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NUTRITIONAL GASTRONOMY IN FOCUS: READY-TO-EAT MEALS, NUTRITIONAL VALUE AND CONSUMER ATTITUDES

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Contents

ABBREVIATIONS AND ACRONYMS

AH: African catfish fillet in fresh basil sauce, potato croquette
ALA: Alpha-linolenic acid
BAP: Brasov stew
BMI: Body Mass Index
CSTB: Broccoli layered with chicken, cheese and eggs
CFIA: The Canadian Food Inspection Agency
CVDs: Cardiovascular Diseases
CSM: Roasted chicken liver with boiled potatoes
DHA: Docosahexaenoic acid
DRV: Dietary Reference Value
EFSA: European Food Safety Authority
EPA: Eicosapentaenoic acid
EU: European Union
FAMEs: Fatty Acid Methyl Esters
FDA: Food and Drug Administration
FPM: Freshly Prepared Meals
FSA: Food Standards Agency
GCS: Grilled chicken breast, cream cheese sauce, jasmine rice
GDA: Guideline daily amount
GDP: Gross Domestic Product
HDL: High-density lipoprotein
HM: Home-Made meal
HRK: Meat casserole with cauliflower
IYCF: Infant and Young child feeding
LDL: Low-density lipoprotein
LTLT: Long-time and low-temperature
MANOVA: Multivariate Analysis of Variance
MUFA: Monounsaturated Fatty Acids
NCD: Non-Communicable Diseases
NFt: Nutrition Facts table
PUFA: Polyunsaturated Fatty Acids
RF: Restaurant Food
RS: Fried pork ribs with sour cream, grated cheese and potatoes with parsley
RTE: Ready-To-Eat meals
SFA: Saturated Fatty Acids
SZK: Székely cabbage
TFAs: Trans Fatty Acids
VA: Vaccenic acid
VM: Beef stew with red wine and eggs barley
VPHT: Vasi steak with mashed potatoes and onions
WHO: World Health Organization

1. INTRODUCTION

The importance of a varied and balanced diet, along with making healthy food choices, cannot be overstated in maintaining wellbeing and minimizing the risk of illnesses. The World Health Organization (WHO) acknowledges the importance of diet and recommends that individuals consume sufficient nutrients and biologically active compounds. These suggestions are for consumers, healthcare practitioners, food industries, and researchers (WHO, 2013). The recommendations are substantiated by extensive scientific evidence that highlights the preventive role of a healthy diet against widespread non-communicable diseases (NCDs) like diabetes, obesity, stroke, heart disease, and cancer. Consequently, a crucial inquiry arises: "How can we prepare and produce food in a manner that maximizes its nutritional value and natural biologically active compounds, whether already present or subsequently added during production?" It is a daunting undertaking that requires proficiency in nutrition, food science and technology, and gastronomy. Each of these disciplines is instrumental in improving food processing and preparation as they have an impact not only on the nutritional and health benefits of food, but also on its characteristics and properties (Roselló-Soto et al., 2019).

In my thesis, I am focusing on the study of food and culture known as gastronomy, with a specific emphasis on ready-to-eat meal. Gastronomy encompasses various aspects of food, including cooking techniques, nutritional information, food science, and palatability. It also involves exploring the sensory qualities of food, researching and understanding food preparation, and writing about the cultural significance of food. Gastronomy is an interdisciplinary field that studies how food intersects with broader cultural practices. Although molecular gastronomy is a well-known application of biological and chemical knowledge to cooking, gastronomy covers a wider range of topics (This, 2009). One important aspect of gastronomy is how the nutritional value of mixed dishes and cuisines can vary due to ingredients and factors like geography and climate, which can impact public health. The term "gastronomy" first appeared in a poem by Joseph Berchoux in 1801, while the term "gourmet" gained popularity after the publication of Brillat-Savarin's book, The Physiology of Taste. According to Brillat-Savarin, the purpose of gastronomy is to ensure that people use the best food possible to sustain their well-being. Nutritional gastronomy, which some consider distinct from culinary nutrition and culinary medicine, focuses on using nutritional knowledge and cooking skills to improve health and prevent diseases like NCDs (Berkeley library, no date).

The leading cause of non-communicable diseases (NCDs) and obesity is presently an imbalanced diet, resulting from excessive energy intake. The global consumption of energy-dense and high-fat foods has surged, and an unhealthy food environment has further contributed to overeating and obesity (Swinburn et al., 2011). NCDs account for 71% of all deaths worldwide, with over 41 million people dying annually from these diseases. Among these deaths, 15 million are premature, occurring between the ages of 30 and 69. Over 85% of these premature deaths are found in low- and middle-income countries (WHO, 2022). The root cause of NCDs is primarily obesity and high body mass index (BMI). The worldwide incidence of obesity has nearly tripled since 1975, with 39% of adults aged 18 and older being overweight and 13% being obese in 2016 (WHO, 2021).

An increase in the availability of prepared meals has resulted from the demand for convenient food options, which are referred to as ready-to-eat (RTE) meals and are sold in single servings in retail stores or delivered. Busy consumers are constantly looking for ways to save time and energy in meal preparation, making this trend an ongoing one. The market for RTE meals was worth 98.12 billion USD worldwide in 2019, with Europe accounting for the majority of revenue at 29.83 billion USD. The market is expected to grow further, with a projected global revenue of 122.95 billion USD by 2024, including 39.36 billion USD in Europe. In Hungary, the RTE market had a revenue of €359 million in 2020, and this is anticipated to rise to €474 million by 2025. Although

RTE meals are popular, they are associated with higher levels of energy, fat, saturated fat, and sugar, and lower levels of micronutrients, which can contribute to weight gain (de Boer et al., 2004; Lachat et al., 2011). According to a 2020 report on data and trends in the EU food industry, the food industry's focus on developing RTE meals has made this sector the world's third most innovative food sector (Food Drink Europe, 2021). (Olsen et al., 2010; Costa et al., 2007; Mordor Intelligence, 2021; Statista, 2021; de Boer et al., 2004; Lachat et al., 2011)

Another element of the unhealthy food environment is some foods that some restaurants and food services provide. Due to the time scarcity, people would rather eat in restaurants than preparing a meal in their home. Thus, making people more dependent on restaurants and food services. In the year 2018, catering services such as restaurants and canteens were responsible for a spending of more than €600 billion by households in the European Union (EU). This figure is equivalent to 3.8% of the GDP of the EU (Eurostat, 2020). In Hungary the number of restaurants and buffets in 2019 was +25 thousand with a household consumption expenditure on restaurants and hotels of +2 million HUF. The restaurants and mobile food services revenue was $2500 million in 2017 and expected to reach almost $3000 million in 2023 (Statista, 2022a, Statista, 2022b). This can give an idea on how the menu creators (mainly chefs and establishment owners) can have a huge impact on consumers' health. Furthermore, with the emerging of social media, chefs got into consumers' homes. People are already influenced by celebrity chefs which can lead to a huge impact on consumers' health and lifestyle.

For the reasons mentioned above and for the fact that there is no research that focuses on this topic in Hungary and the reality that many research have been done on the food safety aspect of RTE meals consumption, I chose to investigate the healthiness of RTE meals in Hungary based on its nutritional profile, the effect of gastronomy traditions on RTE meals in terms of palatability and nutritional profile. Furthermore, I am evaluating chefs' perception on health and nutrition. All these dimensions can have a significant effect on the consumers' dietary habits and lifestyle.

2. OBJECTIVES

Since gastronomy is a complex concept, the overall aim of the thesis was to evaluate the healthiness of RTE meals in Hungary as a recent trend in the food industry based on its nutritional profile, the effect of gastronomy traditions on RTE meals in terms of palatability and nutritional profile, and chefs' perception on health and nutrition. To achieve this overall aim, I carried out investigations with the following specific objectives:

I. To compare the energy content and macronutrients of forty main popular traditional and modern meals in both Jordan and Hungary with the international recommendations, where nutrients were calculated using two different nutrient calculation software and based on known recipes of the meals.
II. To compare the energy, macronutrients, salt, and fiber contents of ready-to-eat meals sold in groceries and delivered by catering services in Hungary with the nutritional guidelines published by the World Health Organization according to gastronomic backgrounds. The nutritional information was obtained from the product label.
III. To determine if the nutritional and sensory characteristics of homemade meals are healthier and better than RTE meals where the nutrient content was determined by laboratory tests on the one hand and was derived from the label or calculated with nutrient calculation software where it was appropriate, on the other hand. The home-made meals were the same as the RTE ones, to the best of the knowledge of the kitchen professionals who prepared them.
IV. To evaluate chefs' perception on health and nutrition using a self-created questionnaire.
V. To evaluate the Hungarian population's beliefs and attitude regarding the healthiness and nutritional content of ready meals in the framework of a representative questionnaire survey.

3. LITERATURE OVERVIEW

3.1 Gastronomy

3.1.1 Definition of Gastronomy

The term gastronomy is of Greek origin and comes from the words ‘gastros’ which means stomach and ‘nomos’ which means knowledge or regulation. It refers to the knowledge and study of food. Dictionaries commonly define gastronomy as the art and science of good eating, highlighting the importance of skill and knowledge in this field. This definition aligns with the original meaning of the term (Oxford Dictionary, no date).

The godfather of gastronomy, Jean-Anthelme Brillat-Savarin, introduced and defined the term in his book The Philosopher in the Kitchen back in 1825. Brillat-Savarin believed that gastronomy is a comprehensive and multidisciplinary approach to food, encompassing natural history, physics, chemistry, cookery, commerce, and political economy, and is the "rational comprehension of all that relates to man's nourishment" (Brillat-Savarin, 1970). He acknowledged the significance of gastronomy in governing all aspects of human life and proposed an academic institution to research it. Other scholars have since supported and expanded on this definition, stressing the need to develop the field for the sustainable future of food and the food industry (Fusté-Forné, 2020).

Gastronomy has been defined by various authors, with Gillespie and Cousins (2011) presenting a two-pronged approach that includes both practice and study. On the practical side, gastronomy involves the implementation of proficiency and direction, which collectively constitute a way of life. This involves the techniques and standards used in converting raw materials into visually appealing, regionally and culturally specific dishes. On the other hand, the study of gastronomy involves a comprehensive understanding of the entire process of food and beverage production and preparation, including the social, cultural, and historical contexts that influence culinary practices. This includes studying cuisine, dining, drinks, and tourism, as well as gastronomic writing, and encompasses the principles, beliefs, and values that shape these practices. (Gillespie and Cousins, 2011)

Jean Anthelme Brillat-Savarin's definition of "gastronomy" is regarded as the most fitting and relevant, although numerous scholars have endeavored to provide diverse interpretations and explanations (Santich, 2004; Fields, 2002; Rand et al., 2003). According to Santich (2004; 2007), Savarin's notion of gastronomy is not limited to the production, material aspects, or preparation of food and drinks, but rather includes all aspects of how, where, when, why, and with whom we eat. Santich (2007) further explained that gastronomy is an interdisciplinary field that centers on food as its axis and encompasses social, cultural, historical, literary, philosophical, economic, and religious aspects. In Figure 1, Santich presents an extensive multidisciplinary model for gastronomy study that incorporates the humanities as well as natural and social sciences.

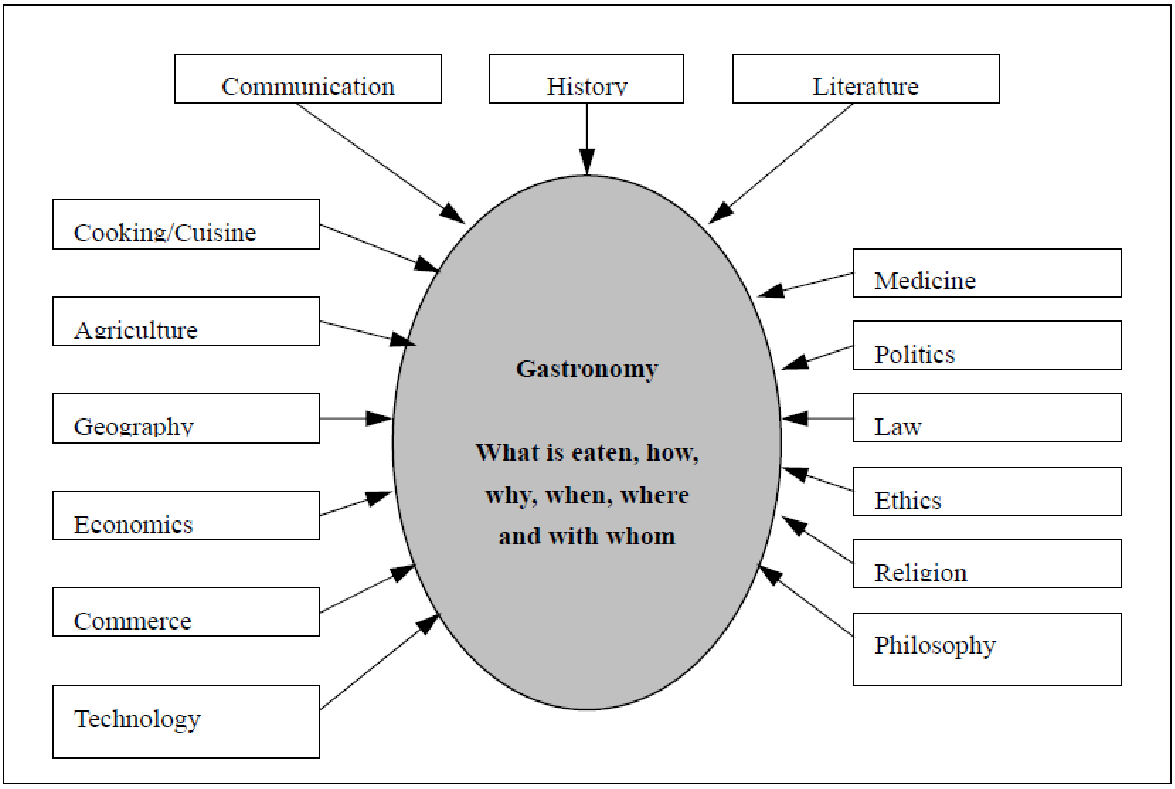


Figure 1 Multidisciplinary model for the study of gastronomy (Santich, 2007)

3.1.2 Hungarian gastronomy

Károly Gundel, a renowned Hungarian restaurant owner and cuisine innovator of the mid-20th century, once mused on the secret to the relish of Hungarian dishes, saying it lies in a cuisine with a diverse heritage that includes Caucasian, Italian, Turkish, Austrian, and French influences, combined with the delicate palates and highly developed taste of the Hungarian people. This unique fusion of equestrian and roasting traditions of Europe serves as a bridge between the gastronomic civilizations of the East and West (Gundel, 1933).

Hungarian cuisine has been shaped by a variety of culinary traditions from other countries over the centuries. One significant influence is French cuisine, but there are many other factors that have contributed to the development of Hungarian cooking. For example, Hungarian kings in the past often married foreign wives, and this led to foreign influences on royal cuisine, which spread to the gentry and peasantry. Viennese cuisine was also a major influence, not only in terms of recipes but also as a means of introducing other national specialties, especially Italian cuisine. The cuisines of neighbouring countries like the Slavs and Romanians have also had an impact on Hungarian cooking. However, the strongest influence was the Turkish conquest of Hungary in the 16th and 17th centuries. All these influences were adapted to Hungarian taste and the raw materials available in the country, sometimes resulting in changes to the ingredients and cooking methods (Gundel, 1956; Venesz, 1958).

According to Bóka and Kovács (2015), Hungarian cuisine combines eastern and western cooking methods, including boiling and stewing as well as roasting. Proper cooking techniques and food processing are crucial for creating nutritious meals and maintaining a healthy diet. When preparing food, consumers have a certain degree of control over the ingredients they add and can retain many of the natural nutrients and bioactive compounds present in the food (Roselló-Soto et al., 2019).

Typically, in Hungary, lunch is the most significant meal of the day and can include several courses, although nowadays it is more commonly just one. The main course usually consists of meat or another source of protein, together with a high-carbohydrate side dish, and occasionally a salad or pickled vegetables. There are two types of Hungarian main dishes: those that need a side dish and those that do not. The most commonly eaten side dishes are usually high in carbohydrates, such as potatoes cooked in different ways, although rice, pasta, or vegetable stews are also frequently consumed. Certain foods require a compulsory side dish, for example, paprikás csirke, which is usually served with nokedli, a type of noodle, while others can be eaten according to personal preference. Some Hungarian dishes also necessitate toppings or bread, such as sour cream and bread with stuffed cabbage (töltött káposzta) (Benkhard and Halmai, 2017).

Lard is the preferred cooking fat in Hungarian cuisine, and smoked and salted fatback are also important ingredients, with meats, particularly pork, being the focus. Hungarian dishes often feature seasonal vegetables and fruits, as well as wheat bread, pasta, potato, rice, eggs, dairy products, and cheeses. The cuisine is known for its unique cooking methods, which involve using lard, wheat flour, and ground red pepper to create a fatty base, as well as toasting, steaming, and thickening with flour and sour cream. Hungarian cuisine is also renowned for its tasty and vibrant soups, including goulash soup and fish soup, which can be prepared at home or over an open flame (Gundel, 2010; Horváth, 2006; Tusor, n.d.; Venesz, 1958).

The use of cooking oil has become increasingly popular in modern Hungarian cuisine, along with the traditional lard, which has had an impact on both home cooking and the food industry. The variety of spices has also expanded beyond the limited range of pepper, cinnamon, clove, vanilla, paprika, cumin, marjoram, and bay leaves, with thyme, summer savoury, and tarragon becoming more easily accessible. Additionally, due to globalization, the average Hungarian diet has become more diverse, incorporating international food ingredients and dishes (Koch, 2015).

3.1.3. Jordanian gastronomy

The cuisine of Jordan is a reflection of the country's history and culture in the Middle East, which is bordered by Iraq, Saudi Arabia, Palestine, and Syria. The region is well-known for its diverse cuisine, ranging from Egyptian legume-based dishes to lamb dishes in Jordan and Lebanon. Even though the Middle East has similarities in terms of religion, language, and culture, there are differences in their gastronomic traditions. Despite this, they all use the same spices and ingredients because they share similar weather and land (Behnke, 2006). Due to its ancient origin, as well as its strong connections to history, religion, and cultural identities, Middle Eastern cuisine is distinct from the cuisines of other regions of the world, and it serves as a unifying and dividing factor among the region's inhabitants (McVeigh, 2009).

Throughout history, Middle Eastern cuisine has been shaped by interactions and influences from neighbouring countries, as well as from other cultures. One notable example is the impact of Greek incursions into the region during the rise of Greek civilization. During this period, Middle Eastern cuisine included a variety of ingredients such as cucumbers, melons, leeks, onions, garlic, lentils, fava beans, garbanzo beans, olives, figs, grapes, dates, almonds, and walnuts. These ingredients were introduced more widely into the Middle East by the Greeks and were also brought back to Greece (McVeigh, 2009).

The Roman Empire played a significant role in the Middle Eastern culinary landscape, with their agricultural expertise and the introduction of new foods from faraway lands following the Greek influence. The Romans' mastery of irrigation allowed for more efficient cultivation of local crops, and the introduction of ingredients like honey, dried and salted fish, and hazelnuts from Eastern Europe, as well as cheeses, chestnuts, wine, and saffron from Mediterranean countries, helped to create more elaborate cuisines that evolved alongside the Persian Empire. The Persians, for their part, brought a variety of spices to the region, including pepper, ginger, cardamom, cinnamon, cloves, nutmeg, and mace, which became widely used. The Ottoman Empire also left its mark on Middle Eastern cuisine, particularly in terms of the tradition of simmering foods in meat broths, soup-making, the stuffing of foods like grape leaves, and the creation of honey-soaked pastries (McVeigh, 2009).

Religious beliefs have a significant impact on the Middle Eastern diet, with dietary restrictions being a major influence. For example, Muslims are required to avoid pork, carnivores, alcohol, birds of prey, improperly slaughtered animals, and blood, except when faced with starvation or forced feeding. Fasting periods for Jews and the Lenten months for Christians also influence dietary choices in the region. Islam is the primary religion in the Middle East, and its food edicts are particularly influential (McVeigh, 2009).

The Middle Eastern culinary tradition is renowned for its artful combination of sweet and sour ingredients, which are balanced in such a way as to enhance the flavours of each. Common sweet ingredients include figs, dried apricots, sugar, and various syrups, such as dibs and pomegranate molasses, while sour components include sumac, pomegranate seeds, lime and lemon juice, dried limes, and verjuice. These elements are frequently used in Middle Eastern meat dishes, rice dishes, stews, and desserts, creating unique flavour combinations that are characteristic of the region (McVeigh, 2009).

The traditional cooking techniques of Middle Eastern cuisine include baking, simmering, stewing, and fire roasting, which have been used throughout history. Most cooking in this region has been done over an open fire or communal oven, and these methods continue to be used in many areas. Although ovens are now commonly used for cooking at home, communal ovens remain in use in many rural parts of the Middle East (McVeigh, 2009).

The Middle East has been a crucial region in the trade of spices from India, Indonesia, and China to Europe due to its geographical location between the two continents. This has led to a deep understanding and extensive use of these spices in Middle Eastern cuisine. Commonly used spices in the region include cinnamon, nutmeg, cloves, peppercorns, tamarind, ginger, turmeric, mace, fennel, coriander, and cumin (McVeigh, 2009).

The Middle East's Mediterranean shoreline encompasses a series of streams, including the Tigris, Euphrates, Orontes, and Jordan, that water the valleys and fields of Iraq, Jordan, Palestine, Lebanon, and Syria. This region is known as the Fertile Crescent and provides a haven for vegetarians due to the plethora of seasonal fruits, vegetables, cereals, herbs, and olive oil. Syria, Jordan, and Lebanon share comparable cooking methods (Nenes, 2009).

Flatbread is an essential part of every meal in the Fertile Crescent, whether it's breakfast, lunch, or dinner. A typical breakfast in this area comprises of raw veggies like carrot sticks, lettuce hearts, cucumber, and green pepper slices. Additionally, it includes salted nuts, olives, crumbly goat cheese, green onions, mint, and mountain thyme, pickled peppers and turnips, strained yogurt (labneh) drizzled with olive oil, and the national dishes, including hummus bi tahini (a paste of chickpeas with sesame seed or olive oil, lemon juice, and garlic), baba ghannouj (a smoky eggplant dip with the same seasonings whipped to a fluffy consistency), and tabbouleh (a salad made of chopped parsley, onions, tomatoes, and mint leaves mixed with softened bulgur and dressed with lemon juice and oil). A stack of puffy flatbread or thin mountain bread is always within easy reach of all diners (Nenes, 2009).

Rice and wheat are the primary grains in the Fertile Crescent area, and they form the foundation of the region's diet. Bread is a staple food that is used extensively in daily meals, and flatbreads are often used as utensils. Bread is highly regarded in the Middle East, and if it falls on the ground, the next person who passes by will pick it up and say a prayer while moving it away from harm. Flatbreads leavened with yeast are the most common types of bread in the area. Besides bread, bulgur is another form of wheat that is used, and rice is a popular ingredient in many Middle Eastern dishes, frequently served with lamb, chicken, or beans for lunch (McVeigh, 2009).

Jordanian culinary customs are notable for the diversity of cooking techniques employed, including grilling, vegetable stuffing, roasting, and the use of specialty sauces. Mansaf, a beloved Jordanian dish commonly served on special occasions, is a prime example. This savoury meal is composed of Arabic rice, a flavourful broth created from dried sour milk (jameed), and lamb or chicken, and it symbolizes the spirit of generosity that is so highly valued in Jordanian culture. Dining etiquette in Jordan encourages guests to eat with their hands from a shared plate, and the amount of lamb offered reflects the host's level of hospitality (Nenes, 2009).

3.1.4 Molecular gastronomy and molecular cooking (science-based cooking)

The process of preparing food is often taken for granted, with little consideration given to why we cook certain foods and avoid others. However, studying the chemical changes that occur during food preparation is crucial in understanding these choices, as even cutting a vegetable can trigger enzymatic reactions. Unfortunately, for many years, the scientific study of these molecular transformations was neglected (This, 2009). In 1988, a new discipline called "molecular gastronomy" emerged, focusing specifically on the chemical phenomena that occur during the preparation and consumption of food, setting it apart from conventional food science and related fields.

Molecular gastronomy investigates the chemical and physical changes that occur during food preparation and how they affect the senses of the consumer. It is a branch of food science and technology that employs knowledge from these fields to improve the quality of dishes. The term 'molecular' refers to the central role of chemistry and physics in this discipline, much like in molecular biology. Molecular gastronomy is a scientific field focused on creating food from raw materials, rather than studying living systems or the universe, and it was founded by Kurti and This with the goal of creating science rather than technology (This, 2006; This, 2013).

