foods and ultra-processed foods. The GPS extract GPX file format added to ARC GIS 10.4.1 to convert the GPX file into a shape file. The data were grouped into different food categories using graduated colours (thematic classification tools) to meet the objective of spatial distribution of foods in Faisalabad. Figure 2 shows the geographic distribution of processed food outlets, popular outlets and drug addicts at Faisalabad. In figure 2, the red label indicates the location of processed food sources.

**Table 1: NOVA Based Food Classification**

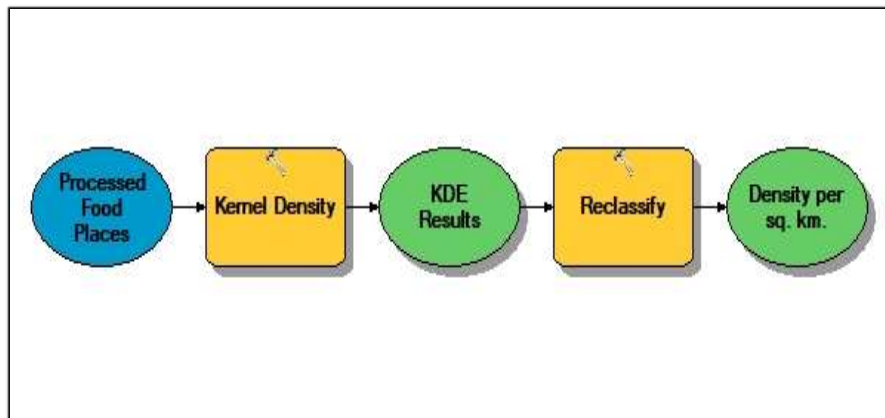
<b>NOVA Based Classification</b>	<b>Items</b>	<b>Processing</b>
<b>Unprocessed Food/</b>	Egg, Milk, Meat, seeds, fruits, Vegetables, Water	Natural Processes, Agricultural Processes, drying, crushing, filtering, pasteurization, refrigeration, grinding, freezing, Fermentation, roasting, boiling,
<b>Culinary Processed food</b>	Hand-made dishes, soups broths, breads, preserves, salads, drinks, desserts	Pressing, Refining, grinding, milling, spray drying, Preservation
<b>Processed Food</b>	Bottled or Canned Meat, Fruits, vegetables, and legumes, Salted or sugared nuts and seeds; salted, cured, or smoked meats, cheeses	Various preservation or cooking methods, and, non-alcoholic fermentation.
<b>Ultra Processed Food</b>	Carbonated, soft, energy fruits drinks; sweet or packaged snacks; ice-cream, sweets, packaged and instant products extra processed breads and buns; stewed or preserve sausages, microwave prepared food, bakery items, baby canned products, Alcoholic products	microwave heating and industrialized processes, Use off additives, dyes colour stabilizers, flavor enhancers, non-sugar sweeteners, processing aids such as carbonating, firming, bulking and anti-bulking, de-foaming, anti-caking and glazing agents,





**Figure 2: Spatial distribution of processed food Sources in Faisalabad**

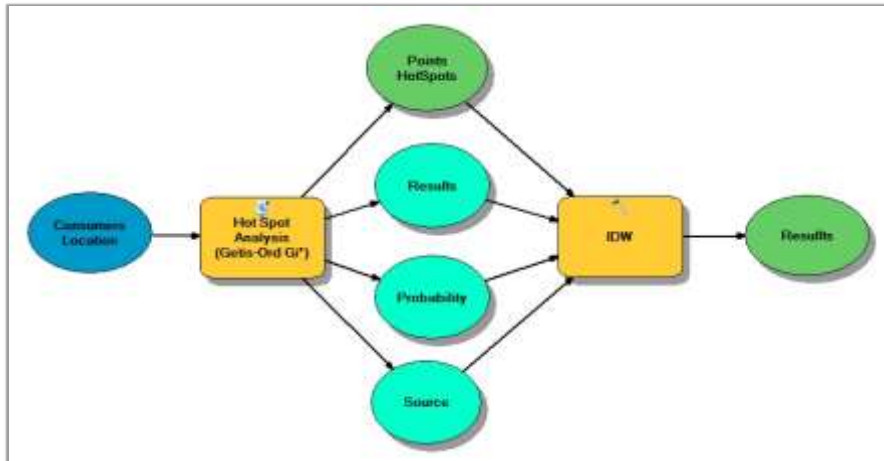
To better understand and identify highest dense clusters of processed food sources, kernel density estimation was used, followed by hot spot analysis. Kernel density analysis and reclassification tools were used to identify density per km<sup>2</sup>. Figure 3 also illustrates the density calculation methodology using the modeling tool in Arc GIS 10.4.1.