Molecular gastronomy revolutionizes kitchen practices by applying scientific approaches to cooking, dispelling false beliefs and erroneous culinary myths. Traditional cooking methods have often been based on superstition and empirical knowledge. The field of molecular gastronomy seeks to verify these culinary beliefs through scientific testing, thus bringing a scientific approach to cooking. de Solier (2010) explains that culinary myths are common, false statements found in cookbooks and taught in culinary schools. Molecular gastronomists use scientific methods to test the accuracy of these beliefs and ensure that cooking practices are based on sound scientific principles. For example, the false theory that meat roasting involves a concentration of juices was debunked through scientific testing, demonstrating the need for molecular gastronomy to bring scientific rigor to the kitchen.

De Solier (2010) stated that molecular gastronomy has different roles for scientists, chefs, and diners. Scientists employ it to obtain knowledge about the physical and chemical mechanisms that take place during cooking, while chefs utilize it as a source of motivation for developing new and innovative dishes. For diners, molecular gastronomy offers a way to expand their knowledge about ingredients, provenance, tools, and culinary techniques. In the laboratory, research focuses on discovering the chemical and physical reactions involved in cooking, and the impacts of various culinary practices. This and Rutledge (2009) described molecular gastronomy as having three components: the technical facets of cooking, the creative aspects of presentation and appearance, and the communal dimension of dining, which involves the pleasure of consuming food with others in a pleasant atmosphere.

3.2 Culinary nutrition

The prevalence of obesity worldwide has increased threefold since 1975, with over 1.9 billion adults being overweight in 2016, of which 650 million were obese, according to the World Health Organization (WHO, 2021). In 2016, 39% of adults were overweight, and 13% were obese, signifying that obesity has become a worldwide epidemic. This is primarily due to the abundance of low-priced, accessible, and highly palatable foods, larger serving sizes, frequent eating out, and processed foods in the present diet (Affenito, 2012; Anand et al., 2015; Chandon and Wansink, 2012). Although the food industry has made strides in transforming unhealthy foods, it is unclear whether replacing natural sweeteners with artificial substitutes will enhance health outcomes. It is evident, however, that a collaborative approach is necessary to inspire and maintain eating habits. Guidelines for nutrition policy are evolving toward advocating for healthy eating patterns in practical situations, such as homes, schools, and workplaces (HHS and USDA, 2015; Pettigrew, 2015). The emerging field of culinary nutrition, which integrates nutrition and culinary knowledge and skills, assists people in maintaining good health and preventing disease. This field combines the sensory-based experience of food and emotions surrounding food with scientific knowledge of how food and dietary preferences impact human metabolism, immunity, and pathophysiology (Irl et al., 2019). Consulting chefs, food industry specialists, healthcare providers, registered dietitian nutritionists, and other medical professionals are collaborating to expand knowledge of nutritional aspects of food for the benefit of the broader individual and population wellness.

The term "culinary nutrition" refers to the combination of nutrition principles and food science knowledge with culinary arts, resulting in an interdisciplinary approach to food that promotes healthy eating behaviours through the mastery of culinary skills. In essence, culinary nutrition is the application of nutrition principles to the preparation and cooking of food. The integration of these disciplines leads to greater culinary confidence and nutrition awareness, resulting in healthier eating habits (de Tomas et al. 2021; Condrasky and Hegler, 2010).

3.3 Cooking techniques and its effect on foods

To ensure nutritious meals, it is vital to use suitable culinary techniques. Which refer to the approaches and procedures employed in preparing, cooking, and serving food that affect it’s physical, chemical, and sensory qualities, as well as its nutritional value. Processing food at home and acquiring fresh food can offer varying degrees of control over the inclusion of ingredients and the preservation of natural nutrients like bioactive compounds. Freshly acquired and homemade food is generally more nutritious than canned and heavily processed food. Although thermal processing can be employed to attain these objectives, cooking food above 100 °C for prolonged periods is not generally recommended. Excessive use of each culinary technique and technology can harm the natural nutritional content of food, altering physical parameters, chemical composition, and leading to the loss of vitamins and bioactive compounds. However, appropriate culinary methods can increase the in vivo bioavailability of many bioactive compounds such as iron and phosphorus, which are vital nutrients for human health (Aranceta Bartrina, 2016; Miglio et al., 2007; Patted et al., 2012; Roncero-Ramos et al., 2011; Roselló-Soto et al., 2019).

Figure 2 illustrates some of the most commonly employed methods for cooking food at home. One of these techniques is steaming, which entails cooking food through contact with water vapor in a covered vessel. In this method, nutritional value is generally preserved, though cooking time may differ depending on the type of food being prepared (Roselló-Soto et al., 2019).

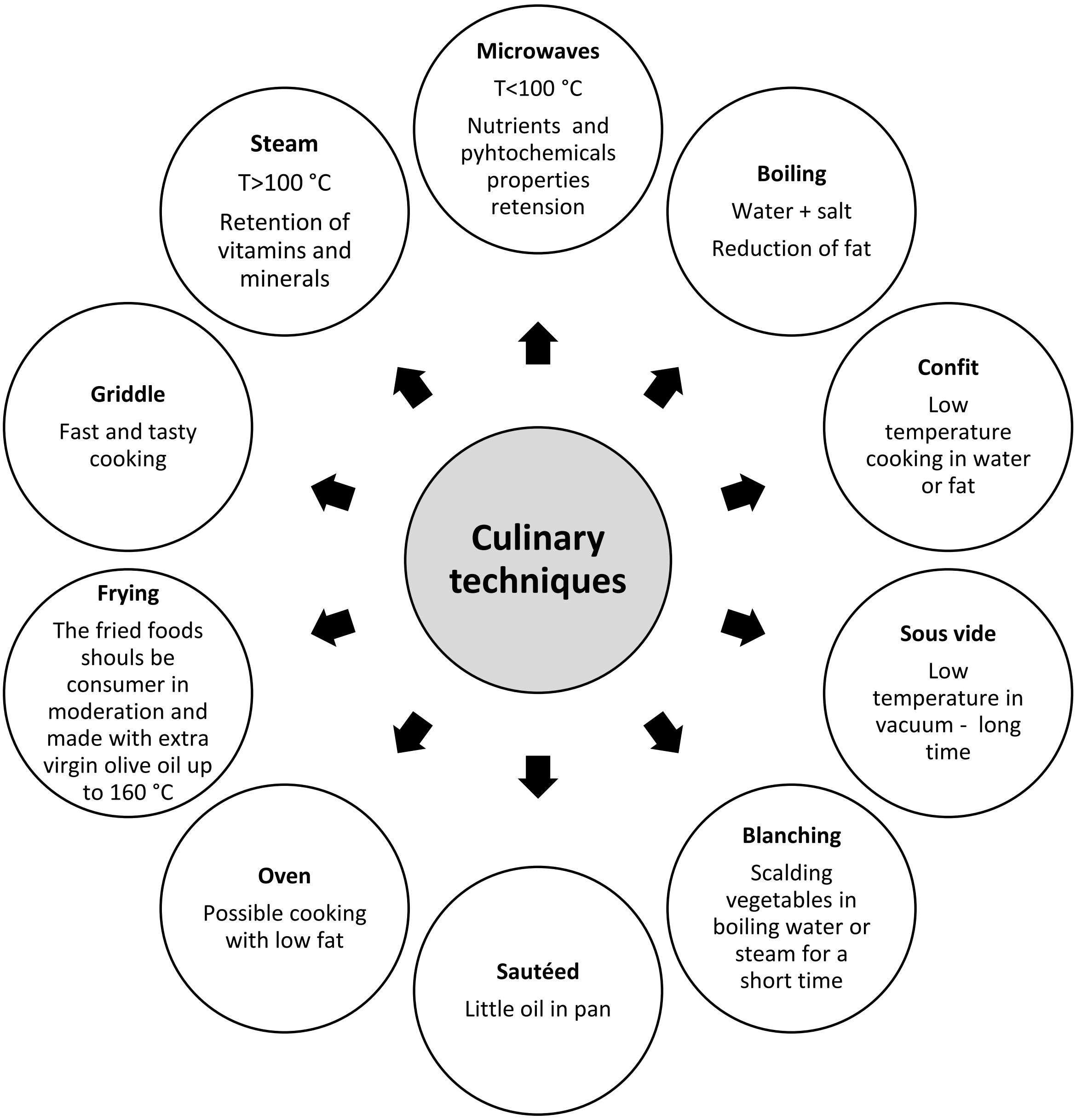


Figure 2 Impact of conventional culinary techniques on nutrient and physiochemical properties retention, fat and salt reduction (Roselló-Soto et al., 2019)

Boiling is a cooking method where food is cooked in water at high temperatures. The effect of boiling on the nutritional content of food depends on the type of food and preparation time. For example, studies have shown that boiling broccoli for more than 10 minutes decreases its acceptability, while boiling cauliflower for the same amount of time does not cause significant changes. Boiling food for an extended period, often more than an hour, is a standard practice for preparing soups and broths, particularly those with vegetables as their primary ingredients. Pressure is also a significant factor in improving the acceptability of such meals (Roselló-Soto et al., 2019).

The use of high heat during griddling or grilling leads to the formation of gas bubbles that create a soft and aerated structure in foods, such as pancakes. Similarly, grilling is a popular method for cooking meat that results in protein denaturation and the formation of a crispy layer that retains the natural juices (Roselló-Soto et al., 2019).

Blanching is a culinary process used to cook fruits or vegetables by briefly immersing them in boiling water, followed by quick cooling in ice water to stop the cooking process. This technique is commonly used to improve food quality, prevent loss of texture, and preserve the colour, flavour, and nutritional value of fruits and vegetables. Blanching is often used as a pre-treatment method before freezing, drying, or canning to inactivate enzymes, remove the peel, and modify the texture of foods (Xiao et al., 2017; Reyes De Corcuera et al., 2004).

The use of an oven to cook food is a straightforward and hygienic process that involves slow cooking at temperatures of approximately 220 °C, without the addition of much fat. This method results in the creation of a crisp outer layer that seals in the natural juices of the food. The technique also produces the distinct roasted flavor that is particularly associated with meats (Roselló-Soto et al., 2009).

To sauté means to cook food, often vegetables, in a pan or wok with a small amount of oil and continuous stirring. This method results in a crispy and tasty dish with minimal added fat (Roselló-Soto et al., 2019).

Long-time and low-temperature (LTLT) cooking, commonly known as sous vide, is a culinary technique that involves immersing food in a glass jar or a plastic pouch and cooking it in a water bath for an extended period. The temperature used is much lower than that used for conventional cooking and is precisely regulated, usually around 55 to 60 °C for red meat, 66 to 71 °C for poultry, and higher for vegetables. The primary purpose is to ensure even cooking, with the inside being properly cooked while preserving the moisture and avoiding overcooking the outside (Dominguez-Gernandez et al., 2018; Li et al., 2019).

The method of cooking food through immersion in hot oil, also known as frying, leads to the evaporation of moisture and alteration in sensory characteristics such as texture and taste. Fritters should be cooked at approximately 160°C with first-press olive oil and eaten in moderation. Deep-frying involves completely submerging food in oil at high temperatures, resulting in the formation of a crispy outer layer, which limits oil penetration inside the food. It is not advisable to reuse oil that has turned dark with remnants of previous frying because it can create harmful substances (Roselló-Soto et al., 2019).

The method of food preservation known as "confit" involves slow cooking food over an extended period. This process entails cooking food in oil, grease or sugar water (syrup) at a lower temperature than deep frying. Deep frying is typically performed at high temperatures ranging from 160 to 230 °C (325 to 450 °F), while confit is cooked at much lower temperatures, often around 90 °C (200 °F) or lower. Modern cooking commonly uses this term to describe slow cooking food in oil or fat at low temperatures (McMeel, 2013).

The microwave is a kitchen appliance that heats food by emitting high-frequency electromagnetic waves, creating friction between water molecules and rapidly heating the food to temperatures up to 100 °C in a short amount of time. Compared to other heating methods, microwaving food tends to preserve its nutritional content and sensory characteristics. However, the texture of the food may be negatively impacted because water may migrate from the inner layers of the food to the surface, where it condenses due to the lower temperature of the air surrounding the food (Roselló-Soto et al., 2019).

3.4 Convenience foods

The trend of convenience food is a significant feature of Western societies, but it is not a modern concept. The people of Ancient Rome, for instance, relied heavily on this type of food, given the absence of kitchens in their apartments. Consequently, they had to obtain their meals from cook shops in the streets. The rationale behind this lifestyle was mainly due to the high cost of firewood and to prevent the occurrence of fires that could wipe out entire cities. Presently, the use of convenience food is driven by various factors, such as the need to save time, minimize physical and mental exertions, and the growing number of individuals who are unfamiliar with cooking meals from scratch and thus rely on pre-packaged products (Jeffers, 1999; Michael Harris and Shiptsova, 2007).

3.4.1 Definition of convenience foods

Convenience foods are a primary source of sustenance for the majority of people in industrialized nations today. This is due to the urbanization of society during the 19th and 20th centuries, which led to the universal consumption of these foods. Commercial enterprises now provide most people's daily sustenance, rather than individuals relying on their own food production efforts. Convenience plays a critical role in modern food choices, with the trend having started in the Western world and now spreading globally. The increasing prevalence of drive-thru windows, microwave meals, take-out options, home grocery delivery, and online shopping underscores the importance of convenience in shaping food preferences (Wales, 1969).

When researching convenience food, many studies tend to focus solely on time as a key factor (Buckley et al., 2007). However, convenience encompasses more than just the saving of time, particularly when it comes to food preparation (Buckley et al., 2007). It also takes into account that the physical and mental exertion required for food-related activities (Buckley et al., 2007; Field and Howell, 1990). To fully understand convenience, it is necessary to consider it at all stages of food consumption and assess the relative importance that consumers assign to time and energy use during acquisition, consumption, and disposal (Brown, 1990). Mary-Ellen Wales created Table 1 to demonstrate what convenience entails at each stage of the consumption process, primarily focusing on vegetables and fruits. Although it provides examples of time and effort differences in meal preparation, it gives readers a general idea of what convenience food means (Wales, 1969).

Jaeger and Cardello (2007) contend that the concept of convenience in food should be analysed from a 'meal perspective,' rather than the 'product perspective' commonly found in literature on the topic. This method considers the 'timing of convenience,' as convenience can be experienced during one or several stages of meal preparation and consumption. The authors propose that the perceived convenience is more affected by the meal's characteristics than the product features.

Therefore, convenience attributes are measured and perceived across the entire food preparation and consumption processes, as separate constructs from time and effort, rather than in individual stages. Consequently, when selecting a food item, the decision is influenced by the larger meal context in which the product is consumed (Jaeger and Cardello, 2007).

Table 1 Convenience in meal preparation (Wales, 1969)

Consumption/ Meal production stage	What is being saved?		
	Time	**Physical effort**	**Mental effort**
Planning	Food item lists, meal plans	Fewer purchasing trips	Room for spontaneous decisions, no complex planning
Purchasing	Larger retailers with more items under one roof, internet shopping, self-check-out facilities	Internet shopping usually home-delivery based, shopping carts allow for the transportation/purchase of many items at one time	Knowing where to find products when shopping, familiar packaging
Storing/ Handling	No education needed about how to store fresh produce properly, no preserves to be made at home, no monitoring of stored items needed	Less weight to be handled (e.g. skins and non-digestible part of product), fewer/ no throwing out of expired produce or staples	Less deterrence caused by spoiled produce or staples
Preparation (Cooking)	Pre-cut and washed fruits and vegetables, kitchen tools such as food processors, microwaves, etc. speed up preparation activities, Take out, pre-made meals, ready bake food items, microwave dishes, marinated items, dishes with shorter cooking times	Physical effort saved when preparation activities such as chopping, peeling, etc. completed by food service provider, less physical effort required through the use of kitchen tools	Less knowledge regarding food preparation required when prepared items purchased, recipes/ cooking instructions on food packaging, safe-handling instructions
Eating	Containers suitable for eating	Bite-sized food, deboned meat, skinless/ boneless meat	Familiar food that children like or can be replaced quickly if they don’t like it
Disposal/Tidy-up	Throw away containers and utensils, Items purchased with proper storage container	Dishwashers	Fewer family disputes regarding tidy-up duties

Convenience food has been defined in various ways in the literature, with the majority of definitions incorporating the three elements of time, effort, and skill. Traub and Odland (1979) provide an early definition of convenience food as "Any fully or partially prepared foods in which significant preparation time, culinary skills, or energy inputs have been transferred from home kitchen to the food processor or distributor." Nowadays, the definition of convenience food encompasses not only the preparation stage of meal planning, purchasing, and cooking but also includes the stages of consumption and clean-up (Brunner et al., 2010).

The meaning of convenience food has undergone significant changes over time. The term is not clearly defined as the concept of convenience involves more than just ease of food preparation. According to Närvänen et al. (2013), the entire consumption experience must be taken into account, and factors such as not having to wait for the food can be a significant benefit. Costa et al. (2007) suggest that the concept of convenience is much broader and encompasses several factors such as where, when, why, what, how, and even with whom we eat.

Twedt (1967) proposes two main criteria for determining "convenient food": i) the added value by the manufacturer, such as instant mashed potatoes that remove the need for peeling and boiling raw potatoes, and ii) the time or effort saved by the manufacturer's processing, which is not dependent on cost or price factors. This criterion can also include levels of convenience, as some processed foods are faster and simpler to prepare than others. Table 2 gives examples of such products, with the basis of comparison being the standard basic form in which the product category is generally accessible to customers.

Table 2 Examples of standard food form and its convenient form (Twedt, 1967)

Basic standard form	Convenient form
Raw potatoes	Instant potatoes
Orange fresh-juice	Frozen orange-juice concentrate
Fresh fruits and vegetables	Frozen fruits and vegetables
Home-prepared soup	Canned, dry, and frozen soups
Ground coffee	Instant coffee
Baked bread	Baked sliced bread
Assembled ingredients	Cake mix, flour mixture

The "basic standard form" can change over time, making it difficult to measure change. Cake mix is becoming so commonly used that it may soon be considered the basic standard form, especially among younger consumers who have grown up using baking mixes. Similarly, the basic standard form of butter has evolved from cream churned at home to packaged butter, with whipped butter and individual portions now considered more convenient forms. To define a convenient food, one could consider it to be a food which, because of processing and/or packaging, is quicker or easier to prepare than the basic standard form in which the product category is generally available to consumers However, some foods that are quick and easy to prepare, like head lettuce, may not qualify as convenient because the basic standard form is the only form generally available in stores. This demonstrates that the definition of convenience can change over time, as in the case of chopped lettuce now being considered a more convenient form than a plain head of lettuce (Twedt, 1967).

3.4.2 Classification of convenience foods

Various systems for categorizing convenience foods have been suggested, some of which are based on prior processing and preparation requirements. Some of these systems are intricate, incorporating matrices with multiple levels of processing and preparation. These systems were created theoretically and confirmed with data from consumers. Some authors have classified convenience foods based on the amount of preparation required, while others have allowed consumers to determine the definition. In a recent study, four categories of convenience foods were identified using food frequency data: highly processed, moderately processed, single components, and salads. These systems indicate that convenience foods are extremely diverse, with a range of processing levels. What degree of processing characterizes convenience food is not distinctly defined and differs among consumers. For instance, some view bread and cheese as convenience foods, while others do not. Nonetheless, ready-to-eat meals are generally considered convenience foods (Brunner et al., 2010; Närvänen et al., 2013; Twedt, 1967).

3.4.3 Ready-to-eat meals (RTE)

In September 1917, the US Army's food division was established to ensure soldiers' nutritional needs were met while reducing food waste. To achieve this goal, the division created specific portion RTE meals that would satisfy soldiers' appetite, increase efficiency, and reduce waste. As the soldiers' load was supposed to consist of weapons and ammunition, the meals had a higher caloric density and lower water content. To prevent spoilage, packaging advancements were introduced. Over time, these meals evolved to provide a longer shelf life, safety, and convenience to the consumer. In 1980, they went into full production and reached the food market in 1983 (Feagans et al., 2010).

Packaged precooked foodstuffs that require minimal preparation before consumption are known as ready-to-eat meals. They are sold in grocery stores or delivered by food or catering services and can be hot or cold, fresh or frozen, and fully prepared. Researchers have varying definitions of these meals, with some defining them as complete meals that require few or no additional ingredients and can replace the main course prepared at home. The food industry generally defines ready meals as pre-prepared main courses that can be reheated in their containers, requiring no further ingredients and only minimal preparation before consumption. Many studies have explored this category of food, including Spencer (2005), Costa et al. (2001), Geeroms et al. (2008), Mahon et al. (2006), Nielsen (2006), Pandrangi and Balasubramaniam (2005), and Howard et al. (2012).

As stated in the 2020 report on data and trends in the food industry of the European Union (EU), the ready meals sector is ranked the third most innovative food industry worldwide (FoodDrinkEurope, 2021). Statista (2021) predicts that in 2021, the per capita consumption of ready meals will reach 15 kg, generating a revenue of 73.08 euros per person. In 2019, the global revenue from ready-to-eat meals was 98.12 billion USD, with Europe leading in revenue at 29.83 billion USD. The global revenue is expected to rise to 122.95 billion USD by 2024, with Europe accounting for 39.36 billion USD. In Hungary, the revenue of the RTE market was €359 million, and it is anticipated to increase to €474 million by 2025 (Statista, 2021).

The popularity of "convenience food" has risen recently, even though there is no agreed definition of this term. Typically, these kinds of foods are defined by their ability to save the customer time, energy, and decision-making processes before, during, and after eating. Convenience encompasses more than just cooking; it also refers to accessibility and purchasing options. These foods can be consumed as a whole meal, part of a meal, or as a snack and are available in various forms, such as chilled/frozen, vacuum-sealed, and canned. Some writers differentiate between easy-to-prepare foods and ready-to-eat (RTE) meals, which are seen as the most extreme form of easy-to-prepare food since they require no additional cooking. Consumers can purchase RTE meals and convenience foods from retailers, takeaway shops, or via home delivery services. However, it's important not to confuse ready meals with takeaway and fast-food or canned food since the former typically requires some cooking or microwaving in its own container before serving (Geeroms et al., 2008; Verriet, 2013; Scholliers, 2015).

3.4.4 Types and labelling of RTE meals

Regulation No 1169/2011 of the European Parliament and of the Council regulates the provision of food information to consumers in the European Union, serving as the basis for Member State regulations. In Hungary, the relevant decree is the 36/2014. (XII. 17.) decree of the Minister of Agriculture, which defines prepacked and non-prepacked food. As per Regulation 1169/2011 from the European Parliament and Council, prepacked food refers to a single item consisting of food and its packaging, which is presented to the final consumer or mass caterers. The packaging must remain unopened and unchanged, preventing the contents from being modified without opening or altering it. However, the regulation doesn't cover foods packed on the customer's request or prepacked for direct sale (EU, 2018).

As per Regulation 1169/2011 of the European Parliament and Council regarding food information to consumers, it is compulsory to provide information about allergens and intolerances present in non-prepacked food. Annex II of the Regulation presents a roster of these substances and products. If non-prepacked food is sold via distance, then the needed information about prepacked food, excluding nutrition labels, should be added to the selling material to be accessible to the final customer before purchasing.

According to the definition given, there are two categories of ready-to-eat meals. The first type includes RTE meals that are pre-packaged and sold in grocery stores, and their contents cannot be changed without opening the packaging. The second type consists of ready-to-eat meals made by food catering companies that provide single-dose portions and are prepared for direct sale. These are considered non-prepacked food items because food intended for direct sale is not pre-packaged by definition.

In the Table 3 there is a summary of the differences between RTE meals according to whether they are commercialized in prepacked or non-prepacked form.

The importance of RTE labelling is linked to its status. According to EU regulation 1169/2011, prepacked foods must have nutrition and allergen labelling on their packaging, while non-prepacked products only require allergen labelling. Therefore, most single-serving food companies do not provide nutrition labelling on RTE meal packaging, although there are some exceptions. Additionally, many RTE food labels lack allergen information, which is crucial for consumers' health. In some cases, a product label may list ingredients but omit nutrition information. If consumers want to know the nutrient content of the product, they typically need to access the manufacturer's website, not the product label, at the time of consumption. This is beneficial because it enables consumers to make informed purchasing decisions based on the product's nutritional value.

Table 3 Differences between RTE meals' types (EU, 2018)

Characteristics	**Ready-to-eat meals sold in groceries (Prepacked food)**	**Ready-to-eat meals sold by single-dose food delivery service (Non-prepacked food)**
Main ingredients	Any food material	Any food material
Food additives	Typically added	Typically not added
Preservation method	Heat treatment, chemical preservatives. In case of metal tin can, sterilization is used.	Heat treatments as normal kitchen technique (cooking, boiling, roasting, sous vide cooking, etc.) Rapid refrigeration after cooking as well as storage and transport at the appropriate temperature
Packaging material	Metal tin can Plastic tray with aluminium foil lid Glass Paper box	Plastic or aluminium tray covered by plastic foil or aluminium film
Serving size	One or two portion in one package	Only one portion
Shelf life	Dependent of the preservation method and packaging material (from 6 days to 5 years)	Not more than 48 hours
Storage and transportation	Dependent on the preservation method and packaging material, products in metal tin can and glass can be stored at room temperature. Products in plastic tray and paper box must be stored not higher than 4°C	Chilled, at temperature not higher than 4°C
Availability	Groceries, supermarkets, stores, vending machines	Website and printed flyers of the food business operator
Distribution	Groceries, supermarkets, stores, vending machines	Only by food delivery services operated by the manufacturer
Purchase	Directly in groceries, supermarkets, stores	By telephone or via the Internet
Food category	Prepacked food	Non-prepacked food
Type of manufacturing company	Large-scale or small and medium-size food producers	Catering businesses and kitchens

Table 3 Differences between RTE meals' types (EU, 2018) cont.

Declared information to costumers according to 1169/2011/EC		
Name of the products	Obligatory, published on the label	Obligatory, published on the label
List of ingredients	Obligatory, published on the label	Obligatory, typically published on the website of the company
Any ingredient or processing aid causing allergies or intolerances used in the manufacture or preparation	Obligatory, published on the label	Obligatory, typically published on the website, or on the printed flyer, but on the packaging material, as well
Quantity of certain ingredients or categories of ingredients	Obligatory, published on the label	Obligatory, published on the label
Net quantity of the food	Obligatory, published on the label	Obligatory, published on the label, on the website or on the printed flyer
Date of minimum durability ('best before' date) or the 'use by' date	Obligatory, published on the label	Obligatory, published on the label
Any special storage conditions and/or conditions of use	Obligatory, published on the label	Obligatory, published on the label
Name or business name and address of the food business operator	Obligatory, published on the label	Obligatory, published on the label
Country of origin or place of provenance where provided	Obligatory, published on the label	Obligatory, published on the label
Instructions for use	Obligatory, published on the label	Obligatory, published on the label
Nutrition declaration	Obligatory, published on the label	Voluntary, typically published on the website or on the printed flyer or sometimes on the label

An imbalance between calorie consumption and expenditure, caused by an increase in calorie-dense foods that are rich in fat and sugars, can lead to non-communicable diseases, such as obesity. RTE meals are often linked with these health issues (Jabs and Devine, 2006; Celnik et al., 2012), although limited research has been conducted on their relationship with health. Nonetheless, studies have indicated that RTE meals are generally high in calories, salt, and fat, and excessive consumption of these meals can increase the risk of obesity and non-communicable diseases (Duffey et al., 2009; Ssewanyana et al., 2018). For more information on this topic, please refer to the results and discussion section.

3.4.5 Drivers of convenience foods' consumption

Brunner et al. (2010) conducted a study with 918 participants to determine the factors that drive the consumption of convenience food. The participants were asked to complete a survey comprising 17 commonly consumed convenience food items, 14 possible drivers, and 7 sociodemographic questions. The convenience food items ranged from pre-washed salads to instant pasta, and were categorized into four groups - highly processed, moderately processed, single components, and salads - using a principal component analysis. Regression analysis was used to examine the potential drivers for each category separately.

The consumption of convenience food is primarily influenced by age, as revealed in the study. Older individuals are less likely to consume convenience food regardless of its category, as they have more time to cook and may prefer preparing meals from scratch. Additionally, those who prioritize naturalness in their food choices tend to avoid processed foods, with the exception of salads that remain unaltered by cutting and washing. Another significant factor is nutritional awareness, which affects the consumption of highly processed foods, single components, and salads. Consumers who are knowledgeable about nutrition may avoid highly processed foods and single components due to concerns about additives and preservatives. However, most moderately processed foods are fresh and equivalent to self-prepared meals, so consumers with a high level of nutritional knowledge are likely to purchase them (Brunner et al., 2010; Lehner, 2005). For more information, please refer to the results and discussion section.

Brunner et al. (2010) reported that the consumption of highly and moderately processed food items is significantly influenced by three factors. These factors are the presence of children in a household, a desire to avoid waste, and cooking skills. For households with larger families, preparing meals from scratch may be more efficient, and parents may opt for natural ingredients to avoid additives and preservatives that are commonly found in processed foods. People who aim to minimize food and packaging waste tend to consume fewer moderately processed food items and single components. A lack of cooking skills is another driving factor in the consumption of highly and moderately processed food items, as individuals with lower cooking skills may resort to these convenient options (Buckley et al., 2007).

Brunner et al. (2010) also states that unique drivers influence convenience food categories. Highly processed food items are affected by employment status and social factors, with part-time or unemployed individuals consuming more of these foods. Moderately processed food items are driven by educational attainment, with those who are more educated consuming more of these products. Three drivers influence single components: value for money, household size, and physical exertion. Consumers who have a smart shopper mentality tend to purchase single component products, which often include items that are easy to prepare, and children enjoy, which may explain the correlation with household size. For salads, consumers who consider convenience foods to be overpriced compared to their quality are likely to purchase fewer of these items.

It is worth mentioning here the usual drivers that affect convenience foods which are: lack of time, too much stress, limited food preparation skills, and social norms. Such results were found in many research that investigated the factors influencing convenience demand (Candel, 2001; Scholderer and Grunert, 2005; Mahon et al., 2006)

3.5. Public catering

Molnár et al. (2016) suggest that the incidence of nutrition-related illnesses is on the rise globally, including Hungary. To reduce the occurrence of these diseases, several measures have been taken worldwide, and Hungary is following suit by promoting healthy eating habits and increasing public health awareness. Rather than treating illnesses, health services and governments have come to recognize the importance of prevention.

Molnár et al. (2016) explain that public catering involves providing food to groups of people of varying ages, genders, and occupations, such as children and youths in schools, college and university students, employees, prisoners, homeless people, patients, and social care residents. Public catering has a significant role in improving public health by meeting consumers' energy and nutritional needs and promoting healthy diets. It is crucial for public caterers to satisfy consumers' expectations regarding the quality and quantity of meals, and to encourage healthy eating habits both in theory and practice. Public caterers have a greater responsibility when serving a larger variety of consumers and serving more meals. It is especially important to control the food that children in social care and educational institutions consume since their health consciousness, dieting behaviours, habits, and taste preferences are still being formed at these ages, which will greatly impact their adult habits and preferences.

3.6 Types of catering services

Czarniecka-Skubina and Rutkowska (2015) note that the concept of catering varies between countries and includes various types. For instance, in Great Britain, catering can be categorized into traditional, contract, franchise, popular, systemic, and function catering. Traditional catering encompasses small businesses, while contract catering involves a signed agreement between the service provider and the recipient. Franchise catering utilizes a franchise system, and popular catering targets a wide audience. Systemic catering is aimed at specific markets, while function catering includes events such as weddings, banquets, cocktail parties, and business meetings. Conversely, in the United States, catering encompasses banquet hall services, off-premise catering for private homes and clubs, and mobile catering that utilizes trucks specially designed for meal distribution.

The text states that catering services can be divided into several categories, such as social catering, office catering, air catering, railway catering, and commercial catering. Office catering, also known as "door to door service," offers pre-packaged food for consumption in the workplace, including salads, sandwiches, confectionery, readymade food, and hot dinners. Companies also provide food and drink services to secretariats as part of the overall workplace service in a "room service" system. Orders are typically placed by phone, and larger orders are contracted to negotiate meal prices and offer free transportation. The meals are transported in specialized packaging and disposable tableware to maintain the proper temperature. The popularity of this type of ready-made meal is evident in Hungary, making it a focal point in the dissertation (Czarniecka-Skubina and Rutkowska, 2015).

3.7 Chefs influence on health

According to Vandana and Kusuma (2017), the most essential aspect that affects the diversity and taste of food products in a food and catering service establishment is the role of the chef. To meet the growing demand of health-conscious consumers, it is crucial for the chef to possess knowledge, attitude, and practices pertaining to nutrition and health.

Due to population growth, urbanization, and an increase in female employment, the trend has shifted from traditional home-cooked meals to using external sources of food supply. However, this has resulted in a rise in metabolic diseases such as obesity, diabetes, and cardiovascular disease, which is a growing concern (Vandana and Kusuma, 2017). Addressing the obesity epidemic requires modifying the eating environment, especially those that promote appropriate energy consumption (Sallis and Glanz, 2009). Promoting healthier diets and sustainable food systems is critical to reducing lifestyle-related morbidity and mortality and preserving the world's ecosystems (Willett et al., 2019). Chefs are crucial in shaping consumer eating habits and transforming food systems (FAO & UNESCO, 2019). Food consumed away from home has become a significant component of the eating environment, accounting for nearly one-third of total calorie intake and more than half of household food expenditures in the US (Todd, 2017). Similarly, in Hungary, households spent 2,142,480 million HUF annually on restaurants and hotels in 2019 (Statista, 2022c). Therefore, chefs have a unique opportunity to influence Americans' dietary intake by ensuring the nutritional quality of food consumed away from home (Yoon et al., 2020).

The role of culinary educators, chefs, cooks, and culinary students, in promoting healthier meal options is often overlooked, despite their significance in the foodservice industry (Hamm et al., 1995). Cooks and chefs have a direct impact on the consumer experience in foodservice environments, yet their eagerness to promote healthy alternatives is often lacking. The restaurant industry presents unique opportunities for chefs to shape customer eating habits by offering reduced-calorie options when dining out. A report by the Keystone Center for the U.S. Food and Drug Administration in 2005 emphasized the need to encourage low-calorie and less calorie-dense foods while discouraging the marketing of high-calorie and high-density food portions, in order to influence consumer behaviour (Keystone, 2006). The report also stressed the importance of providing menu options with lower energy density (calories per weight) to prevent obesity. Health-care providers are usually the primary focus when addressing health risks, but the role of foodservice workers and trainers cannot be ignored.

Despite the recommendation of nutrient content of meals by nutrition experts and agencies, kitchen workers like chefs can also play a role in promoting public health by offering healthier meal options that appeal to customer's taste preferences. However, chefs often face challenges such as customers' preference for less healthy and high-calorie items, staff's lack of knowledge and skills in preparing healthier options, and higher ingredient costs that may reduce the profitability of healthier meals. Interestingly, some chefs reported their own unhealthy eating habits due to the unavailability of quality vegetables and fruits at their workplace (Mahadevan and Feldman, 2011). Nonetheless, a recent survey revealed that nearly all chefs believed that calories in a dish could be reduced by 10-25% without affecting its taste. While old perceptions still exist regarding the difficulty of reducing calories while maintaining flavour, chefs can significantly influence the culinary landscape and provide healthier options (Gillis et al., 2020). In the early 1990s, a study of culinary students stated that nutrition was only "somewhat important."

The impact of famous chefs has stretched beyond the kitchen, influencing public opinion, commercial interests, and governmental policy regarding nutrition and sustainability issues (Giousmpasoglou et al., 2020). Despite chefs' optimistic attitudes toward promoting nutrition, this does not always lead to improved nutritional knowledge or the production of healthier meals (Friesen et al., 2002; Lessa et al., 2017). Although no research has been conducted in Hungary, celebrity chefs, authors, and presenters have gained prominence in the United Kingdom in recent years. According to a study, terrestrial TV stations broadcast 18 hours of cooking programs each week, with two popular shows, "Can't Cook, Won't Cook" and "Ready Steady Cook," attracting between one and two million viewers, or 20% of the viewing public. Although the audience for these programs is typically low-income and working-class, "Ready Steady Cook" attracts more than three million viewers, with equal viewership from middle and working-class viewers (Caraher et al., 2000). The increasing number of food service centers presents a difficult challenge for chefs who must balance the need to provide nutritious and tasty food while also being economically feasible. This has created a demand for trained chefs and other personnel in food service management (Vandana and Kusuma, 2017).

4. MATERIALS AND METHODS

4.1 The types of meals examined and related definitions

Traditional meal: A meal was considered a "traditional meal" if all the ingredients and preparation methods in the recipe were mainly traditional as known to the people from the same nation.

The national cuisine of Hungary features classic dishes that use authentic ingredients and flavourings such as pig, fat, quark, shallot, ground chili pepper (*Capsicum annuum* L.) (known as őrölt piros paprika), pickled cabbage, dried legumes, and sour cream (tejföl). National cooking techniques, such as sweating, browning, caramelizing shallots, thickening with flour and sour cream or fat, utilizing smoked fat or ham, and pickling vegetables, are used to prepare these meals. Examples of classic dishes include paprikás csirke (a creamy paprika-flavoured chicken stew), stuffed cabbage, beef goulash (known as pörkölt) with small dumplings (nokedli), lentil stew or pottage with meatloaf, Viennese schnitzel, Bakony-style pork stew with pasta, potato and sausage casserole, stuffed peppers in tomato sauce with boiled potatoes, and lecsó (a stew made with onions, peppers, and tomatoes). The classic dishes were chosen from national cookbooks like Gundel (1937) and Horváth (2006).

Innovative meals: In other words, meals that use non-traditional ingredients and seasonings or incorporate modern kitchen techniques or machines are considered "innovative meals." For example, the use of Indian curry as an ingredient, sous-vide as a technique, or Pacojet as a device would qualify a meal as innovative. If such ingredients, techniques, or machines were not traditionally used by the people of the same nation and the style and ingredients are similar to those popular in restaurants today, the meal would be considered innovative.

Ready-to-eat meal (RTE meal): A pre-prepared main course that can be reheated in its container for no more than 15 min and requires no additional ingredients Howard *et al.* (2012).

Main course: A meal that is consumed at lunch and represent a main meal to people from the same nation.

Single dose delivery service: A food delivery company that is a trendy part of the Hungarian catering industry. Their popularity increased during the lockdown caused by the coronavirus epidemic in 2020 and 2021. Single-dose meals can be ordered by the consumer based on menus on companies' websites or printed flyers. The product, packaged in a sealed plastic tray with a label mainly containing the name, weight, and shelf life of the product, is delivered to the house by the company, and only heating is required before consumption.

Prepacked meals: prepacked meals refer to meals that are packaged and sold in a ready-to-eat form. These are typically convenient, quick, and easy to prepare, and often come with portion control. They can be found in grocery stores, supermarkets, or even ordered online.

Non-prepacked meals: Non-prepacked meals, on the other hand, are meals that are not packaged or processed, but rather made fresh, often from raw ingredients.

4.2 Reference values

Energy: There is no specific recommendation on the energy distribution of meals throughout the day. Typically, people have four eating occasions consisting of breakfast, lunch, evening meal, and snacks. The most significant contributions to daily energy intake are usually lunch and evening meals, with a perceived 30-30% contribution each. Breakfast and snacks make up half of the remaining 40% (Nutrition Advice Team, PHE 2017; Wang et al., 2013). Although there is no practical guidance on the contribution of each meal, various countries have instituted regulations for public catering that define the proportion of energy content for lunch at approximately 35% of total daily energy intake. For example, Hungary, Spain, the Czech Republic, and Moldova (EU commission, 2015; FAO, 2019; Ministerial Decree of Ministry of Human Resources, Hungary, 37/2014. [IV. 30.], 2014). The European Parliament and Council Regulation 1169/2011 establishes the daily reference intake for energy for adults at 8,400 kJ or 2,000 kcal. Main dishes are assessed based on 35% of this recommended energy intake, which equals 700 kcal (EU, 2018).

Macronutrients: We used the World Health Organization's population nutrient intake goals to establish our recommended intake levels for saturated fat, sugar, and macronutrients that help prevent chronic diet-related diseases. According to WHO, these nutrients should account for 15-30% of energy intake for fat, less than 10% of energy intake for saturated fatty acids, 55-75% of energy intake for carbohydrates, less than 10% of energy intake for sugar, and 10-15% of energy intake for protein (WHO, 2003).

Sodium and fiber: Special indexes developed by Howard et al. (2012) were used to compare the sodium and fiber content in a meal. According to EU regulation 1169/2011, which sets reference values for energy (8.4 MJ) and salt/sodium (5 g/2 g), a sodium content of 0.2 g/MJ means that values above this do not meet the international sodium recommendation. For fiber, the European Food Safety Authority (EFSA) (2010) recommends a daily intake of 25 g and with an energy intake recommendation of 8.4 MJ, a value greater than 3 g/MJ must meet this recommendation.

4.3 Comparison of traditional and modern meals: Jordan and Hungary

4.3.1 Selection of recipes

The selection of main course recipes was done randomly, with the only requirement being that the meal is typically eaten as a main course. This meant that soups, sweet dishes, and side dishes eaten alone were excluded. However, if a main course is typically eaten with a side dish, that side dish was considered. There were no dietary restrictions on the meals selected, such as being gluten-free, lactose-free, sugar-free, or low in carbohydrates (Kiss et al., 2020).

We obtained 40 Jordanian recipes from the online platform of a renowned and celebrated Jordanian cook, Manal Alalem. The Arabic website featured not only recipes but also videos that were useful in demonstrating kitchen techniques. Occasionally, the methods depicted in the videos were essential for making accurate nutrient calculations.

The collection of the Hungarian recipes (n=40) was sourced from four books, including three popular traditional cookbooks, and one book containing novel recipes. These books are named as follows: i) The classic Hungarian cuisine (Horváth, 2010), ii) Aromas of Hungary (Unger, 1994), iii) Fresh Hungarian recipe book (Kalla, 1998), and iv) Top recipes from Budapest Business School (edited by Lugasi, 2019).

All recipes were for 4 persons, the nutrients were calculated based on this. List of Hungarian and Jordan meals and their ingredients and some pictures on these meals are present in Appendixes A and B. It is worth to mention that the meals were not physically prepared at a kitchen, only the ingredients were taking under consideration.

4.3.2 Calculation of the nutritional values of the selected meals

The macronutrients and micronutrients, including energy (kcal, kJ), carbohydrate (g), protein (g), fat (g), fibre (g), and sodium (mg), for one serving of each meal were calculated using two software programs based on the specified raw ingredients in the recipes. One of the software programs employed was ESHA Food Processor® Nutrition Analysis (ESHA, 2023), a globally recognized program with an exhaustive and thorough database of foods and ingredients. The other program used was NutriComp DietCAD (NutriComp, 2023), a Hungarian software designed for nutritionists and dieticians, featuring a tool for nutrition planning and an extensive database of raw food materials with nearly 1600 food contents and a wide array of nutrients.

If an ingredient for a meal was not found in the software, it was replaced with the closest available item. For instance, the nutritional information for white rice was used as a substitute for basmati rice. If there was no suitable replacement available, the nutritional information was manually inputted. To avoid variations in ingredient weight between the two software programs, all ingredients were recorded in grams.

4.4 Examination of Hungarian ready-to-eat meals

4.4.1 Selection of ready-to-eat meals sold in groceries and delivered by catering industry in Hungary

Our criterion for selecting the types of RTE meals was that the meal should be a main dish, thus excluding soups, side dishes, sweets, and special diets such as vegan, low carb, low fat, gluten-free, lactose-free, and others. To verify that the meals typically consisted of a protein source such as meat, fish, cheese, or quark, a starchy element such as potatoes, rice, pasta, or noodles, a vegetable portion, and a sauce, we examined the list of ingredients. Moreover, we assessed the meal's components to ensure that it accurately represented a main course. As a result, we discovered that each dish contained a complete protein.

In March 2020, data on nutritional information for 177 ready-to-eat (RTE) meals packaged by 15 different commercial brands were collected from grocery stores in Hungary, with the aim of collecting data on all relevant products available at the time. The products were searched for on the websites of major and minor food retail chains and food industry enterprises. The prepacked meals were labelled as whole foods and were packaged in plastic trays (34%), paper boxes (11%), glass containers (6%), or metal tin cans (49%). These meals were available in leading supermarkets in Hungary and the label instructions stated that no additional ingredients were required for preparation. Based on the list of ingredients on the label, 104 and 73 items were classified as traditional or innovative, respectively. Appendix C includes some samples.

In a separate investigation, we acquired the nutritional information for 1017 non pre-packaged RTE meals transported by the leading seven food delivery companies in Hungary between March 1st, 2020, and May 31st, 2020. To classify the meals furnished by the catering industry, we depended on the ingredient lists published on the corporation's webpage, partitioning them into traditional and advanced meals (477 and 540 items, respectively). Certain illustrations of the specimens are available in Appendix D. It is worth to mention that we did not have any information regarding the sales of these meals.

In both surveys, we enlisted the expertise of gastronomy specialists, who are culinary instructors at the Department of Hospitality, Faculty of Commerce, Hospitality, and Tourism, Budapest Business School (Budapest, Hungary). These specialists have years of experience in the culinary field and were responsible for selecting the traditional and innovative meals.

4.4.2 Collection of nutritional data

To gather nutritional information for our evaluation, we consulted the labelling and online portals of food service companies. We recorded the data on the energy (kcal), carbohydrate (g), sugar (g), protein (g), fat (g), saturated fatty acids (g), and salt (g) contents per one serving and 100 g of the RTE meals. However, the majority of prepacked RTE meals sold in groceries did not list their fiber content on the label, so we excluded this variable when assessing meals sold in supermarkets. Likewise, for most meals delivered by food services, their websites did not indicate their fiber content, hence we could only evaluate the fiber content of 103 meals (55 from the traditional group and 48 from the innovative group). Also, we excluded the salt content of a few prepacked RTE meals sold in supermarkets (n = 6) owing to their high salt content (e.g., 25 g in one portion). We used the salt content information provided on the meal's label or food service website to estimate the sodium content per serving of each meal.

The WHO guidelines were used to compare the energy percentage derived from macronutrients listed on the label with the re-evaluated energy, as there was often a discrepancy between the energy indicated on the label/website and the energy calculated based on the macronutrients listed on the same label/website.

4.5 Examination of nutritional content and organoleptic characteristics of non-prepacked ready-to-eat and home-made meals

4.5.1 Samples

Three food delivery companies provided ten non-prepacked ready-to-eat (RTE) meals, which were traditional Hungarian dishes such as beef stew with red wine and tarhonya (a special Hungarian pasta), roasted chicken liver with boiled potatoes, meat casserole with cauliflower, grilled chicken breast, cream cheese sauce, and jasmine rice. The weight of each dish was measured, including any separate parts such as toppings, side dishes, sauces, or dressings. This measurement was essential to ensure the dishes could be prepared at home with the same ingredients and nutrients. The companies' websites provided all the necessary ingredient and nutrient information for the products. The ten meals were acquired on three separate occasions in August, September, and October of 2021.

The ten meals used in the study were also prepared as home-made (HM) meals in the study kitchen at the Department of Hospitality Faculty of Commerce, Hospitality and Tourism Budapest Business School, (Budapest, Hungary). The HM meals were prepared by kitchen experts and their recipes were compiled based on the ingredients and weight of individual parts of the RTE meals, as well as the traditional preparation methods. To ensure consistency, the HM meals were prepared at three different times, in September, October, and November 2021, with three independent replicates for each RTE and HM meal.

The ten meals are:

1. Fried pork ribs with sour cream, grated cheese and potatoes with parsley (RS)
2. African catfish fillet in fresh basil sauce, potato croquette (AH)
3. Brasov stew (BAP)
4. Broccoli layered with chicken, cheese and eggs (CSTB)
5. Grilled chicken breast, cream cheese sauce, jasmine rice (GCS)
6. Meat casserole with cauliflower (HRK)
7. Roasted chicken liver with boiled potatoes (CSM)
8. Székely cabbage (SZK)
9. Vasi steak with mashed potatoes and onions (VPHT)
10. Beef stew with red wine and eggs barley (VM)

Both types of meals are shown in Appendix (E) in the appendixes section.

4.5.2 Sensory analysis

Five sensory panellists, trained according to Hungarian Standard MSZ ISO 6658:2018 (Nébih, 2013), assessed the meals for appearance, consistency, smell, and taste using a specialized device developed by the National Food Chain Safety Office for sensory evaluation in public catering. The evaluations were rated on a scale from one to five, with a predetermined weighting factor assigned to each trait, and the scores were summarized. The assessment sheet can be found in Appendix F.

4.5.3 Nutritional analysis

To eliminate measurement errors, one portion of each meal was homogenized using a specialized kitchen tool that grinds all ingredients into very small grain sizes. The dry material, fatty acid composition, salt, and macronutrient contents of the meals were analysed. The macronutrient content was determined following the Official Methods of Analysis of AOAC International, using the Soxhlet (AOAC, 2005a), Dumas (AOAC, 2005b), and total carbohydrate (AOAC, 2016) methods to determine fat, protein, and carbohydrate, respectively.