**Figure 3: Model builder for kernel density analysis**

The hotspot analysis was also used to determine the spatial significance of processed foods sources. Hotspot Gitis Ord  $G_i^*$  analysis and IDW have

been used to identify the highest and lowest clusters. Model for the representation of the hot spot analysis of the surface representations were in Figure 4.



**Figure 4: Model builder representation for hotspot analysis**

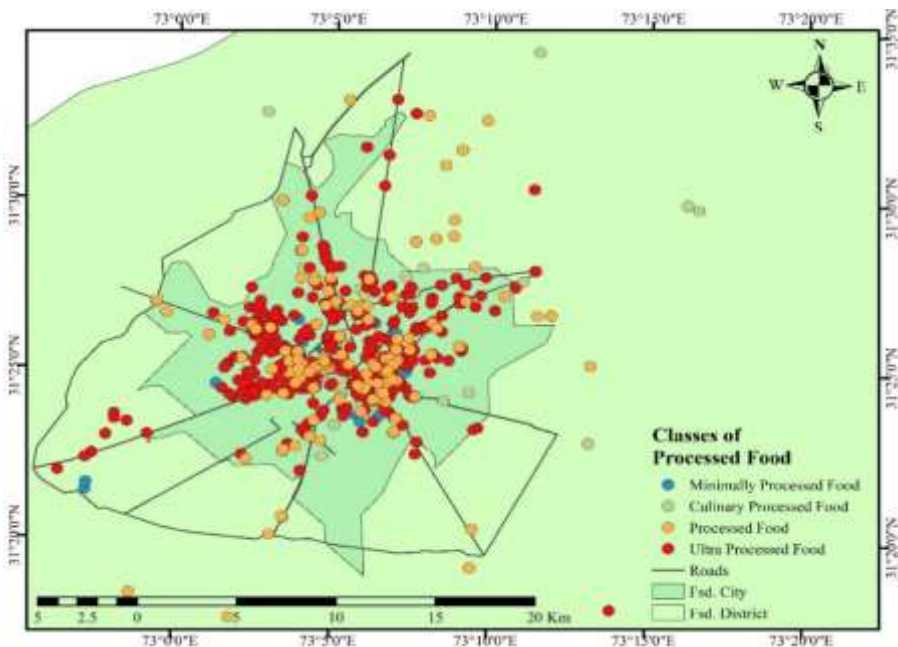
### **3. RESULTS AND DISCUSSIONS**

Foods are an important part of life for the Faisalabad population, and its consumption is increasing and changing rapidly from day to day. This research focuses on spatial distribution, density and cluster of food sources, particularly markets for processed foods in Faisalabad. Modern technologies, cultural change and professional life have had a significant impact on our dietary habits.

#### **3.1. Spatial Distribution of Foods Outlets in Faisalabad**

Faisalabad City has been crowded by various food stores, shops, markets, stores and restaurants. People have easy access to these outlets. Figure 5 shows the geographic distribution and available services of food outlets into four major categories using NOVA classifications. The 1259 commercial points of sale for foods were classified as minimally processed foods, processed culinary foods, processed foods and ultra-processed foods. The availability of unprocessed or minimally processed foods was found less in the city. 57 places were tagged for minimally processed foods such as fruit and vegetable markets, butchers and fish markets, some private stores, grocery stores, flour mills and supermarkets. However, these products have also undergone various processing techniques like pasteurization, crushing, fermenting milk for yogurt, drying, roasting, freezing and cooling.