The crude fat was determined using a semi-automatic system (SOXTHERM 2000, Gerhardt, Germany). The crude protein determination was carried out with the analysis of total nitrogen by whole combustion of the sample under oxygen (Elementar, Rapid cube, Germany). Total carbohydrate was measured titrimetrically after a long acidic hydrolysis based on classical Schoorl method. For the determination of sugar content, a titrimetric Luff-Schoorl method was used without acidic hydrolysis. Mohr's method (Mohr, 1856) was used to determine the salt content The energy content was calculated numerically from the macronutrients' analytical results. For the measurement of fatty acids as fatty acid methyl esters (FAMEs), a gas chromatographic method was used based on an international (ISO 12966-4:2015) and a Hungarian Standard (MSZ 19928:1986).

4.6 Chefs' Perception of Nutrition and Health in Hungary

In order to evaluate chefs' perception of nutrition and health, we created a questionnaire by modifying and expanding previous surveys conducted by Johnson et al. (2002) and Vandana and Kusuma (2017) based on Palmer's and Leonto's (1995) survey. We distributed the questionnaire via Google Forms to 2,446 hospitality businesses in Hungary with permanent kitchens, including restaurants, bistros, grill bars, and public catering services, between March 2021 and January 2022. We collected email addresses using a systematic Google search method based on Hungary's regions and capital. A total of 190 complete responses were received, after excluded responses from consumers, waiters, salespeople, and consultants from the analysis (number of excluded responses are ten).

The questionnaire contains 2 sections. The first section includes 9 questions on demographic information, such as position, gender, age, qualification, work experience, establishment type, establishment location, consumers' nationality, and age of the respondent. The second section of the survey contains 30 statements/questions aimed to assess chefs' perceptions towards health and nutrition. This section is divided into 4 parts, each part focused on a particular aspect of health and nutrition. The 4 parts are: perception on health (7 statements), perception on nutrition (5 statements), perception on nutrition practices (10 statements), and perception on consumer concern (8 statements). Respondents were asked to use 5-point Likert scale where '1' stands for strongly disagree, '2' disagree, '3' neutral, '4' agree, '5' strongly agree. To read the full questionnaire, please look at Appendix (G) in the appendixes section. Table 4 represents the demographical information on our sample.

Table 4 Demographical profile of the respondents

Question	Answers	Number of respondents	Percentage (%)
Position	Chef/Cook	103	54
	Owner/Manager	87	46
Gender	Male	128	67
	Female	62	33
Age	<25	12	6
	≥25 to ≤40	67	35
	>40	111	59
Education	Cooking education	88	46
	Non-cooking education (university or high school)	102	54
Work experience	< 15 years	75	39
	>15 years	115	61
Type of establishment	Restaurants	158	83
	Public catering services	9	5
	Bistro	23	12
Location	Capital	107	56
	Big city	35	19
	Small town and village	48	25
Consumers' nationality	Local	80	42
	International	17	9
	Both	93	49
Consumers' age	<18	3	2
	18-34	45	23
	35-35	135	71
	>55	7	4

4.7 Consumers' belief and attitude regarding the healthiness of RTE meals in Hungary

For the purpose of assessment of the Hungarian consumers' beliefs and attitude towards RTE meals, we developed a questionnaire that consists of 30 questions dividing into 2 parts. The first part contains 8 demographical questions on gender, age, weight, height, qualification, income, location and occupation, which are showed in Table 5 and Figure 3. The second part contains 22 questions to assess the Hungarian consumers' belief and attitude regarding RTE meals' healthiness and consumption. To read the full questionnaire, please look at Appendix (H) in the appendixes section.

The data collection was carried out by ResearchCenter Ltd. (Budapest, Hungary) on its own panel - and to a lesser extent with the involvement of a partner panel - between September 15 and 28, 2022. A multi-stage, proportionally stratified probability sampling method was used to prepare the sample, resulting in a representative sample of the 18-65-year-old (economically active) internet-using adult population obtained along the dimensions of gender, age, region (EU NUTS1), education (primary+secondary vs. higher education) and type of settlement. The confidence interval of the used sample of 1,000 persons is +/- 3.1%. This means that referring to the entire sample, the reported data do not differ from reality with a probability of 95%. At the same time, within this range, the measured data are the most probable values, so they can be projected onto the entire population. The questionnaire was designed and put together by the researchers. The agency gave some suggestions regarding the structure and the rotation of some questions only (In case of Q1, Q3, Q5, Q8, Q16, Q18, Q19, Q21 the answers were rotated when respondents completed the questionnaire.)

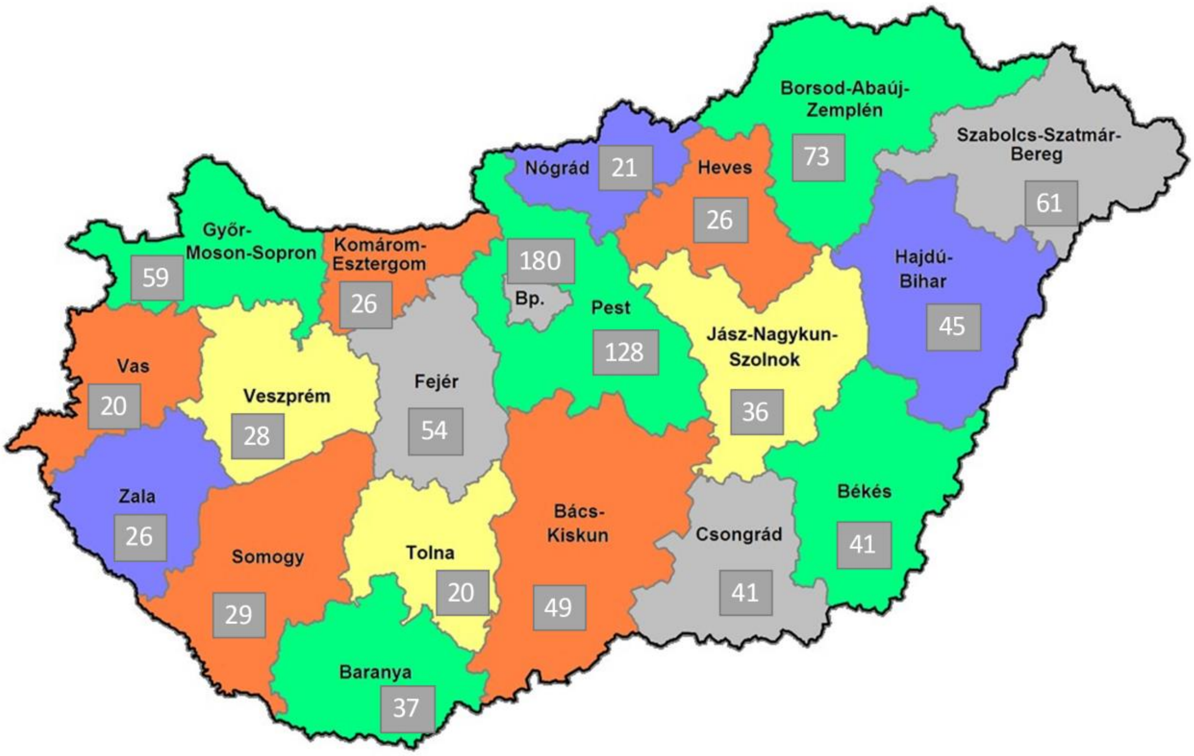


Figure 3 Locations of the respondents

Table 5 Demographical profile of the respondents

Question	Answers	Number of respondents.	Percentage (%)
Gender	Male	470	47
	Female	530	53
Age	18 – 34 years	260	26
	35 – 49 years	279	28
	> 50 years	461	46
BMI (n=958)	Underweight	32	3
	Normal	333	35
	Overweight	336	35
	Obese	257	27
Education	Elementary school	72	7
	High school graduation	504	50
	University, college	211	21
	Vocational school	199	20
	Scientific degree (PhD, DSc)	14	2
Income	I can live from my income, but I can't put it aside	483	48
	I can live from my income, and I can put a little aside	275	28
	I have significant savings	23	2
	It is hard living from my income	219	22
Occupation	Retired	320	32
	Employee	490	49
	I don't work at a workplace, I'm at home, my partner works	51	5
	Unemployed	60	6
	Self-employed	23	2
	Student, college / university student	29	3
	Business owner	6	1
	Other	21	2

4.8. Statistical analysis

In this subchapter, all statistical methods that were used to analyse the data from all the researches are discussed. All statistical analyses were performed using the R software (R CORE TEAM, 2017) and SPSS v 28 software (IBM, 2022).

4.8.1. Comparison of traditional and modern meals: Jordan and Hungary

Using the Wilcoxon test, the percentage of energy per serving in the meals was compared to 700 kcal, and the macronutrient energy percentage in the meals was compared to the nutrient intake goals recommended by WHO (WHO, 2003) to prevent chronic diet-related diseases. The nutritional content per serving for each meal was calculated by dividing the total content by the number of servings in the recipe.

4.8.2. Examination of Hungarian ready-to-eat meals

The statistical analysis was conducted by employing the Wilcoxon-test, which was introduced by Wilcoxon in 1945, to compare the nutrient contents and energy percentage from daily reference intake in the traditional and innovative groups of RTE meals. Additionally, the energy percentage from macronutrients was compared with the nutrient intake objectives established by the World Health Organization (WHO) in 2003 for preventing chronic diseases related to diet. The researchers also evaluated the sodium density, which was determined to be 0.2 g/MJ. To assess any significant differences between the ratios of meals within the recommended nutrient range, the $\chi 2$ test introduced by Pearson in 1900 was utilized. For both tests, a significance level of α = 0.05 was used.

4.8.3. Examination of nutritional content and organoleptic characteristics of non-prepacked ready-to-eat and home-made meals

A multivariate analysis of variance (MANOVA) was used to check if there is a significant difference between both meals' nutritional contents and organoleptic characteristics. Moreover, we used descriptive analysis to display fatty acids composition and independent samples t-test was used to compare the total sensory evaluation score of both meals. 95% Confidence Interval method and independent samples t-test were used to compare the analytical values with the values on the nutritional labels of RTE meals.

4.8.4. Chefs' perception of nutrition and health in Hungary

To analyse the responses received from chefs and culinary personnel, we used the Mann-Whitney U Test and the Kruskal-Wallis Test to compare groups and descriptive analysis.

4.8.5. Consumers' belief and attitude regarding the healthiness of RTE meals in Hungary

We used descriptive analysis and cross tabulation to test if the consumption of RTE meals is independent from the variables (gender, age, BMI, education, income and occupation).

5. RESULTS AND DISCUSSION

This section is divided into five parts. Each part will contain the research's results and discussion of each research done for the objectives mentioned in the objective part of the dissertation.

5.1 Nutritional value of traditional and modern meals: Jordan and Hungary

5.1.1 Nutrients in Jordanian meals referring to the recommendations

The median energy percentage of meals, energy percentage from macronutrients, as well as fiber and sodium density for meals in Jordan are presented in Table 6. None of the Jordanian meals met all of the recommended nutrient values. The table also shows the count of meals that met each specific WHO nutrient recommendation.

There was no significant difference observed between the recommended value and the energy content of some meals that were either higher or lower. The deviation from the recommendation was not one-sided. The *p* values of Table 6 indicate that the carbohydrate content of Jordanian meals is significantly lower than the lower end of the recommendation, while the sugar and saturated fatty acids content meet the recommendation of less than 10% of energy. The protein content significantly exceeds 15% of energy. The fat content significantly exceeds the upper limit of the recommendation. Based on the data calculated from recipes, Jordanian meals do not meet the recommendations for sodium and fiber.

Assunção et al. (2017) justify the differences between the two software by the assumption that the nutrient levels vary based on several factors, such as the food's geographical location, growing conditions, environment, harvest, preparation, and analysis methods. This assumption is based on the variety of nutrients present in the different food composition tables, which serve as the database in these software programs.

5.1.2 Nutrients in Hungarian meals referring to the recommendations

Table 7 displays the median percentage of energy from meals, energy percentage derived from macronutrients, and the fiber and sodium densities for Hungarian meals. All of the Hungarian meals failed to meet the recommended nutritional guidelines. Moreover, Table 7 illustrates the number of meals that met each nutrient-specific WHO recommendation.

The discrepancy from the recommended energy content of 35 E% in Hungarian cuisine is notable, based on calculations from both ESHA and NutriComp software, unlike in Jordanian cuisine. The median of carbohydrate and sugar energy ratio for main courses was below the recommended lower limit, while the energy ratios of protein and fat content exceeded the upper limit of the recommendation. However, the median for saturated fatty acids, fiber, and sodium did significantly differ from the recommendation.

Table 6 Median percentage of energy from meals, energy derived from macronutrients, and sodium and fiber density of Jordanian meals calculated with two different nutrient calculation software (ESHA and NutriComp)

Nutritional content	**Jordan**				**No. within recommendation value**		**Recommended value**	**Alternative hypothesis**
	ESHA (median)	***p*-value[1]**	**NutriComp (median)**	***p*-value[1]**	**ESHA**	**NutriComp**		
Energy% (kcal)	27.5	>0.05	30.3	>0.05	0	0	35% (700 kcal)[2]	is not 35%
Carbohydrate (E%)	44.1	<0.05	46.2	<0.05	7	10	55-75 %	less than 55%
Sugar (E%)	3.6	<0.05	3.2	<0.05	33	39	<10%	less than 10%
Protein (E%)	21.1	<0.05	22.8	<0.05	5	4	10-15 %	greater than 15%
Fat (E%)	37.9	<0.05	34.7	<0.05	10	10	15-30 %	greater than 30%
Saturated fatty acids (E%)	9,1	<0.05	8.9	<0.05	23	19	<10%	less than 10%
Fiber (g/MJ)	2.22	>0.05	2.02	>0.05	13	14	>3.0[3]	greater than 3 g
Sodium (g/MJ)	0.55	>0.05	0.42	>0.05	5	3	<0.2[4]	less than 0.2 g

[1] Wilcoxon test comparing recipes with recommended value.
[2] 35% of the total daily intake of calories (2000 kcal)
[3] Based on 8.4 MJ/day (2000 kcal/day) diet and recommended daily fibre intake of >25 g.
[4] Based on 8.4 MJ/day (2000 kcal/day) diet and recommended daily sodium intake of <2 g.

Table 7 Median percentage of energy from meals, energy derived from macronutrients, and sodium and fiber density of Hungarian meals calculated with two different nutrient calculation software (ESHA and NutriComp)

Nutritional content	**Hungary**				**No. within recommendation value**		**Recommended value**	**Alternative hypothesis**
	ESHA (median)	***p*-value[1]**	**NutriComp (median)**	***p*-value[1]**	**ESHA**	**NutriComp**		
Energy % (kcal)	46.4	<0.05	42.1	<0.05	0	0	35% (700 kcal)[2]	is not 35%
Carbohydrate (E%)	30.3	<0.05	26.4	<0.05	1	1	55-75 %	less than 55%
Sugar (E%)	5.0	<0.05	3,8	<0.05	34	36	<10%	less than 10%
Protein (E%)	19.9	<0.05	22.3	<0.05	4	4	10-15 %	greater than 15%
Fat (E%)	52.3	<0.05	49.8	<0.05	4	3	15-30 %	greater than 30%
Saturated fatty acids (E%)	14.9	>0.05	17.3	>0.05	5	4	<10%	less than 10%
Fiber (g/MJ)	1.91	>0.05	2.16	>0.05	8	9	>3.0[3]	greater than 3 g
Sodium (g/MJ)	0.39	>0.05	0.39	>0.05	2	2	<0.2[4]	less than 0.2 g

[1] Wilcoxon test comparing recipes with recommended value.
[2] 35% of the total daily intake of calories (2000 kcal)
[3] Based on 8.4 MJ/day (2000 kcal/day) diet and recommended daily fibre intake of >25 g.
[4]Based on 8.4 MJ/day (2000 kcal/day) diet and recommended daily sodium intake of <2g.

5.2 Nutritional content of prepacked RTE meals sold in groceries and non- prepacked RTE meals delivered by catering industry in Hungary

5.2.1 Nutrients in different types of prepacked ready-to-eat meals sold in groceries

In this study, the examined pre-cooked dishes are commonly formulated as a substitute for a single main course and retailed in supermarkets. The package sizes of these dishes corresponded to one serving, with weights varying between 330 g and 500 g (n=177). If the package size was intended for two servings, we modified the nutritional information to reflect the nutrient content per serving.

The nutrient composition of 177 prepacked, ready-to-consume meals marketed in major supermarkets in Hungary is presented in Table 8. These meals are divided into two categories: traditional Hungarian and innovative. The median energy content per serving was 432 kcal, with a significant variation ranging from 259 to 1009 kcal. The fat content per serving ranged from 2.0 to 58.4 g, with a median of 18.0 g, while the saturated fat content varied from zero to 19.2 g, with a median of 6.8 g. The carbohydrate content per serving ranged from 5.3 to 93.1 g, while sugar content ranged from 0 to 56 g. The protein content per serving ranged from 1.2 to 52.4 g, with a median of 46.5 g, while the sodium content per serving varied from 0 to 2.89 g/MJ, with medians of 8 g and 1.26 g/MJ, respectively.

In terms of per serving, the conventional dishes had noticeably lower energy, carbohydrate, and protein amounts compared to the creative ones, whereas they contained substantially higher fat and sodium levels. The variations in saturated fat acids and sugar content, however, were not statistically significant.

The energy percentage derived from daily reference intake (2000 kcal), energy derived from macronutrients, and sodium (g/MJ) across different kinds of RTE meals are shown in Figure 4. In comparison to the innovative dishes, the conventional Hungarian meals demonstrated a noteworthy reduction in energy (as a percentage of the daily recommended value of 2000 kcal) and energy obtained from carbohydrates and protein. Conversely, the creative meals presented significantly lower energy derived from fat, saturated fatty acid, sugar, and sodium.

Table 8 Median of nutrients per portion of ready-to-eat meals sold in leading supermarkets in Hungary

Meals	**Energy (kcal)**	**Fat (g)**	**Saturated fatty acid (g)**	**Carbohydrate (g)**	**Sugar (g)**	**Protein (g)**	**Sodium (mg)**
	in one portion median [interquartile range]						
Traditional, n=104 (for sodium, n=102)	411 [364-482]	19.4 [14.0- 27.0]	6.8 [4.0-9.5]	41.2 [26.4-52.0]	7.8 [4.9-26.1]	17.6 [14.3-23.4]	2914 [1829-3145]
Innovative, n=73 (for sodium n=69)	463 [374-552]	14.8 [10.0-23.1]	6.6 [2.8-9.2]	56.1 [38.8-68.0]	8.0 [4.5-12.8]	22.8 [20.1-28.4]	1297 [1179-1961]
p-value*	0.021	0.001	0.241	<0.001	0.080	<0.001	<0.001

*Wilcoxon test comparing nutrients in traditional and innovative meals

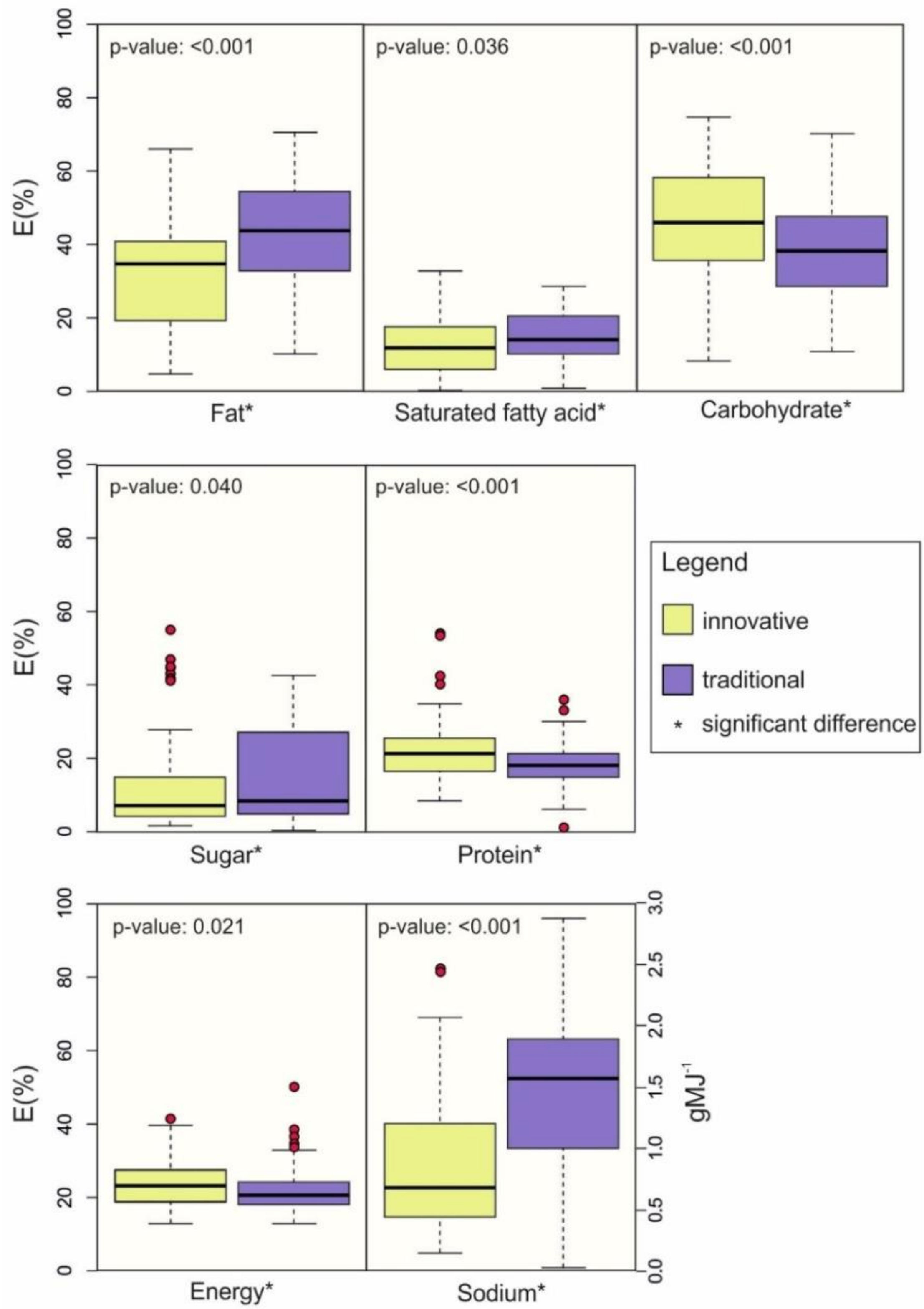


Figure 4 Boxplots of energy derived from daily reference intake (2000 kcal) and sodium (g/MJ) in ready-to-eat meals sold in leading supermarkets in Hungary

(In this context, energy refers to the percentage of energy derived from daily reference intake (2000 kcal). The energy derived from each macronutrient, including fat, saturated fatty acid, carbohydrate, sugar, and protein, is also represented. The sodium content of a single serving meal is indicated as g/MJ. Outliers are indicated by red dots. Statistical differences were calculated using the Wilcoxon-test, with p<0.05.)

5.2.2 Nutrients in the prepacked RTE meals sold in groceries referring to the recommendations

In Table 9, the median percentage of energy derived from macronutrients, energy from daily reference intake, and sodium density of RTE meals are shown. None of the meals met the WHO nutrient intake goals for preventing diet-related diseases. The fat, saturated fatty acid, and protein intake goals were exceeded in the RTE meals, while the energy derived from carbohydrates was below the recommended level in both traditional and innovative meals. Only innovative meals met the recommended value for sugar intake. The protein content in both groups of RTE meals exceeded the recommended level. Figure 5 depicts the number of meals that met specific criteria in traditional and innovative meals, with both having a higher number of meals meeting only the sugar recommendation and a lower number of meals meeting the sodium recommendation.

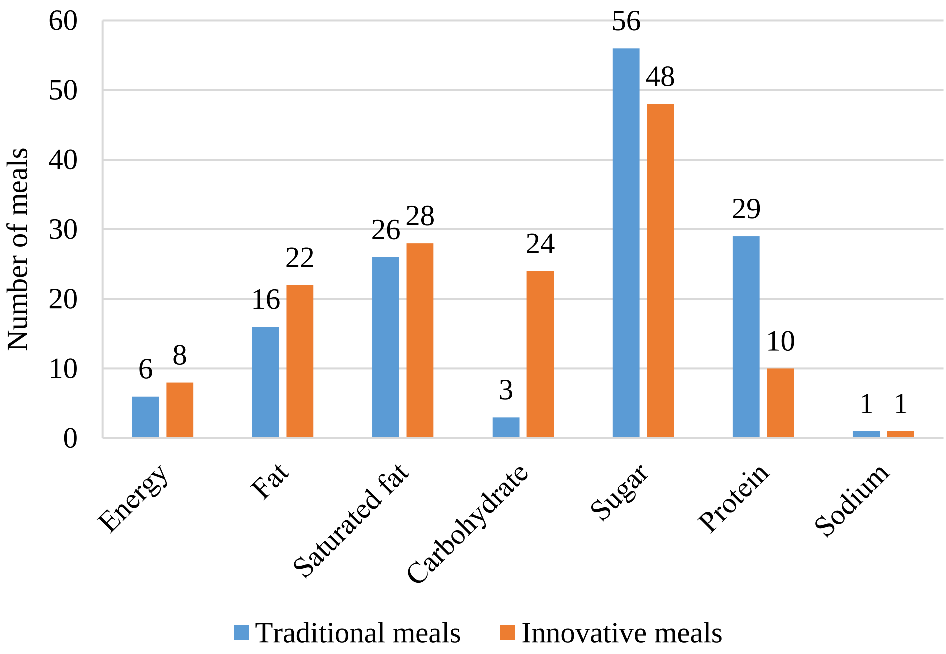


Figure 5 Number of prepacked RTE meals sold in groceries that met a specific criterion

Table 9 Median percentage of energy derived from daily reference intake (% of 2 000 kcal), energy derived from macronutrients and sodium density of RTE meals

Nutrients	**Meals**						**Recommended value**	**Alternative hypothesis**
	Traditional (n=104, for sodium, n=102)		**Innovative (n=73, for sodium, n=69)**		**Total (n=177, for sodium, n=171)**			
	Median (Interquartile range)	***p*-value[1]**	**Median (Interquartile range)**	***p*-value[1]**	**Median (Interquartile range)**	***p*-value[1]**		
Energy (E%)	20.6 [18.2-24.1]	<0.001	23.1 [18.7-27.6]	<0.001	21.6 [18.4-25.8)	<0.001	35% (700 kcal)[2] (30-35%)	Is not 35%
Fat (E%)	43.6 [32.7-54.0]	<0.001	34.5 [19.1-40.6]	0.172	38.0 [29.0-49.1]	<0.001	15-30%	>30%
Saturated fatty acid (E%)	13.8 [10.1-20.4]	1.000	11.7 [5.8-17.4]	0.991	13.2 [9.3-19.9]	1.000	<10%	<10%
Carbohydrate (E%)	38.2 [28.6-47.3]	<0.001	45.9 [35.5-58.2]	<0.001	43.0 [32.1-49.9]	<0.001	55-75%	<55%
Sugar (E%)	8.0 [4.4-26.4]	0.996	6.8 [3.8-14.4]	0.049	7.7 [4.3-20.4]	0.884	<10%	<10%
Protein (E%)	17.9 [14.5-20.9]	<0.001	21.0 [16.0-25.2]	<0.001	18.9 [15.1-23]	<0.001	10-15%	>15%
Sodium (g/MJ)	1.59 [1.03-1.91]	1.000	0.70 [0.46-1.22]	1.000	1.26 [0.65-1.71]	1.000	<0.2[3]	<0.2

[1] Wilcoxon test comparing energy and nutrients' energy percentage of ready meals to recommendations
[2] 35% of the total daily intake of calories (2 000 kcal)
[3] Based on 8.4 MJ/day (2 000 kcal/day) diet and recommended daily sodium intake of <2 g.

The $\chi 2$ tests in Table 10 indicate the significant differences between traditional and innovative RTE meals in meeting the recommendations for fat, carbohydrates, and protein. Innovative meals had a significantly higher proportion of fat and carbohydrates that complied with the recommendations. However, traditional RTE meals had a higher proportion of foods that met the recommendation for protein content.

Table 10 Results of $\chi 2$ tests conducted on the number of traditional and innovative meals that meet the recommendations

Nutrients	**Traditional**	**Innovative**	***p*-value**
	proportion of meals meet the recommendation, %		
Energy (% of 2000 kcal)	5.8	11.0	0.208
Fat (E%)	15.4	30.1	0.019
Saturated fatty acid (E%)	25.0	38.4	0.057
Carbohydrate (E%)	2.9	32.9	<0.001
Sugar (E%)	53.9	65.8	0.113
Protein (E%)	27.9	13.7	0.025
Sodium density (g/MJ)	0.98	1.45	1.000*

*χ^2 approximation may be not correct, because the expected counts within the recommendation are too small in the categories (<5). The Yates continuity correction was used.

5.2.3 Nutrients in different types of non-prepacked RTE meals delivered by food services

Figure 6 illustrates that traditional Hungarian RTE meals had significantly higher energy content, energy derived from fat, saturated fatty acid, and sodium content when compared to innovative meals, in terms of percentage of the daily recommended value of 2000 kcal. In contrast, innovative meals had significantly higher energy derived from carbohydrates, sugar, and protein. However, there was no significant difference in fiber content per energy unit between the two types of meals.

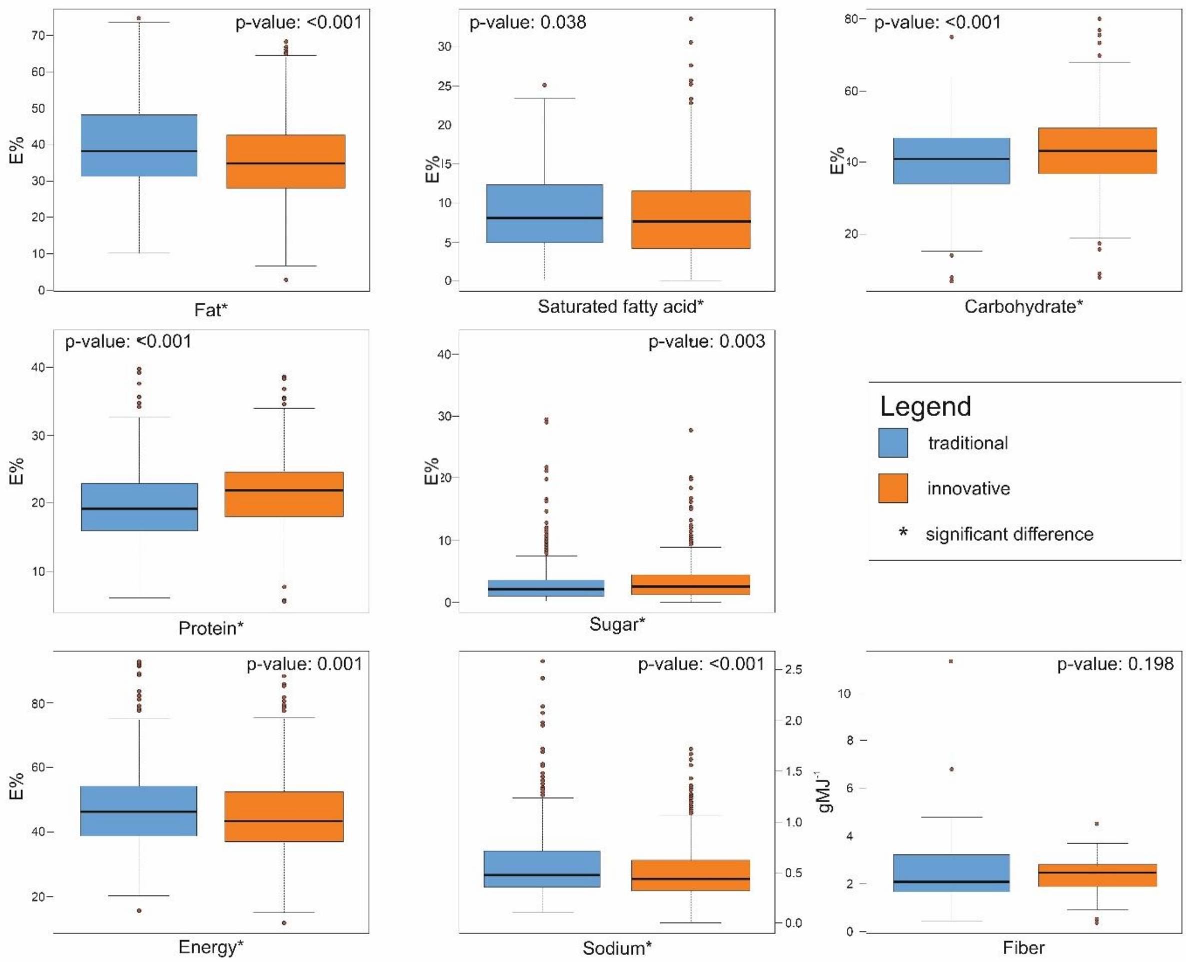


Figure 6 Boxplots of energy derived from daily reference intake (2000 kcal), sodium and fiber (g/MJ) of RTE meals delivered by food services in Hungary (traditional n= 477, for fiber n=48; innovative n=540, for fiber n=55)

(The daily reference intake (2000 kcal)-derived energy percentage is represented by the term "energy" in the lower left corner of this figure, whereas "fat," "saturated fatty acid," "carbohydrate," "sugar," and "protein" refer to the energy derived from the respective macronutrient. "Sodium" and "fiber" denote the sodium and fiber content of a single-serve meal expressed as g/MJ. The significant differences were calculated using the Wilcoxon test, with a significance level (α) of 0.05.)

According to the results of the $\chi2$ test presented in Table 11, there are notable dissimilarities between the conventional and modern RTE dishes in fulfilling the guidelines for energy, fat, carbohydrate, protein, and sodium. The innovative dishes exhibited a significantly greater ratio of meals that satisfied the recommendations for energy, fat, carbohydrate, and sodium, whereas the conventional RTE dishes had a higher proportion of meals that fulfilled the requirement for protein. The number of meals that met specific criteria in both conventional and modern dishes is depicted in Figure 7, with each having more meals that only fulfilled the sugar recommendation and fewer meals that fulfilled the sodium recommendation.

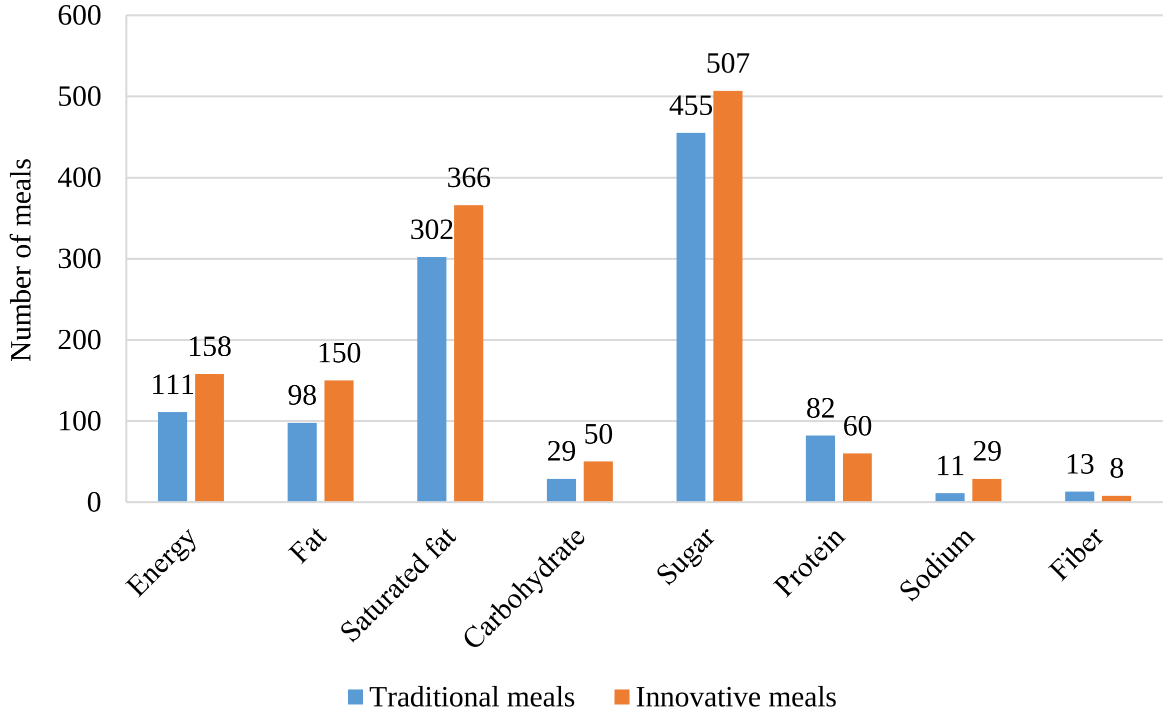


Figure 7 Number of non-prepacked RTE meals delivered by food services that met a specific criterion

Table 11 Results of χ^2 tests conducted on the proportion of the traditional and innovative meals that meet the recommendations (α=0.05)

Nutrients	**Traditional**	**Innovative**	***p*-value**
	proportion of meals meet the recommendation, %		
Energy (% of 2000 kcal)	23.3	29.3	0.015
Fat (E%)	20.5	27.8	0.004
Saturated fatty acid (E%)	63.3	67.8	0.067
Carbohydrate (E%)	6.1	9.3	0.029
Sugar (E%)	95.4	93.9	0.146
Protein (E%)	17.2	11.1	0.003
Sodium density (g/MJ)	2.3	5.4	0.006
Fiber density (g/MJ)	27.1	14.5	0.058

5.2.4 Nutrients in the non-prepacked RTE meals delivered by food services referring to the recommendation

In this study, the RTE meals examined were intended to substitute for one main course and were delivered to homes or workplaces by the company. The meals were packaged in sealed plastic trays and labelled with the product name, weight and shelf life. Heating the meals was the only required preparation before consumption. As a result, one serving size corresponded to the package size of the meals, which ranged from 250 g to 500 g (n=1017).

The median value of the total energy amount per serving of RTE meals was 900 kcal, but there was a wide variation between 236 to 1858 kcal. The quantity of fat per portion ranged from 2.0 to 131 g, with a median value of 36.3 g. For each serving, the amount of saturated fatty acids ranged from 0.0 to 41.6 g, with a median value of 7.8 g. The median values for carbohydrates, sugar, protein, sodium, and fiber per serving were 92.5 g, 5.2 g, 46.2 g, 1.7 g, and 7.6 g, respectively. However, the amount of each nutrient varied considerably, with the lowest and highest values being 12.0 and 253 g for carbohydrates, 0 and 68.3 g for sugar, 6.8 and 97.9 g for protein, 0 and 9.0 g for sodium, and 1.2 and 25.0 g for fiber (n=1017).

In this study, both traditional and innovative RTE meals were examined, and neither met the nutrient intake objectives established by the WHO to prevent diet-related diseases. The amount of energy, fat, and sodium expressed as g/MJ, as well as the percentage of daily reference intake derived from 2000 kcal, exceeded the recommended levels. Figure 8 demonstrates that the carbohydrate energy content of both meal types was below the recommended levels, whereas the protein energy content exceeded the recommendations. Only a small number of samples satisfied the fiber content requirement, while both meals met the recommendations for sugar and saturated fatty acid content, as depicted in Figure 9.

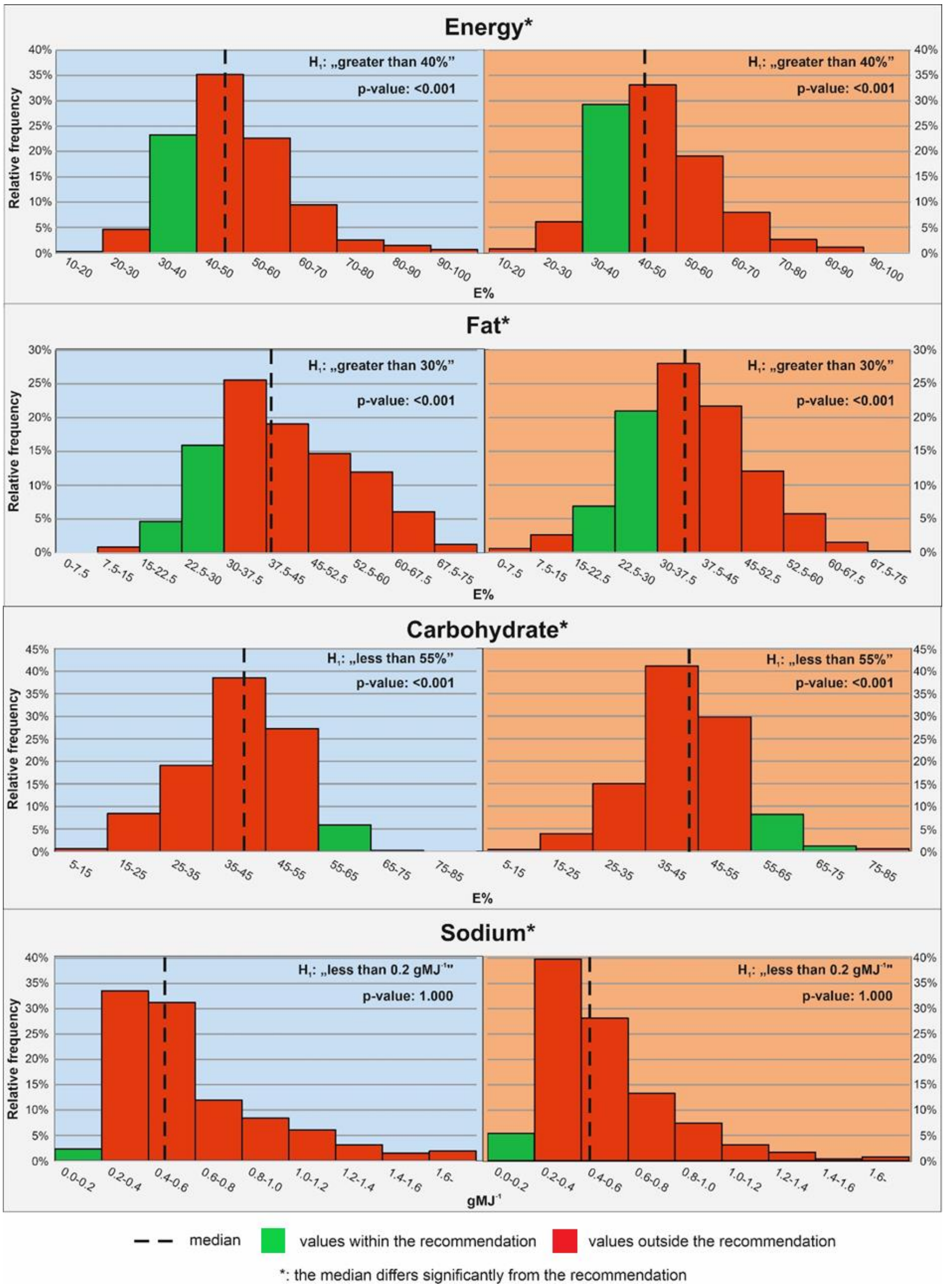


Figure 8 Histograms of the energy percentage derived from the daily reference intake (2000 kcal), energy% derived from fat and carbohydrate, and the sodium content (g/MJ) of two types of RTE meals: traditional (n=477, on the left with a blue background) and innovative (n=540, on the right with an orange background)

(Wilcoxon-test was used to compare the energy and nutrients' energy percentage of ready meals to recommendations at α=0.05. The nutrients in meals were compared to the WHO recommendation and to the Hungarian Ministerial Decree published in 2014; a 35% of the total daily intake of calories [2000 kcal]. The sodium recommendations were based on 8.4 MJ/day diet and recommended daily sodium intake of 2 g.)

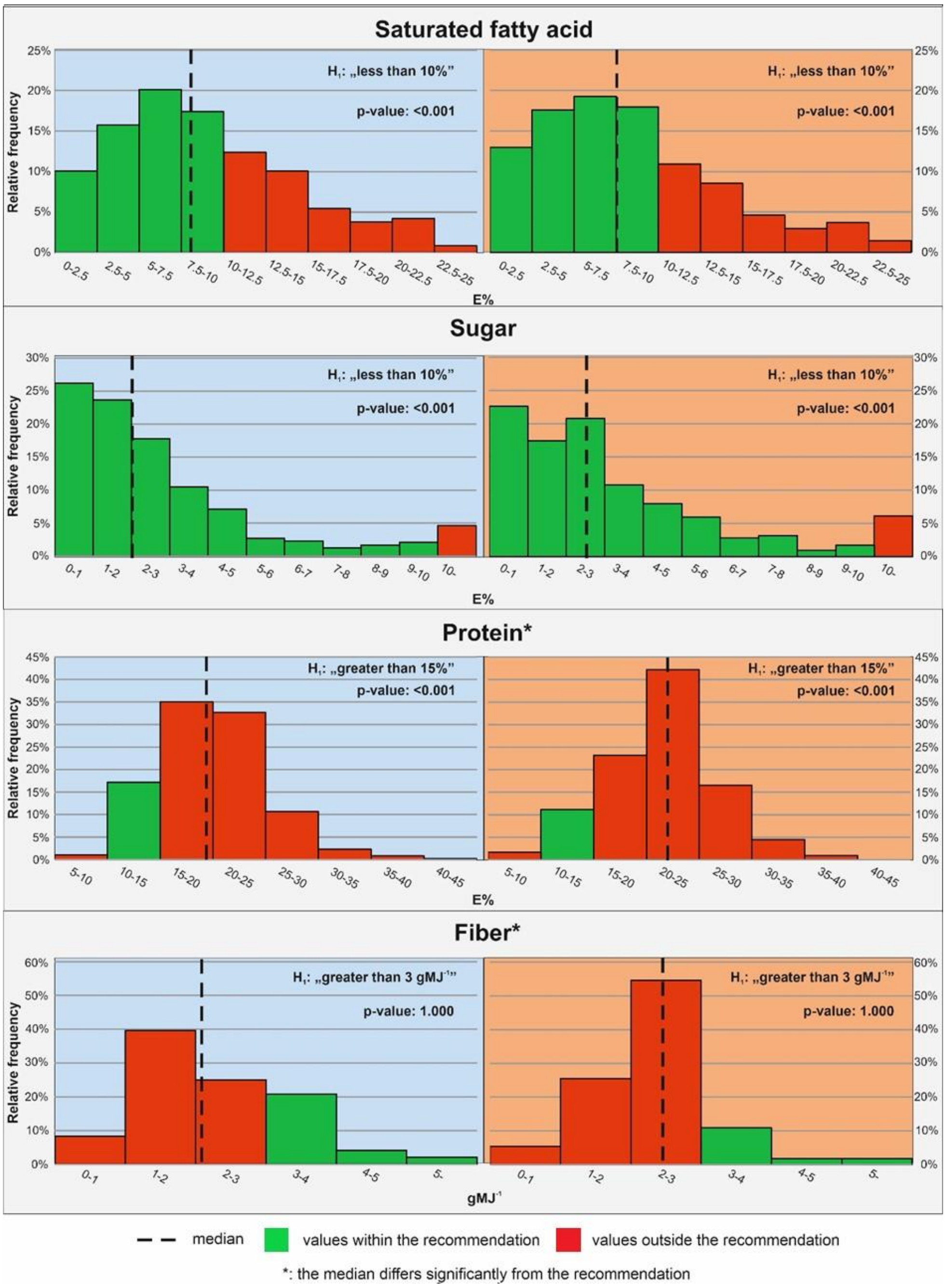


Figure 9 Histograms of the energy% percentage derived from saturated fatty acids, sugar and protein, and the fiber content (g/MJ) of two types of RTE meals: traditional (n=477, for fiber n=55, on the left with a blue background) and innovative (n=540, for fiber n=48, on the right with an orange background)

(Wilcoxon-test was used to compare nutrients' energy percentage of ready meals to recommendations at α=0.05. The meals were compared to the WHO recommendation. The fiber recommendation was based on 8.4 MJ/day diet and recommended daily fiber intake of 25 g.)

Despite the lack of studies on ready-to-eat meals in Hungary, previous research in different countries has examined the nutritional composition of ready meals. This was done by analyzing the nutritional information labels provided by manufacturers, which is similar to the approach taken in this study. Howard et al. (2012) examined the energy and macronutrient content of 100 own-brand ready meals sold by top UK supermarkets, using the label information. The authors compared the nutrient levels in these meals to the nutritional recommendations provided by the WHO and discovered that none of the ready meals met the WHO's recommendations. These findings are consistent with the findings of the current study.

In their research, Kanzler and colleagues (2015) analysed 32 ready meals, including main dishes, that were sold in continental Europe and were either chilled, frozen, or heat-treated. The researchers found that 50% of the meals were nutritionally imbalanced, with high levels of fat (more than 30% of energy) and low levels of carbohydrates (less than 50% of energy). The protein content of the meals was generally higher than recommended.