The second group is involved in the culinary processing of foods through refining, milling, pressing, spray drying and grinding. Using the first group prepared products (minimally processed foods), culinary processed foods have been cooked in the kitchen of restaurants and houses. Different goods such as bread, preserve, pasteurized dairy canned products, cooking vegetable oil, drinks, iodized salt, vinegar, sugar extract from sugar cane, multiple deserts and salads were prepared falls into the culinary processed food. 153 records were recorded in various food industries, dairy farms, certain wholesalers and retail stores, markets, grocery stores and supermarkets. The third category (processed foods) used ingredients from minimal and culinary processed food groups. The most common ingredients were sugar, salt and oil used for the preparation of processed foods. Prepared food items were durable due to their packaging in bottles, tin and cans. Vegetables and fruits were further extracted into antioxidant syrup. Smoked meat and salted meat were stocked by preservatives. A variety of fruits and nuts are also wrapped in sugar and salt. 191 places like shopping markets, grocery stores, grocery marts, packaging food industries, wholesalers and retailer's shops, juice corners, ice bars, food packing industries, bakeries, ready to made chicken food stores, restaurants, and shopping centers were geocoded to determine the main sources of processed food.



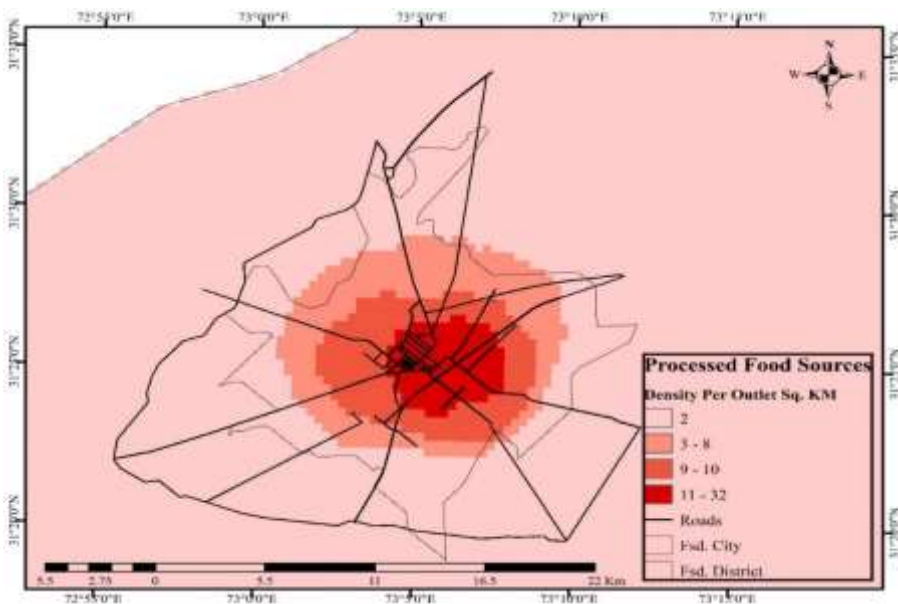
**Figure 5: Spatial distribution of food classification outlets in Faisalabad**

Ultra processed added into the fourth class which includes various ingredients such as sugar, salt, fats, oils, antioxidants, preservatives, taste