In a cross-sectional study, Remnant and Adams (2015) investigated the nutritional composition of 166 ready-meals sold in UK supermarkets. The authors found that RTE meals had high levels of salt and saturated fat but low levels of sugar. They concluded that these supermarket RTE meals did not meet the nutritional requirements of a healthy diet. These findings are consistent with the results of our study, which revealed high levels of fat and salt in RTE meals.

Using the traffic light labelling system, Kim and Kim (2019) analysed the nutritional value of 506 ready meals in South Korea. They discovered that only 0.2% and 5.9% of the meals received all four and three green lights, respectively, while 42.3% of meals received no green lights. Similarly, Hillier et al. (2020) examined 1681 chilled and frozen ready meals from 10 UK supermarket websites using the same labelling system. The authors found that while 46% of meals were rated green for one Front of Pack nutrient, only 6% of meals received green ratings for all four nutrients. Despite the use of the traffic light system to evaluate the healthiness of meals, both studies provide evidence supporting our finding that ready meals generally fail to meet nutritional guidelines.

Kim and Choi (2020) conducted a comparative analysis of 80 ready-to-heat meal replacements in South Korea and restaurant foods to assess their levels of fat, sugar, and sodium. The researchers observed that the total sugar content per serving and the total saturated and trans fatty acid content in both home meal replacements and restaurant foods were within the recommended daily intake limits. However, the sodium content per serving was relatively high, consistent with our study's findings that ready meals tend to have high salt levels. Although our results differ from the authors' regarding fat content, with our study finding high levels of fat and saturated fatty acids in ready meals, we both agree that ready meals are typically high in salt.

According to Benkhard and Halmai (2017), the Hungarian cuisine is mainly characterized as Central European, with influences from Eastern Europe and Columbia. Key ingredients in Hungarian cuisine include tomato, potato, *Capsicum* sp, and sunflower seed. Lunch is considered the most important meal of the day in Hungary and traditionally consists of multiple courses, although modern times have moved towards a single course. The main course typically includes meat or other protein sources, accompanied by a high-carbohydrate side dish, and sometimes salad or pickled vegetables. Hungarian main dishes come in two variations, with or without a side dish. Common side dishes are rich in carbohydrates, such as potatoes prepared in various ways, and rice, pasta, or vegetable stews or soups are also frequently consumed. Some dishes require an obligatory side dish, like nokedli served with paprikás csirke (a type of noodle). It's also typical to use toppings or bread with some Hungarian dishes, such as stuffed cabbage (töltött káposzta) served with bread and sour cream.

Meat, especially pork and chicken, is a staple of Hungarian cuisine, along with lard, sunflower oil, seasonal fruits and vegetables, wheat bread, pasta, potato, rice, eggs, and dairy products such as cheese (Gundel, 1937; Horváth, 2006; Tusor, no date). The cuisine is known for its extensive use of high-fat smoked pork products. In addition to the ingredients, the cooking methods used in Hungarian cuisine are unique, typically involving a fatty base made from lard, wheat flour, and ground red pepper (őrölt paprika), followed by toasting, steaming, and thickening with flour and sour cream.

According to Nagy et al. (2017), the Hungarian population's salt intake is significantly higher than the recommended value of 5g/day due to the high salt levels in both traditional dishes and pre-packaged food. Women's salt intake is approximately 11.1 g/day, and men's salt intake is around 15.8 g/day, which is two to three times higher than the recommended value.

Stefler et al. (2020) highlighted in newly released research that the traditional dietary practices may be a factor in the poor health condition and high CVD mortality rates of Eastern European populations. While only Russia, Poland, and the Czech Republic were examined in this study, Hungarian society's history, location, and culinary traditions are very comparable to those countries, indicating that unhealthy aspects of their national cuisine could have an impact on the health of the Hungarian population.

The variation between innovative and traditional RTE meals can be attributed to the impact of Hungarian gastronomic traditions. These traditions are a blend of equestrian and European roasting practices, which connect Eastern and Western culinary civilizations. Additionally, Hungarian cuisine has adopted numerous recipes from other nations, such as French, Viennese, Italian, Slavic, Romanian, and Turkish cuisines. Of course, these influences often necessitated changing the ingredients and cooking methods to suit the Hungarian palate and adhere to the availability of raw ingredients in Hungary (Gundel, 1933; Gundel, 1937; Tusor, no date).

According to Bóka and Kovács (2015), Hungarian cooking techniques blend Eastern techniques such as boiling and stewing with Western ones like roasting. These techniques refer to the various methods and procedures involved in the preparation, cooking, and presentation of food, which have a significant impact on the physical, chemical, and sensory properties of food as well as its nutritional value.

The average Hungarian diet has changed in both the food industry and home cooking practices, resulting in changes to traditional Hungarian cuisine. Cooking oil for frying meat is now more commonly used in households, supplementing the formerly predominant use of lard. The variety of spices has also expanded from limited options such as pepper, cinnamon, clove, vanilla, paprika, cumin, marjoram, and bay leaves to include thyme, summer savory, and tarragon. In addition, globalization has brought many international food ingredients and dishes into the average Hungarian diet (Bóka and Kovács, 2015).

5.3 Nutritional content and organoleptic characteristics of non-prepacked ready-to-eat and home-made meals

5.3.1 Comparison of organoleptic characteristics of non-prepacked RTE and HM meals

Figure 10 displays that there was a significant difference between RTE and HM meals on the dependent variables at $p < 0.001$. When considering the results for dependent variables separately, Figure 8 demonstrates significant differences in appearance, consistency, smell, and taste. The means of HM meals were higher than RTE meals in all dependent variables; appearance (4.82 vs. 3.94), consistency (4.63 vs. 3.54), smell (4.74 vs. 3.72), and taste (4.59 vs. 3.42). The t-test indicated that HM meals (M=18.79, SD=1.31) were significantly more acceptable than RTE meals (M=14.55, SD=2.86) according to the MSZ standard; $p<0.001$. The results of each meal sensory evaluation is presented in Appendix (I). In the appendix, the evaluation of these meals can have a big and a small difference. It is highly possible that it is because of personal preferences or the fact that most of these meals are well known to the Hungarian population. Thus, the chef at the catering company, and the chef at BGE are able to create a good meal that is preferable to the tasters.

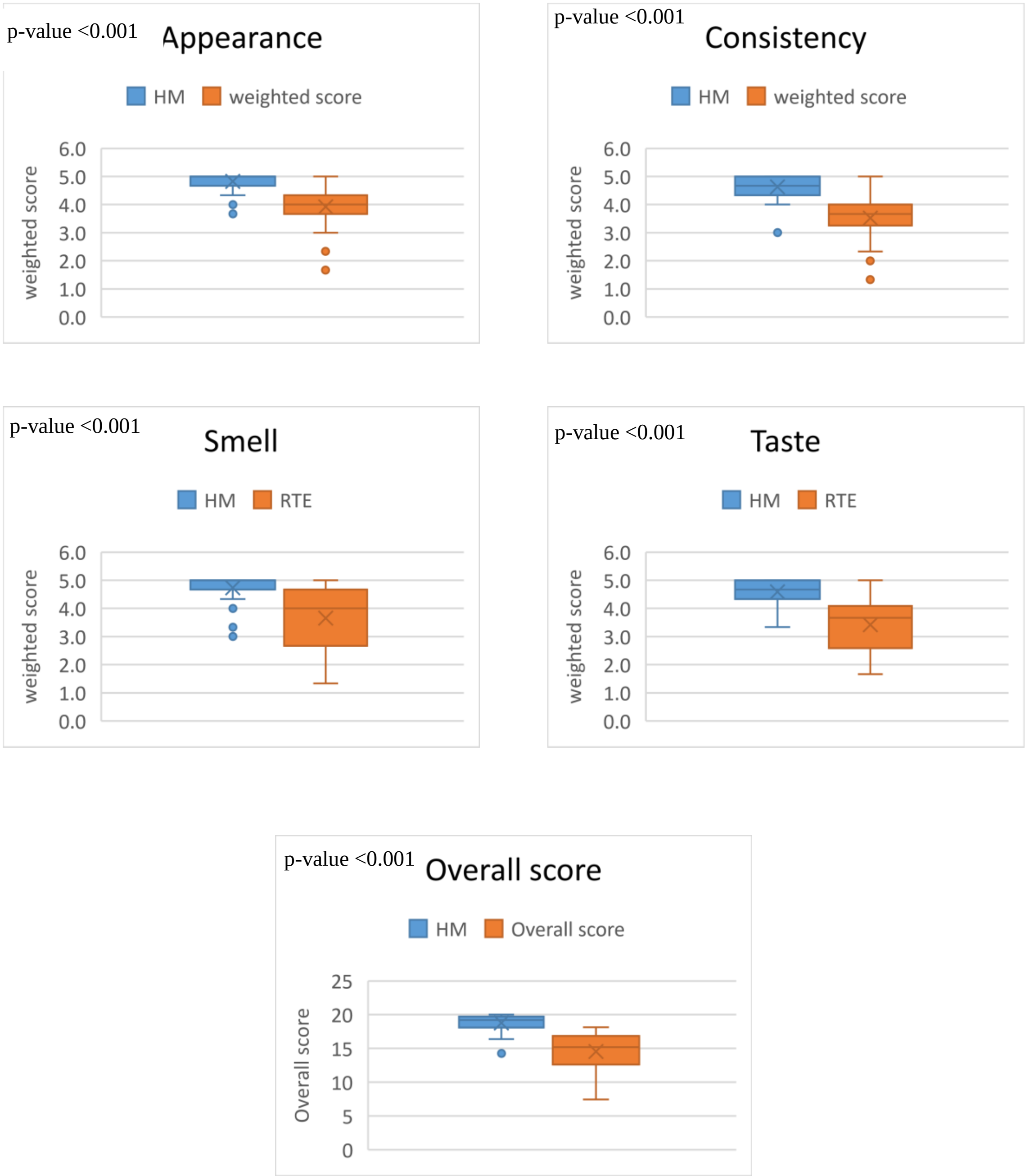


Figure 10 Comparing appearance, consistency, smell, and taste between RTE and HM meals based on the same recipes

There have been no recent investigations into the sensory characteristics of HM and RTE meals in Hungary. Nonetheless, studies carried out in Ireland have demonstrated that HM meals have better sensory evaluation than RTE meals. In their study of 702 consumers' attitudes towards chilled ready meals in Ireland, Reed et al. found that manufacturers must strive to enhance the sensory quality of RTE meals, especially given the fact that the primary obstacle to their consumption was a preference for homemade food. The majority of non-consumers of chilled ready meals were women over the age of 45 living in rural areas and from lower socio-economic groups, who favoured home-cooked food, with 50% citing this as their primary reason for doing so (Reed et al., 2003; Farley and Reed, 2005).

Due to factors such as imbalanced nutritional content, preparation, storage, and prolonged consumption during the COVID-19 pandemic, RTE meals may have a lower sensory evaluation than freshly prepared meals (FPM). In their study, Carvalho et al. (2018) evaluated the taste of

RTE meals provided to soldiers in a Brazilian army construction unit and compared them to FPM. They found that while both types of meals had recommended fat percentages, 88% of FPM and 100% of RTE contained more sodium than recommended. Moreover, RTE had lower protein and higher moisture than FPM among high-protein meals. At first, the acceptability of RTE was equal to or greater than FPM, but over time, the acceptability and consumption of RTE decreased significantly.

In a study assessing the quality of homemade retort pouch packed Chuncheon Dakgalbi, the impact of cooking time and storage temperature was investigated. The Chuncheon Dakgalbi was packed in a retort pouch and cooked (autoclaved) for 10, 20, or 30 minutes at 110°C and 0.75 kgF, then quickly cooled in a chilling room at 2°C and stored for four weeks at either 4°C or 25°C. Sensory analysis of the samples demonstrated that those cooked for longer periods of time had higher sensory ratings, especially in terms of texture and overall acceptability, with statistical significance ($p<0.05$) (Muhlisin et al., 2013).

The answer to why a person/consumer (or in this case a sensory panellists) dislike or like a certain product or food can be very complex. However, in this case we could think of 2 reasons, 1) During COVID restriction, the tasters were consuming more of RTE meals, thus some of them got used to the RTE meals taste and this leads to a lower evaluation. 2) The study was not anonymous, and tasters were aware that this study was on going and their co-workers were the chefs who prepared the home-made meals, so this might cause some kind of bias and it leads to a lower evaluation. To conclude, it might be a psychological reason.

5.3.2 Comparison of the nutritional content of RTE and HM meals

Table 12 displays the means of weight, macronutrients, sodium, and calories determined by laboratory analysis for both HM and RTE meals. To investigate the difference between the two meal types, a one-way multivariate analysis of variance was performed using eight dependent variables: weight, macronutrients (carbohydrates, sugars, fats, SFA, and proteins), sodium, and calories, with meal type being the independent variable. Results showed no significant difference between RTE and HM meals in terms of the combined dependent variables, $F(8, 51) = 1.474$, $p = 0.190$; Wilks' Lambda = 0.812.

Table 12 Comparison of weight, macronutrients, salt, and energy between RTE and HM meals' means

Variable	**RTE meals (n=30)**		**HM meals (n=30)**	
	Mean	**±SD**	**Mean**	**±SD**
Weight (g/serving)	527	64.5	516	75.4
Carbohydrate (g/serving)	46.0	19.6	53.5	26.7
Sugar (g/serving)	6.15	1.72	6.19	2.13
Fat (g/serving)	28.0	10.2	31.3	13.4
Saturated fatty acids	7.56	3.76	8.47	4.49
Protein (g/serving)	30.85	5.97	37.0	11.6
Salt (g/serving)	6.81	1.92	6.64	0.88
Energy (kcal/serving)	575	134	662	197

No laboratory analyses have been conducted to compare the nutritional content of RTE and HM meals in Hungary. However, previous studies have compared the nutritional properties of ready meals and recipes based on label information or nutritional software. Naruseviciute et al. evaluated the nutritional characteristics of the ten most commonly consumed ready meals in Scottish households and corresponding homemade meals. The ready meals were analyzed using product labels, while the recipes were evaluated using the NetWisp dietary analysis software. No significant differences were found in energy, macronutrients, fiber, or sodium content per 100 g between the two groups. These findings suggest that the notion that cooking at home is healthier and more economical than purchasing ready-made meals may be oversimplified, and that choosing healthier meals is more important than how they are prepared (Boom et al., 1997).

Howard et al. (2012) carried out a study to compare the nutritional value of main meals made by television chefs (n=100) and RTE meals sold by supermarkets (n=100) with WHO and UK Food Standards Agency (FSA) guidelines. None of the recipes or RTE meals fully complied with WHO's recommendations. Nevertheless, RTE meals were more likely to adhere to the recommended proportions of energy derived from carbohydrates and sugars, and density of fiber. In contrast, recipes were more likely to meet the suggested sodium density. Per portion, the recipes had significantly more energy, protein, fat, and saturated fat than the RTE meals, but less fiber. The distributions of traffic light colours according to the FSA's food labelling recommendations differed for recipes and RTE meals. Modal traffic light was red for recipes and green for RTE meals.

Carstairs et al. (2016) compared the nutritional and food diversity of commercially available infant and young child feeding (IYCF) meals and published home-cooked recipes for the same age group, with the aim of comparing their nutritional contents to age-specific recommendations. The study included 278 commercial IYCF savoury meals and 408 home-cooked recipes from top-selling IYCF cookbooks. The commercial products were found to offer more variety of vegetables per meal than the home-cooked recipes. However, the recipes contained 26% more energy and 44% more protein and total fat than commercial products. Although the majority of commercial products met the energy density recommendations, 50% of home-cooked recipes exceeded the maximum range. The study concludes that commercial meals provide a meal that is more energy-dense with more vegetable variety per meal than home-cooked meals, but home-cooked meals offer a less expensive meal option, although most of them exceed recommendations for energy and fats.

Table 13 shows the amount of nutrients in 100 g of every individual RTE and HM meals that are measured by three different methods; laboratory analysis, labelling by the manufacturer, and nutritional software analysis. It can be observed that most of the meals contain similar nutrient amount.

A significant difference between the measured nutrients of the African catfish fillet RTE and HM meal can only be found in the fat content, the HM contained more fat than the RTE, and therefore the energy content of the latter was lower. For most nutrients, the data given on the label (RTE) and calculated with NutriComp (HM) differ from the measured values, although in the case of the HM meal, the measured higher fat content was almost the same as the calculated value.

In the case of "Brasov" stew, with the exception of carbohydrates, the measured values of the other nutrients were almost identical in RTE and in HM meals. There is a big difference between the measured and stated on the label (RTE meals), or between calculated (HM meals) values was also shown in the case of carbohydrates.

Regarding the Broccoli layered with chicken meal, the total carbohydrate is different between the RTE and HM. The RTE contained higher amount. However, when looking at the RTE's label and the meal's NutriComp value, the label one is higher in carbohydrate as well.

When looking at the Grilled chicken breast, there was not significant difference between the RTE and HM meals. However, when comparing the labelling value with the value obtained from NutriComp, the label value contains higher amounts in the total carbohydrate.

In the Meat casserole, the only nutrient that is significantly different between the RTE and HM meals is fat. The RTE meals contained higher amounts. The values from the label and NutriComp are more or less the same.

In the Roasted chicken liver, all nutrients were in similar amounts in the RTE and HM meals. Only the total carbohydrate, protein, and fat were higher in the labelled value than the one measured by NutriComp. For the Fried pork ribs, all nutrients were the same in both RTE and HM meals as well as between the labelled and NutriComp values. Regarding the Székely all nutrients are similar in both meals and when comparing the labelled and NutriComp values. In Vasi meal, more or less the nutrients were also the same for RTE and HM meals. However, the total carbohydrate and protein were higher in the labelled value more than the NutriComp one. For the Beef stew the measured value in the total carbohydrate was significantly higher in the HM meals than the RTE ones. When comparing the labelled and NutriComp values; fat amount was higher in the labelled ones.

Table 13 Amounts of nutrients and energy in 100 g of individual RTE and HM meals

Meal	Type	Characteristics	Total carbohydrate	Total sugar	Salt content	Protein	Fat	SFA	Energy
			g/100g						kcal/100 g
African catfish fillet in fresh basil sauce, potato croquette	RTE	measured average±SD	13.0±1.0	1.1±0.2	1.3±0	6.6±0	6.0±0	1.4±0.2	136±9.2
		label	16.8	1.0	0.6	9.7	4.7	0.6	151
	HM	measured average±SD	13.9±0.76	1.7±0.25	1.6±0.09	5.9±1.16	12.3±0.41	2.4±0.16	195±7.7
		calculated by NutriComp	16.1	2.0	1.3	7.2	12.2	1.9	207
"Brasov" stew	RTE	measured average±SD	13.5±1.9	1.4±0.3	1.2±0.2	6.5±0.1	8.0±1.4	1.5±0.3	156±5.4
		label	22.4	0.3	3.3	10.3	12.7	2.3	251
	HM	measured average±SD	15.5±3.1	1.3±0.3	1.6±0.3	6.6±1.6	7.0±1.5	1.0±0.3	156±26.7
		calculated by NutriComp	24.7	1.4	1.2	8.4	6.6	1.1	195
Broccoli layered with chicken. cheese and eggs	RTE	measured average±SD	5.3±0.4	1.2±0.4	1.2±0.2	7.0±0.8	6.0±1.8	2.4±1.1	106±20.6
		label	9.3	1.2	0.7	11.9	5.6	2.9	136
	HM	measured average±SD	8.1±1.8	1.7±0.2	1.5±0.2	8.1±2.3	7.0±2.2	2.9±0.9	132±20.5
		calculated by NutriComp	6.6	0.7	0.6	8.9	5.2	2.1	109

Table 13 Amounts of nutrients and energy in 100 g of individual RTE and HM meals Cont.

Meal	Type	Characteristics	Total carbohydrate	Total sugar	Salt content	Protein	Fat	SFA	Energy
			g/100g						kcal/100 g
Grilled chicken breast, cream cheese sauce, jasmine rice	RTE	measured average±SD	14.4±0.8	0.9±0.4	1.3±0.4	7.9±0.1	3.6±0.7	1.4±0.3	125±6.1
		label	21.4	0.6	1.0	9.7	5.7	2.0	178
	HM	measured average±SD	15.6±0.3	0.8±0.2	1.2±0.2	9.7±1.7	4.7±1.9	1.6±0.5	147±20.9
		calculated by NutriComp	15.0	1.2	1.1	10.2	6.6	1.7	161
Meat casserole with cauliflower	RTE	measured average±SD	7.7±0.5	1.8±0.2	1.2±0.2	4.5±0.4	5.4±0.2	1.7±0.1	100±2.0
		label	10.3	1.9	2.7	5.6	9.5	2.8	152
	HM	measured average±SD	8.9±1.2	1.8±0.1	1.3±0.2	8.4±4.4	7.1±1.0	2.5±1.0	137±22.3
		calculated by NutriComp	11.2	1.2	0.5	5.5	8.8	3.0	147
Roasted chicken liver with boiled potatoes	RTE	measured average±SD	5.9±0.5	1.6±0.2	1.9±0.4	5.8±0.5	4.1±1.5	0.7±0.2	86.5±14.3
		label	19.8	1.2	0.9	10.4	10.1	1.6	213
	HM	measured average±SD	6.1±0.5	1.7±0.3	1.3±0.0	6.9±0.5	3.1±0.2	0.7±0.1	82.2±4.9
		calculated by Nutriomp	12.1	0.8	0.9	5.7	2.6	0.5	96.3

Table 13 Amounts of nutrients and energy in 100 g of individual RTE and HM meals Cont.

Meal	Type	Characteristics	Total carbohydrate	Total sugar	Salt content	Protein	Fat	SFA	Energy
			g/100g						kcal/100 g
Fried pork ribs with sour cream. grated cheese and potatoes with parsley	RTE	measured average±SD	13.2±1.1	1.0±0.3	1.4±0.5	7.7±0.7	8.1±0.2	2.7±0.1	161±3.2
		label	16.8	0.7	1.6	8.3	9.3	3.7	187
	HM	measured average±SD	11.1±0.9	1.1±0.1	1.3±0.0	8.5±1.4	8.8±1.1	2.9±0.5	162±9.7
		calculated by NutriComp	16.1	0.8	1.1	7.7	7.5	1.7	165
"Székely" cabbage	RTE	measured average±SD	2.0±0.2	1.5±0.2	1.8±0.6	4.7±0.8	6.4±1.0	2.5±0.6	87.3±5.6
		label	6.5	1.7	0.4	8.5	11.5	4.2	164
	HM	measured average±SD	2.1±0.2	1.4±0.3	1.5±0.1	4.7±0.5	3.9±0.4	1.9±0.2	63.9±5.3
		calculated by NutriComp	5.6	1.5	1.1	5.5	12.6	4.3	159
"Vasi" steak with mashed potatoes and onions	RTE	measured average±SD	11.0±1.0	1.1±0.4	1.5±0.1	7.5±0.6	9.1±2.4	1.4±0.3	160±18.8
		label	19.7	1.1	0.6	10.2	6.0	1.4	175
	HM	measured average±SD	9.5±1.3	0.8±0.2	1.4±0.1	9.8±1.0	7.0±0.1	1.1±0.1	145±8.5
		calculated by NutriComp	12.8	0.8	0.9	6.7	8.6	1.5	157

Table 13 Amounts of nutrients and energy in 100 g of individual RTE and HM meals Cont.

Meal	Type	Characteristics	Total carbohydrate	Total sugar	Salt content	Protein	Fat	SFA	Energy
			g/100g						kcal/100 g
Beef stew with red wine and tarragon	RTE	measured average±SD	10.5±0.8	1.2±0.1	1.6±0.4	6.2±0.4	2.5±0.2	0.4±0.0	91.9±1.0
		label	13.2	0.4	2.0	6.2	11.0	3.3	178
	HM	measured average±SD	20.77±1.27	0.77±0.25	1.19±0.05	8.8±2.5	4.7±0.3	0.7±0.0	164±10.6
		calculated by NutriComp	12.7	0.6	0.9	6.3	6.6	1.8	137

5.3.3 Trans and saturated fatty acids content of non-prepacked RTE and HM meals

Reducing the intake of high-fat foods has been recommended by nutrition and health experts for many years to prevent cardiovascular diseases (CVDs), which are a leading cause of global death (Ghazavi et al., 2020). Recent studies suggest that the type of fat consumed is more important than the amount of fat in causing CVDs, with saturated and trans fatty acids (SFAs and TFAs) raising low-density lipoprotein (LDL) and reducing high-density lipoprotein (HDL) levels (Sacks et al., 2017; Nazari et al., 2012). With the exception of stearic acid, SFAs increase serum cholesterol levels, while TFAs contribute twice as much to total cholesterol growth (Polley et al., 2018). The overconsumption of SFAs and TFAs increases the risk of various diseases (Sacks et al., 2017). Severe frying, prolonged cooking, and the use of hydrogenated oils in restaurants, which are significant causes of TFA intake in many countries (Abramovič et al., 2018), result in TFA production in prepared foods.

As shown in Table 14, the presence of trans-fatty acids in RTE and HM meals has little significance. Elaidic acid is the primary trans-fatty acid and was not detected in all samples. Other trans-fatty acids found were C18:2 9t12t, C18:2 9c12t, C18:2 9t12c, and C18:1 11t (n-9) known as trans vaccenic acid. The effects of consuming diets high in industrially produced hydrogenated fats containing trans fats on health are well documented. However, it is unclear whether consuming diets with vaccenic acid (VA), which is the primary trans isomer in ruminant fats, has similar health risks. So far, epidemiological, clinical, and rodent studies have not established a relationship between consuming VA and the risk of heart or cardiovascular disease, insulin resistance, or inflammation. VA is the sole known precursor of c9,t11 conjugated linoleic acid, and current studies suggest that consuming this trans-fat may offer health benefits beyond those associated with conjugated linoleic acid (Field et al., 2009).

In a study conducted by Indian researchers, detailed information about the fatty acid profile, particularly trans fatty acids, found in selected processed foods, both branded and unbranded, was presented. The analysis involved 30 food items, 15 of which were branded and the remaining were unbranded. Examples of branded products included cooking butter, Vanaspati, fat spread, brown bread, crispy snack, cake, potato chips, chocos, health drink, noodles, soup mix, Alu bhujia, biscuits, and choco cream biscuits. Unbranded samples included items such as samosa, jalebi, bun, namak para, biscuits, boondi, chegodi, potato chips, murukku, gulab jamun, pizza bread, vegetable curry puff, ragi biscuit, trans-esterified fat, and cake. The study revealed that the quantity of TFA, SFA, MUFA, and PUFA varied significantly among the samples. Vanaspati had the highest fat content, chocos had the highest SFA content (82%), boondi had the highest PUFA content (74%), and cake had the highest TFA content. The predominant trans forms in all samples were elaidic acid and linolelaidic acid, whereas vaccenic acid was only present in health drinks. The study also found that six out of 15 product labels misrepresented the TFA content (Geetha et al., 2016).

Table 14 Average level of trans fatty acids in individual RTE and HM meals

Meals	Elaidic acid C18:1 9t		Total trans fats under the scope of the legislation[1]		Trans vaccenic acid C18:1 11t (n-9)	
	g/100 g fat	mg/100 g product	g/100 g fat	mg/100 g product	g/100 g fat	mg/100 g product
RTE meals						
RS	0.59[1]	47.1[1]	0.38	30.3	<0.02	<1
AH	<0.02	<1	0.15	9.4	<0.02	<1
BAP	0.10[1]	9.2[1]	0.10	8.9	<0.02	<1
CSTB	<0.02	<1	0.30[2]	14.7[2]	0.90[1]	49.8[1]
GCS	<0.02	<1	0.20[1]	8.1[1]	0.93[1]	40.8[1]
HRK	0.22[1]	12.6[1]	0.32[1]	18.3[1]	<0.02	<1
CSM	0.07[1]	3.8[1]	0.13[1]	5.6[1]	<0.02	<1
SZK	<0.02	<1	0.20[1]	14.0[1]	<0.02	<1
VPHT	<0.02	<1	0.18[1]	18.5[1]	<0.02	<1
VM	<0.02	<1	0.13[1]	3.5[1]	<0.02	<1
HM meals						
RS	0.19	16.7	0.34	30.2	0.51	44.3
AH	0.12[1]	14.7[1]	0.22	27.1	0.13	15.8
BAP	0.05	4.1	0.14	10.1	<0.02	<1
CSTB	0.24	16.7	0.47	32.2	0.75	50.6
GCS	0.16	7.4	0.37	16.4	0.47	22.4
HRK	0.21	15.1	0.38	27.1	0.59[2]	42.3[2]
CSM	0.11	3.4	0.35	10.5	<0.02	<1
SZK	0.42	16.2	0.61	23.7	0.42	16.6
VPHT	0.08	5.5	0.23	16.1	<0.02	<1
VM	<0.02	<1	0.11	5.2	0.16	7.3

RS: Fried pork ribs with sour cream, grated cheese and potatoes with parsley, AH: African catfish fillet in fresh basil sauce, potato croquette, BAP: “Brasov” stew, CSTB: Broccoli layered with chicken, cheese and eggs, GCS: Grilled chicken breast, cream cheese sauce, jasmine rice, HRK: Meat casserole with cauliflower, CSM: Roasted chicken liver with boiled potatoes, SZK: “Székely” cabbage, VPHT: “Vasi” steak with mashed potatoes and onions, VM: Beef stew with red wine and “eggs barley”

Note: for some meals (e.g. RS), the results of some fatty acids like elaidic acid were, 1) 0.59, 2) undetectable, 3) undetectable. The TFA is the average of all the meals’ samples’ results (including the RS meals), thus it gave a smaller amount than the total TFAs.

[1]only one sample

[2]two samples

As per the Hungarian Decree 71/2013 section 3(1), it is not allowed to sell food items containing more than 2g of trans fats per 100g of total fat content for the end-consumers. The definition of ‘trans-fat’ according to section 2(b) of the Decree includes a ‘fatty acid that consists of a non-conjugated trans configuration with at least one double carbon-carbon bond,’ including C18:1 6t, C18:1 9t (elaidic acid), C20:1 11t, C22:1 13t, C18:2 9t12t, C18:2 9c12t, C18:2 9t12c, C18:3 9t12t15t, C18:3 9t12t15c, C18:3 9t12c15t, C18:3 9c12t15t, C18:3 9c12c15t, C18:3 9c12t15c trans fatty acids in detail. The Decree also states that for processed food items made of multiple ingredients, section 3(1) does not apply if the total fat content is less than 20%, where the trans-fat amount cannot exceed 4g for every 100g of total fat content, or if the total fat content is less than 3%, where the trans-fat amount cannot exceed 10g for every 100g of total fat content. The RTE and HM meals have trans fats content of less than 2g per 100g of total fat content, and therefore meet the Hungarian Decree's standards for trans fatty acids (Carreño, 2013). As a result, the trans fats content of RTE meals can be considered satisfactory.

Several studies have examined the TFA content of various food products, such as fast food and restaurant food, but limited data is available on the TFA content of mixed dishes or ready meals. Asgary et al. (2009) conducted a study in Iran to determine the amounts of different fatty acids, including TFAs, in fast food products such as hamburgers, pizzas, sausages, and calbas, which were randomly selected seven times from restaurants and supermarkets. The study showed that calbas had significantly higher levels of stearic acid (C18:0), the most common saturated fatty acid in Iranian fast foods. The TFA content of these products ranged from 23.6% to 30.6% of total fatty acids, with elaidic acid (C18:1 9t) being the most common TFA. The cis unsaturated fatty acid content of tested fast foods varied from 25.3% in sausages to 46.8% in calbas, with oleic acid (C18:1 9c) followed by linoleic acid (C18:2) being the most common fatty acids in these products (Asgary et al., 2009).

A study by Al-Amiri et al. (2020) aimed at evaluating the fatty acid profile of 37 commonly consumed foods in Kuwait, including seafood, soup, cheese, rice-based dishes, desserts, seed-based dishes, meat-based dishes, vegetable-based dishes, and sandwiches. The study found that all 37 foods had low levels of trans fatty acids.

The saturated fatty acids' profiles for individual RTE and HM meals are shown in Table 15. The main fatty acids present in all meals in both RTE and HM meals were palmitic acid (C16:0) and stearic acid (C18:0). The RS meal from RTE meals and CSTB meal from HM meals contained the highest palmitic acid contents. SZK contained the highest content of stearic acid in RTE meals and RS contained the highest content from the HM meals. Whereas VM from RTE meals contained the lowest palmitic and stearic acids contents and CSM meal from the HM meals contained the lowest palmitic acids content and VM was also the lowest in stearic acids content from the HM meals. Some meals also contained a considerable amount of myristic acid (C14:0). The high content of palmitic acid can be explained by the usage of sunflower oil in cooking all of these meals (Chowdhury et al., 2008). The average of the used sunflower oil in the HM meals was 18.8 g/portion ±6.8 g as the standard deviation. For the RTE meals, we could not find the exact amount of the used oil.

In order to evaluate the significance of saturated fat intake from RTE meals, we compared their SFA content with the Dietary Reference Value (DRV) nutritional recommendations (Zlotkin, 2006). DRVs are estimates of nutrient intake used to plan and evaluate the diets of healthy individuals, with a daily intake of 2,000 calories serving as the reference point. EFSA recommends an SFA DRV of 20 g, and the RTE meals cover 37.8% of this value. Similarly, HM meals cover 42.4% of the SFA DRV.

Policnik et al. (2021) conducted a study to assess the composition of primary school meals in Slovenia (n=40) and compare it with the country's dietary guidelines using chemical analysis. The aim of the study was to determine if the meals meet the guidelines. The chemical analysis results indicated that the school lunches contained 16.7 g of dietary fats, with saturated fatty acids accounting for 4.7 g, polyunsaturated fatty acids accounting for 4.7 g, monounsaturated fatty acids accounting for 5.8 g, and industrial trans fats accounting for 0.2 g/100 g of a meal (which is equivalent to 1.2 g/meal).

Table 15 Saturated fatty acid in individual RTE and HM meals (mg/100 g of product)

RTE meals	**C4:0**	**C6:0**	**C8:0**	**C10:0**	**C12:0**	**C14:0**	**C15:0**	**C16:0**	**C17:0**	**C18:0**	**C20:0**	**C21:0**	**C22:0**	**C24:0**
RS	52.0	40.4	30.0	78.5	101	331	38.4	1375	21.3	538	17.2	3.3	36.4	14.8
AH	15.9	12.1	8.9	22.0	29.1	114	13.7	762	9.9	320	14.9	5.5	35.9	14.9
BAP	tr	tr	tr	tr	tr	31.4	2.3	894	9.5	484	19.5	9.4	46.8	18.7
CSTB	49.6	36.6	25.7	65.9	85.0	299	33.7	1321	19.6	458	7.6	3.0	16.4	9.1
GCS	26.9	20.5	14.4	38.1	50.4	175	19.4	725	10.5	239	7.3	2.2	14.4	8.7
HRK	21.1	16.3	11.7	31.3	40.3	149	16.2	909	12.8	390	10.2	6.8	22.3	10.2
CSM	tr	tr	tr	tr	tr	tr	tr	380	2.9	262	9.7	3.8	27.2	13.4
SZK	36.8	27.8	19.8	52.1	66.4	255	27.4	1319	21.0	575	12.4	11.0	17.7	10.2
VPHT	tr	tr	tr	tr	3.5	25.2	2.9	790	6.8	424.1	23.5	4.1	64.7	24.3
VM	tr	tr	tr	tr	tr	10.2	1.6	234	4.3	130	5.9	tr	17.5	6.5
HM meals	**C4:0**	**C6:0**	**C8:0**	**C10:0**	**C12:0**	**C14:0**	**C15:0**	**C16:0**	**C17:0**	**C18:0**	**C20:0**	**C21:0**	**C22:0**	**C24:0**
RS	52.1	40.6	30.4	75.3	95.9	338	38.3	1515	22.3	601	19.5	3.7	43.5	16.7
AH	14.4	11.3	9.5	20.9	29.5	154	14.9	1407	12.2	600	32.7	11.8	87.9	32.4
BAP	tr	tr	tr	tr	tr	13.7	tr	594	5.6	330	19.8	tr	55.1	19.3
CSTB	60.0	46.7	33.6	87.5	113	388	45.0	1539	24.5	528	11.3	3.0	23.6	12.5
GCS	30.4	23.7	17.1	44.4	57.6	196	21.1	802	11.7	304	10.3	1.9	23.4	10.4
HRK	42.8	33.6	24.3	64.5	83.1	298	33.7	1321	19.8	514	14.8	6.6	31.2	14.2
CSM	tr	tr	tr	tr	tr	4.3	0.9	342	3.3	279	7.8	3.9	20.2	14.7
SZK	24.8	19.4	14.0	37.8	48.3	189	18.7	1036	15.8	444	6.7	10.1	1.3	4.4
VPHT	tr	tr	tr	tr	tr	22.5	tr	651	4.9	351	19.0	2.9	53.3	19.1
VM	tr	tr	tr	tr	tr	8.5	1.8	414	4.9	213	11.3	tr	34.7	12.6

tr: traces (<0.01 mg/100g meal), RS: Fried pork ribs with sour cream, grated cheese and potatoes with parsley, AH: African catfish fillet in fresh basil sauce, potato croquette, BAP: "Brasov" stew, CSTB: Broccoli layered with chicken, cheese and eggs, GCS: Grilled chicken breast, cream cheese sauce, jasmine rice, HRK: Meat casserole with cauliflower, CSM: Roasted chicken liver with boiled potatoes, SZK: "Székely" cabbage, VPHT: "Vasi" steak with mashed potatoes and onions, VM: Beef stew with red wine and "eggs barley".

5.3.4 Mono- and polyunsaturated fatty acids in non-prepacked RTE and HM meals

Lee et al. (2016) stated that polyunsaturated fatty acids (PUFAs) are vital constituents of cell membranes and important nutrients for treating various chronic illnesses, autoimmune responses, and non-alcoholic fatty liver. The two types of PUFAs are ω-3 and ω-6 fatty acids, which are not produced by the body and need to be obtained through diet. Long-chain PUFAs, including n-3 and n-6 fatty acids, have been studied for decades and have shown benefits such as reducing the risk of certain types of cancer, inflammatory reactions, and disorders of the nervous and cardiovascular systems (Harris et al., 2013; Kromhout and Goede, 2014). In addition, PUFAs play a role in skeletal muscle metabolism and exercise and have strong antioxidative and anti-inflammatory properties, which contribute to better health, especially in physically active people who produce high levels of reactive oxygen (Arterburn et al., 2006).

The scientific research conducted so far has shown that dietary monounsaturated fatty acids (MUFA) can have a positive impact on reducing the risk factors associated with various health disorders, such as metabolic syndrome. MUFA consumption can lead to a healthier blood lipid profile, regulate blood pressure, and positively affect insulin sensitivity and glycemic control. Additionally, MUFA intake has been linked to a decrease in obesity, weight gain, body mass index (BMI), and non-alcoholic steatohepatitis (Machate et al., 2020).

Table 16 shows the total monounsaturated, polyunsaturated, n-3, and n-6 fatty acids and n-6/n-3 ratio in RTE and HM meals in mg per 100 g of product. From the RTE meals, VPHT meal contained the highest amount of MUFA, PUFA, total n-6 fatty acids, and n-6/n-3 ratio. CSTB meal was the highest in total n-3 fatty acids from RTE meals. The lowest in the amount of MUFA and total n-3 fatty acids is VM meal, of PUFA and total n-6 fatty acids is GCS meal, and of n-6/n-3 ratio is CSTB meal from RTE meals. In the HM meals, the highest in MUFA, PUFA, and total n-6 fatty acids is AH meal. CSTB meals is the highest for total n-3 fatty acids, and VPHT meals is the highest in the n-6/n-3 ratio. CSM HM meal was lowest for the amount of MUFA and total n-3 fatty acids. While SZK meal was contain the lowest amounts of PUFA, total n-6 fatty acids, and n-6/n-3 ratio in the HM meals. The dominant fatty acids in both meals from PUFA and MUFA are linoleic acid and oleic acid, respectively. Such fatty acid profiles can be explained by the type of fats used in cooking these meals.

Table 16 Total mono- and polyunsaturated, n-3, n-6 fatty acids and n-6/n-3 ratio in individual RTE and HM meals (mg/100 g of product, average ± SD)

Meals	RTE					HM				
	Total MUFA	**Total PUFA**	**Total n-3**	**Total n-6**	**n-6/n-3**	**Total MUFA**	**Total PUFA**	**Total n-3**	**Total n-6**	**n-6/n-3**
RS	2516±101	2515±232	35.3±4.2	2466±227	70±2	2978±671	2602±90	36.7±4.1	2552±88	70±9
AH	2038±413	2300±503	65.2±6.4	2227±492	34±5	4813±351	4639±444	62.2±9.0	4554±413	74±4
BAP	2878±683	3233±328	29.2±3.2	3198±326	111±18	2548±331	3216±795	22.7±44.1	3188±788	140±20
CSTB	1931±532	1255±213	85.4±19.2	1160±221	14±5	2362±736	1456±381	89.7±15.4	1351±371	15±4
GCS	1110±237	950±205	21.1±7.7	924±193	45±8	1585±706	1378±673	23.8±4.3	1345±667	54±18
HRK	1799±127	1693±198	49.8±14.1	1641±204	35±12	2519±284	1836±399	58.5±4.2	1766±405	31±9
CSM	1287±559	1945±660	55.7±1.2	1886±656	34±11	939±181	1409±96	107±27.0	1294±105	13±4
SZK	2248±364	1341±308	36.7±6.4	1300±305	37±13	1553±175	304±308	32.7±3.2	263±34	8±0
VPHT	3161±859	4181±1081	28.3±11.2	4140±1062	153±31	2743±94	2962±62	23.2±10.0	2928±69	141±50
VM	885±78	1087±56	8.0±1.7	1078±54	138±25	1782±100	2044±114	31.2±3.3	2007±116	65±8

RS: Fried pork ribs with sour cream, grated cheese and potatoes with parsley, AH: African catfish fillet in fresh basil sauce, potato croquette, BAP: "Brasov" stew, CSTB: Broccoli layered with chicken, cheese and eggs, GCS: Grilled chicken breast, cream cheese sauce, jasmine rice, HRK: Meat casserole with cauliflower, CSM: Roasted chicken liver with boiled potatoes, SZK: "Székely" cabbage, VPHT: "Vasi" steak with mashed potatoes and onions, VM: Beef stew with red wine and "eggs barley".

According to EFSA's 2009 report, the most abundant n-3 fatty acid in food is alpha-linolenic acid (ALA), and the proposed reference intake value for ALA on food labels is 2g, which is in line with average intakes in some European countries. The recommended daily intake for ALA is 2-3 g/day for individuals with energy intakes between 1800-2700 kcal/day, taking into account cardiovascular health and neurodevelopment. The proposed reference intake value for EPA plus DHA, long-chain n-3 PUFA, is 250mg/day, based on the latest evidence of their relationship with cardiovascular health. This value is higher than the proposed reference intake value of 200 mg/day and average intakes of EPA plus DHA in some European countries. On the other hand, the proposed reference intake value for ALA, n-6 PUFA, is 10g/day, consistent with the recommended intakes for cardiovascular health in adult individuals in European countries. This value is lower than the mean intakes observed in Europe and the lower bound of intake recommended by some authorities (EFSA, 2009).

ALA content in RTE meals was 25.3 mg/g of meal, which is considered a low amount taking into account EFSA recommendations. The same thing goes for their contents of EPA and DHA. RTE meals contained traces amount of these fatty acids <0.01% mg/100 g of meal. On the other hand, RTE meals' content of n-6 accounts for 20% of what EFSA's panel proposed as labelling reference intake value (10 g). The HM meals contained also a low amount of ALA (23.2 mg/100 g of meal), a traces (<0.01% mg/100 g of meal) of EPA and DHA, and the same amount of n-6 as RTE meals.

Maintaining a healthy balance of n-6 and n-3 PUFAs in the diet is crucial for optimal health. The benefits of n-6 and n-3 PUFAs are dependent on their balance in the diet. Western diets are frequently high in n-6 PUFAs, particularly linoleic acid (18:2 n-6), which may increase the risk of cardiovascular disease, cancer, and inflammatory and autoimmune diseases. This is because of competition between n-6 and n-3 PUFAs for metabolic enzymes, which results in an imbalance in eicosanoid production. On the other hand, consuming higher amounts of n-3 PUFAs, notably long-chain n-3 PUFAs from fish and fish oil, has been linked to a lower risk of heart disease and cancer, as well as reduced inflammation, and better brain and cognitive health. To achieve an optimum balance of n-6 and n-3 PUFAs in the diet, it is necessary to increase n-3 PUFA intake through food sources such as fish and reduce n-6 PUFA intake. The recommended n-6/n-3 ratio is below 4:1, and the suggested n-3 PUFA intake is between 1.8 to 1.9 g/day (Ma et al., 2015).

The results of the MANOVA analysis are presented in Table 17. To investigate the differences between fatty acid profiles of RTE and HM meals, a one-way between-groups multivariate analysis of variance was conducted. Seven dependent variables, including SFA, MUFA, PUFA, TFA, n-3 fatty acids, n-6 fatty acids, and n-6/n-3 ratio, were used. The independent variable was the type of meal. The combined dependent variables showed no statistically significant difference between RTE and HM meals. Moreover, Table 17 indicates the contents of SFAs, MUFA, PUFA, n-3, n-6, and n-6/n-3 ratio are similar in both RTE and HM meals.

Table 17 Fatty acid content comparison between RTE and HM meals

Fatty acids	RTE meals (n=30)	HM meals (n=30)	p-value
Saturated fatty acids (mg/100 g meal)	1525	1775	0.529
Monounsaturated fatty acids (mg/100 g meal)	1985	2382	0.347
Polyunsaturated fatty acids (mg/100 g meal)	2050	2184	0.101
Trans fatty acids (mg/100 g meal)	20.1	38.3	0.069
n-3 fatty acids (mg/100 g meal)	41.5	48.8	0.545
n-6 fatty acids (mg/100 g meal)	2002	2125	0.811
n-6/n-3 ratio	67.1	61.1	0.786

There are no published studies that examined fatty acids profile for RTE or HM meals in Hungary. However, in 2009, the fatty acid composition of the complete daily diet of 105 kindergartens was determined in the laboratory of the former National Institute for Food and Nutrition Science (Budapest, Hungary). The amount of TFA and essential fatty acids was between 9-98 mg/100 g meal and 160-2344 mg/100 g meal, respectively (Lugasi A., personal communication, unpublished data). There have been limited studies examining the fatty acid composition of both RTE and traditional meals and fast foods globally. Leighfield et al. investigated the total fat, fatty acid, and tocopherol content of 21 ready meals in the UK, with only two of them meeting the recommended nutrient levels. The majority of the meals were high in total and saturated fats, with six having essential fatty acid levels below the recommended limit and four having levels above the recommended range. Furthermore, most of the meals had low amounts of arachidonic and docosahexaenoic acids, and twelve samples had insufficient levels of alpha-tocopherol, which is of particular concern due to the possibility of generating reactive free radicals during storage and reheating (Leighfield et al., 1993).

Musaiger et al. (2008) assessed the fatty acid profile of frequently consumed fast foods in Bahrain. They discovered that the most abundant fatty acids in these fast foods were oleic acid (32.9-50.4 mg/100 g), linoleic acid (5.0-33.6 mg/100 g) and palmitic acid (16.8-24.9 mg/100 g).

Un Nessa and colleagues (2008) investigated the fatty acid profile and the percentage of SFA, MUFA, and PUFA in 184 samples of 18 types of fast foods, traditional snacks, and sweets in Dhaka city. Traditional snacks had a greater percentage of SFA, ranging from 24.4% to 65.5%, while fast foods had a higher proportion of PUFA, ranging from 11.9% to 52.8%. Across all foods, MUFA content was mainly composed of oleic acid (18:1), ranging from 29.8% to 42.3%. The study indicated that these commercial fast foods and traditional snacks from Bangladesh contained high levels of SFA, mainly in chicken patties (50.2%), beef pizza (48.1%), beef patties (46.6%), and all sweetmeats except kalojam (35.6%). The fat content's SFA was primarily sourced from animal fats and palm oil (Un Nessa et al., 2008).

A study conducted in Iran by Mohammadi-Nasrabadi et al. (2021) aimed to evaluate the fat and fatty acid composition and salt content of restaurant foods (RFs) and identify ways to decrease them using the SWOT (strengths, weaknesses, opportunities, and threats) analysis. The authors examined five common foods, analysing 70 samples. The results showed that Samosa had the highest total fat content (16.92%), while Koobideh kebab with rice had significantly higher levels of SFA and TFA (44.42% and 2.86%, respectively) than the other samples. The SWOT analysis revealed that the absence of standardized recipes for measuring accurate fat and salt content was the primary weakness, and an opportunity was the inclusion of food labelling on menus. RFs had alarmingly high levels of TFA and salt, and it is vital to develop strategies to reformulate them and decrease their fat and salt content.