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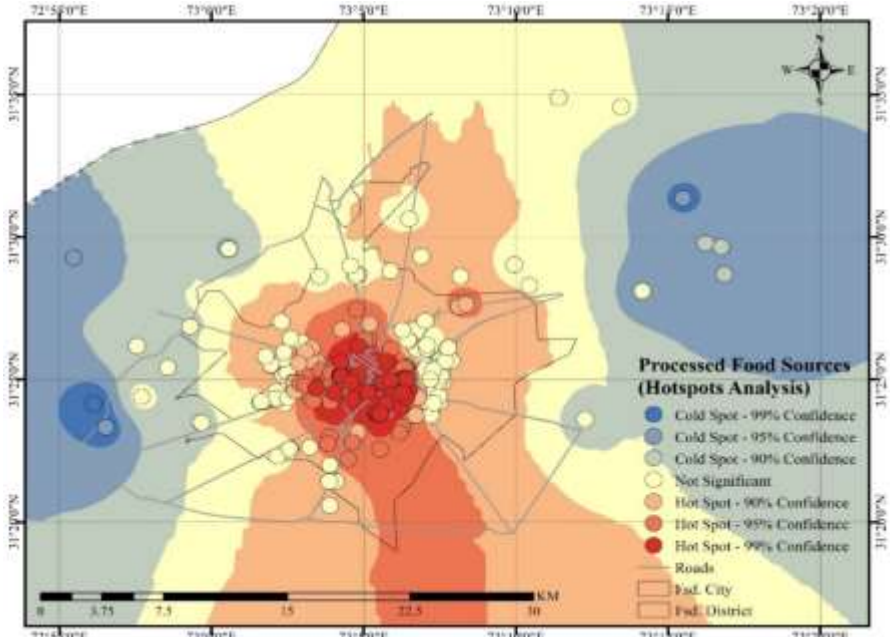
enhancer, colour stabilizers, non-sugar sweetener and many more techniques. Variety of ultra-processed food prepared like pastries, cakes, burger, sausages, formula milk, pizzas, desserts, sweets, chocolate candies, nuggets, margarines and spreads, carbonated drinks, meal and dish substitutes, ready to heat meals, and prepared meals (pasta, pizza, pies, meat). 858 ultra-processed foods (restaurants, franchises, food outlets, ice cream bars, beverage industries, shopping centres, markets, breakfast outlets, food stalls, grocery stores and stores) appear in Figure 4.1. A male restaurants manager interviewed about Ultra Processed Food “Every Restaurant, grocery store, marts, utility store and even small retailer shop are crowded by thousand varieties of processed and Ultra Processed food in Faisalabad”.



**Figure 6. Spatial density of processed food outlets in Faisalabad**

Figure 6 shows the market density for processed food products, restaurants and franchise of fast food chain in Faisalabad. Restaurants are crowded near the city's CBD area, which represents the density of 32 restaurants per square kilometers of dark red colour. The density decreases as we move into the outlying areas of Faisalabad because the number of restaurants and processed food has declined. Next rings representing the 9 to 10 restaurants per square kilometre in light red colour, 3 to 8 restaurants per square kilometre in dark pink and 2 restaurants per square kilometre in light pink colour. The core business area has the largest groups of restaurants so the density is high around them. The population has also declined from central to peripheral regions, and this also has an impact on the food industry.

Figure 7 shows the optimized hotspot clusters on restaurants and sources of processed food in Faisalabad. The highest group of restaurants and processed food sources are identified in red hotspots with a positive 99% confidence level and these places are of great spatial importance in relation to space and processed food sources. The main processed food clusters are located in the city centre.



**Figure 7. Spatial clusters of processed food outlets in Faisalabad**

The greatest proportion of processed food sources lies around Jaranwala Road, Jhang Road, Narwala Road, Kotwali Road, Janubi Narwala Road, Sargodha Road and Satyana Road. Blue cold spots represent the lowest quantity of processed food sources at a negative 99% confidence interval. These locations were also statistically significantly associated with the lowest frequency. The cold blue spots present in the outskirts of Faisalabad where the frequency of restaurants is the lowest. Light red is the least common source of processed foods as opposed to dark red. Light blue and light red are statistically significant with a 95 per cent confidence level. The yellow zone is statistically and spatially non-significant with a 90% confidence interval. Here, z score is zero and this spectacle does not have an apparent cluster of restaurants.

#### 4. CONCLUSION

Urbanization and working life are factors which have allowed the emergence of more and more processed industries in the urban area of Faisalabad. The usage of processed foods has increased due to numerous

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factors such as ease of cooking, good taste, easy accessibility, and less costly cooking time, and high quality of food. These factors helped to better locate the points of sale of processed foods in the city. Many points of sale for processed foods and brands have developed a competitive environment with each other, so each outlet has made their manufacturing of processed foods more successful and flourish. Besides their all benefits; processed foods also have a dark side in the form of diseases. As a great intake of processed and ultra-processed foods develop many diseases in populations. It is therefore imperative to improve and increase the sources of minimally or unprocessed processed foods and fresh fruits, vegetables and less processed foods. They can play a major role in the improvement of the nutritional quality of the diet in the population of Faisalabad. However, this is a major challenge for economic Development and the sustainable. There is dire need to use organic food to maintain healthy life style.

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