Pleadin et al. (2021) compared the fatty acid composition of dry-fermented sausages and dry-cured meat products in Croatia and Montenegro. The study included 60 samples from five types of products produced using similar technology. Oleic acid was the most abundant fatty acid, comprising 42.29% to 42.34% of prosciutto. Palmitic and stearic acid were highly represented in dry sirloin (27.60%) and dry rack (16.08%) from Croatia. The fatty acid profile was typical of pork meat products and exhibited a decreasing trend in MUFA (41.97% to 49.75%), SFA (39.96% to 45.94%), and PUFA (7.69% to 14.96%). The n-6/n-3 ratios were higher than recommended, ranging from 14.82 (pancetta, Montenegro) to 25.83 (pancetta, Croatia), and only differences in pancetta samples were noted between the two countries. Furthermore, the PUFA/SFA ratios did not meet the health recommendations, ranging from 0.17 (dry sirloin, Croatia) to 0.38 (pancetta, Montenegro).

In their research, Al-Amiri et al. (2020) investigated the potential cardiovascular risk associated with 37 commonly consumed foods in Kuwait by analysing their fatty acid profile, nutritional quality, and cholesterol composition. The foods contained SFA, MUFAs, and PUFAs ranging from 0.01 to 21.83, 0.01 to 25.51, and 0.013 to 22.87 g/100 g edible portion, respectively. C16:0, C18:1c, and C18:2c (n-3) were the predominant fatty acids, comprising 10.12-44.90%, 16.99-42.56%, and 0.45-56.52% of total fatty acids, respectively, in all the foods. The study found that the levels of trans fatty acids were low in all the foods.

Madani et al. (2022) examined the fatty acid compositions of popular fast and traditional foods in Isfahan, Iran. They analysed 40 food items from 19 restaurants and found that palmitic acid was the most prevalent SFA in all samples. Although 30% of the analysed foods contained trans fatty acids above 2%, traditional foods had higher levels of TFAs than fast foods. The study demonstrated that traditional foods contained higher levels of both SFAs and TFAs than fast foods.

In general, both RTE and HM meals in Hungary contain an appropriate amount of SFA and TFA. Nevertheless, they contain a low amount of EPA, DHA and ALA. RTE meals contain less TFA than HM meals (difference is not significant), and are equal in EPA, DHA, and ALA.

5.3.5 The accuracy of food labelling

Table 18 shows the comparison of energy, macronutrient, and salt between the analytical and RTE meals' label's values with the analytical values' lower and upper confident intervals. There were significant differences between the value listed on the RTE meals' labels and the analytical values regarding weight, energy, carbohydrate, and fat content. The protein, sugar, saturated fatty acids, and salt content were not significantly different. The actual weight of the meals was less than the one listed on the label. The analytical values of energy, carbohydrate, and fat contents were less than the labelled ones.

Table 18 Comparison of the average energy, macronutrient and salt content between measured and labelled values in RTE meals

Variable	Analytical value (n=30) Lower CI 95%	Analytical value (n=30) Upper CI 95%	Analytical value's means (n=30)	Label values' means (n=10)	p-value
Weight (g/serving)	503	551	527	478	<0.05
Carbohydrate (g/serving)	38.7	53.3	46.0	71.2	<0.05
Sugar (g/serving)	5.51	6.79	6.15	4.72	0.057
Fat (g/serving)	24.2	31.8	28.0	40.3	<0.05
Saturated fatty acids (g/serving)	6.16	8.96	7.56	11.7	0.061
Protein (g/serving)	28.5	33.0	30.8	36.5	0.245
Salt (g/serving)	6.09	7.53	6.81	6.71	0.949
Energy (kcal/serving)	525	625	575	825	<0.05

In Hungary, there is no available research on the precision of pre-prepared meals; however, an earlier investigation conducted in Canada scrutinized the credibility of food labels for diverse food items. The Canadian Food Inspection Agency (CFIA) carried out the study in 2014, which assessed the precision of sodium, calories, trans fats, saturated fats, and sugar reported on the Nutrition Facts table (NFt) for chosen foods and beverages in Canada. Over 1000 products were collected from supermarkets, bakeries, and restaurants, and the disparity between label and laboratory values was computed for each product. The findings displayed that 16.7% of the products were "unsatisfactory," with laboratory values exceeding ±20% of the NFt value. Sodium had the highest proportion of unsatisfactory products (18.4%), while trans-fat had the lowest (4.3%). The unsatisfactory products had nutrient content exceeding the NFt. Although sodium and calories were consistently underreported, the NFt values for the other nutrients were not substantially different from laboratory values (Fitzpatrick et al., 2014).

Recent research in Brazil compared the nutritional quality of macronutrients and fatty acids in ten industrial formulas with the values reported on the labels. The study revealed that four formulas had lower total lipid content, while two had lower total protein content than reported. Further, four formulas had higher carbohydrate content than stated on the labels. Although the caloric density values were within the acceptable limits, six formulas had higher levels of SFA, and four had lower levels of MUFAs than stated. In addition, seven formulas had lower levels of PUFAs than reported, and only 30% of the formulas met all the macronutrient criteria mentioned on the labels (Führ et al., 2022).

A study by Jumpertz et al. (2013) aimed to assess the precision of energy and macronutrient data on pre-packaged energy-dense snack food products. The researchers evaluated the accurate caloric content of 24 popular snack food products in the U.S. and macronutrient content in 10 chosen items. The findings showed that there was a 1.2% overstatement in serving size (p = 0.10). After taking into account the variations in serving size, metabolizable calories were 6.8 kcal or 4.3% higher than the label statement. In a small convenience sample of the snack foods tested, the carbohydrate content was 7.7% higher than the label statement, but fat and protein content were not meaningfully different from label statements (-12.8%). The overage in calories was largely attributed to imprecise carbohydrate content and serving size, accounting for 40% and 55%, respectively. Even though the caloric content in the tested energy-dense snack foods was higher than the label statements, it remained within Food and Drug Administration (FDA) limits.

A study conducted by Fabiansson (2006) in Australia analysed 350 samples of 70 different items from regular supermarkets to evaluate the accuracy of the nutritional information displayed on their labels. The results showed a significant difference between actual and reported values with an average deviation of -13% to +61% for individual nutritional components. While there is no established tolerance limit in Australian food regulations, some nations allow a ±20% deviation, and others have distinct upper and lower limits that allow a maximum deviation of -20% for beneficial nutritional compounds and +20% for unfavourable compounds. If a leeway of ±20% for any nutritional component on the label was introduced, only 16% of the 70 products would be in full compliance, while 51% of products would be in full compliance with separate upper and lower limits. However, compliance rates increased to 27% and 70% of products, respectively, when insignificant variations that are irrelevant to consumers, such as all variations of less than 1g/100g, or 10 kJ/100g for energy and 10 mg/100g for sodium, potassium, calcium and cholesterol, were excluded.

In general, the labelling in the Hungarian catering industry is not precise. Food caterers need to implement additional food quality measurements, and relevant authorities must take more stringent action to meet EU regulation No. 1169/2011's mandatory nutritional labelling requirements.

5.4 Chefs' perception of nutrition and health in Hungary

Table 19 shows the descriptive statistics regarding chefs' perceptions about the role and importance of nutrition in their personal lives and the restaurant environment. In general, the respondents revealed homogenous attitudes about nutrition.

The neutral responses to the statements; "*Customers consider nutrition when selecting a restaurant*", "*Consumers do take nutrition into consideration while selecting and ordering menu*" and "*Consumers are concerned about fat in their diet*" have important implications for food services, chefs, and consumers. Customers prioritize tastes over health (Johnson *et al.*, 2002), even though they claim they want healthier menu options (Vandana and Kusuma, 2017), they do not translate this desire into reality by regularly requesting healthier options from restaurants. Catering businesses may wish to offer more nutrition-conscious items but cannot do so unless it is profitable. Several studies support this claim (Rouslin and Vieria, 1998) showing that customers would accept healthful food only if the food appeals to the senses, looks exciting, and tastes good. Chen et al. (2008) showed that managers believe that 1) the atmosphere in the restaurant, 2) the appealing display of food, and 3) eating habits and lifestyle were more important than personal health when selecting a meal.

Table 19 Chefs' perceptions about the role and importance of nutrition in their personal and professional lives

Statement	Mean (SD)
Perception of health	
Low-fat meals are good for maintaining body weight and health	3.85 (1.20)
High-fat meals increase bad blood cholesterol and the risk of heart diseases	3.91 (1.15)
Diabetic consumers need more vegetables and less fat and energy-dense foods	3.99 (1.18)
Milk and milk products are a good source of quality proteins and calcium and are always good for health and growth	3.41 (1.15)
Fish, prawns, and seafood are better for health than meat products	4.03 (1.06)
Wrong nutrition plays an important role in the development of diabetes, cancer, and heart diseases	4.46 (0.94)
In my own diet, I try to cut down my fat intake	3.57 (1.15)
Perception of nutrition	
Eggs, chicken, and meat provide a high amount of quality protein and iron	3.89 (1.03)
Salads provide essential vitamins and fiber	4.62 (0.79)
A combination of cereals and legumes enhances the nutritive value of a meal	4.22 (1.00)
Germination and fermentation of foods increase the nutritive value in terms of protein and vitamin C	4.05 (1.09)
Dishes like Gulyás soup, stuffed cabbage, and Hungarian stew from pork knuckle are nutritious and good for health	2.51 (1.06)
Perception of nutrition practices	
In my work, nutrition principles are followed every day in food selection and menu planning	3.69 (0.99)
In my work, selecting nutritious food is important in menu planning	3.9 (1.05)
In my work, preparing low-fat meals is a challenging task	2.74 (1.27)
Suitable cooking methods are considered in the selection of recipes and menus	4.51 (0.82)
A suitable color combination is considered in the selection of recipes and menus	4.41 (0.93)
Suitable nutritive values are considered in the selection of recipes and menus	3.61 (1.15)
Quality standards are followed in the preparation and serving of meals	4.57 (0.84)
I like the challenge of making a low-fat meal delicious	3.42 (1.22)
In my opinion, cooking a low-fat meal is more work than it is worth	2.18 (1.20)
A low-fat meal does not taste as good as a high-fat one	2.4 (1.36)

Table 19 Chefs' perceptions about the role and importance of nutrition in their personal and professional lives Cont.

Statement	Mean (SD)
Perception of consumer concern	
Customers consider nutrition when selecting a restaurant	2.87 (1.03)
Consumers do take nutrition into consideration while ordering from the menu	2.93 (0.95)
Consumers are concerned about fat intake	2.67 (1.01)
The frequency of restaurant eating will have an impact on individual nutritional health status	2.97 (1.26)
All the recipes are prepared considering different types of consumers and their health conditions	3.61 (1.15)
Quality holds more importance than quantity in the maintenance of one's health	4.25 (1.09)
The number of consumer requests for special menu items is increasing	4.33 (1.00)
Customers with special nutritional needs can select appropriate items from our menu	4.02 (1.10)

Fernandes and colleagues (2015) discovered that providing accurate information on the calorie or nutrient content of the menu can encourage consumers to choose healthier options. One example is the study by Krešić et al. (2019), which investigated the link between nutrition knowledge and the use of nutrition labels in grocery stores. The study observed the effect of disclosing energy value information on menu selection in a group of hospitality management students. The findings revealed that providing energy value information led to the selection of food with lower calorie, fat, and sodium content. Moreover, habitually reading nutrition labels on packaged food products was a significant predictor of choosing food with lower energy, fat, saturated fat, sugar, and sodium content. In contrast, nutrition knowledge was found to have an insignificant influence on food selection. This suggests that various factors, such as menu design, can play a significant role in consumers' food choices.

The disagree responses to the statements "*In my opinion, cooking a low-fat meal is more work than it is worth*", "*Low-fat meal does not taste as good as high-fat ones*", and "*In my work, preparing low-fat meals is a challenging task*". The responses between neutral and agree to the statements "*I like the challenge of making a delicious low-fat meal*" and "*The frequency of restaurant eating will impact individual nutritional health status*" show that chefs are willing to decrease the fat and calorie content of the menu. In addition, it indicates a positive change in attitude towards the development of low-fat and healthier recipes. Obbagy et al. (2011) have researched chefs' opinions about reducing the calorie content of menu items in restaurants. Authors found out that nearly all chefs (93%) thought they could reduce calories in menu items by 10–25% without customers noticing. This can be supported by the findings of Fernandes et al. (2015). Moreover, a study (Condrasky et al., 2007) about chefs' opinions of restaurant portion sizes indicated that chefs believe that the amount of food served influences how much patrons consume and that large portions are a problem for weight control. In addition, the responses in Table 19 under the perception of health and perception of nutrition support the idea that chefs and catering personnel are caring more and more about nutrition and health.

The results of our survey showed no significant variations in menu planning related to nutrition among chefs and culinary personnel with diverse backgrounds (i.e., age, gender, work experience, educational level, position, type and location of establishment) (Gillis et al., 2020). Nonetheless, managers and owners consider health more than chefs and cooks ($p<0.05$) (mean rank=105.5 vs 87.0), and those with over 15 years of experience regard health aspects more than those with less than 15 years ($p<0.05$) (mean rank=103.6 vs 83.1). It can be inferred that chefs and cooks in Hungary require more nutritional education. In a US study by Friesen et al. (2002), certified executive chefs' nutrition knowledge, attitudes, and behaviors were measured, and the results showed an average knowledge score of 70% on 17 general nutrition knowledge questions, considering that certified executive chefs in the US must complete 30 hours of nutrition education with an additional eight hours every ten years for recertification. Reichler and Dalton (1998) examined if practicing chefs' and student chefs' knowledge, attitudes, and practices about healthful food preparation align with the Dietary Guidelines for Americans, and more than two-thirds of the chefs and student chefs correctly responded to questions about nutrient composition of food and how cooking affects nutrient content. However, all chef groups were confused about fat and cholesterol in food and the body. In conclusion, considering the renewed interest in international and culinary nutrition, rethinking the delivery of food service training is essential.

5.5 Consumers' belief and attitude regarding the healthiness of RTE meals in Hungary

We had 1000 complete responses from Hungarian consumers. 23.74% of respondents never consumed RTE, 32.9% of them used to consume it but stopped. Thus, at the time of the survey, 56.8% of the respondents were not consumers of RTE. More than one third of the respondents (35.3%) have been consuming this type of food for a long time, and another 7.9% have recently added this type of convenience product to their diet. Data are on Figure 11. We included the 23.74% of consumers that never consumed RTE meals to understand why they don't choose to consume RTE meals.

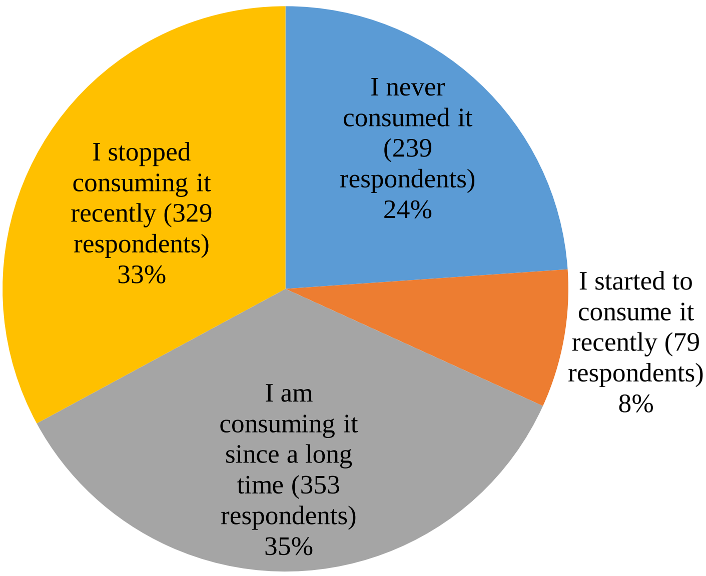


Figure 11 Distribution of respondents in terms of current RTE consumption

Figure 12 shows the reasons why the consumers (who never consumed and who stopped consumed recently, totally 56,8%) refuse to consume RTE meals. Respondents could choose more than one reason. A total 1691 answers were recorded. The main reason to not consume RTE meals for the Hungarian consumers was that they like to prepare their own food (20% of 1691 answers), followed by the opinion that RTE meals are expensive (15%), and full of preservatives (12%), and according to only 1% of respondents, RTE portions are too large. It is no shock that consumers who chose not to consume RTE meals enjoy cooking. This is similar to a previous study done by Ahlgren et al. (2004) their results found that a higher proportion of the non RTE meals' consumers (70%) stated that they enjoy cooking than the RTE meals consumers (60%). These results support with what has been reported that convenience orientation is related negatively to cooking enjoyment (Candel, 2001).

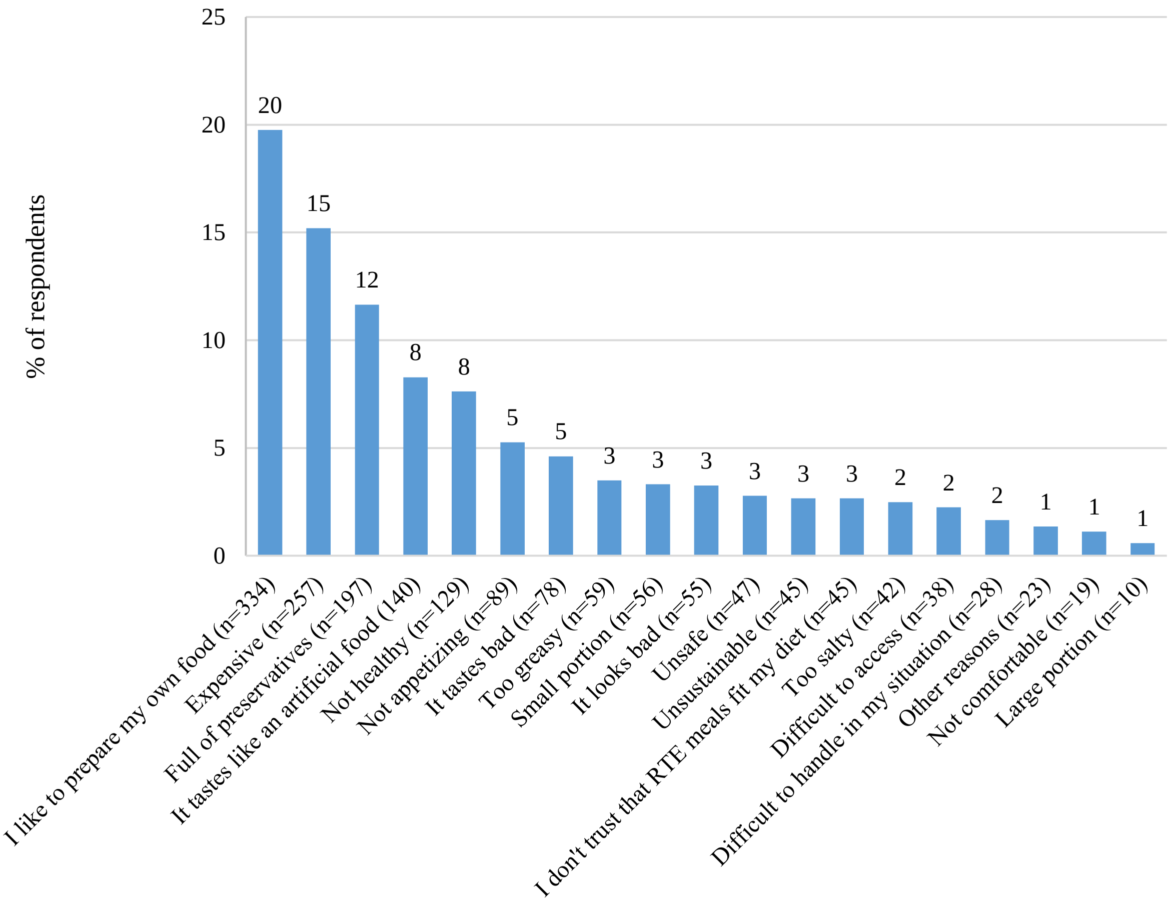


Figure 12 Reasons why respondents do not consume RTE meals (capita, percentage of total respondents)

Figures 13 a-p represent the belief that Hungarian consumers have about RTE meals' nutritional content, healthiness, and safety. According to the Chi^2 test, the consumption of RTE meals and the Hungarian consumers' belief regarding if RTE meals' are healthy is dependent (Chi^2 (4) = 29.42; p<0.001). According to the adjusted residues, Hungarians who do not consume RTE meals believe more than the ones who consume RTE meals that RTE meals are not healthy (|AdjRes|>2). The consumption of RTE meals and the Hungarian consumers' belief regarding if RTE meals are healthier than HM meals are dependent (Chi^2 (4) = 31.93; p<0.001). The RTE meals consumers tend to disagree more than the non-consumers of RTE meals with the statement "RTE meals are healthier than HM meals" (|AdjRes|>2). However, the non-consumers strongly disagree with the same statement more than RTE consumers do (|AdjRes|>2). The consumption of RTE meals and the Hungarian consumers' belief regarding if RTE meals are healthier than restaurants' meals or fast foods are dependent (Chi^2 (4) = 24.94; p<0.001, Chi^2 (4) = 18.51; p<0.001). The Hungarian RTE non-consumers believe that the restaurants' meals and fast foods are healthier than RTE meals more than the RTE consumers do (|AdjRes|>2).

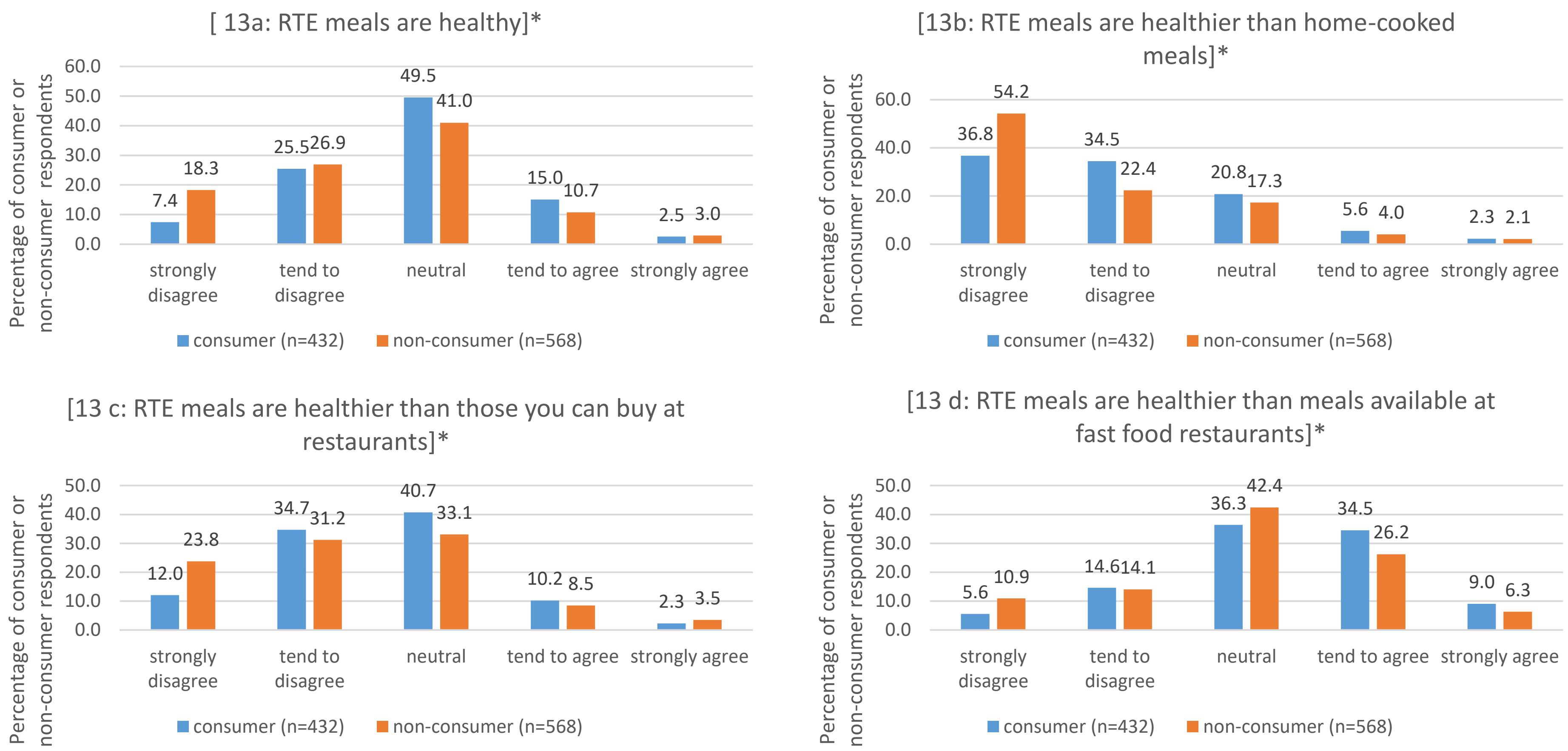
The consumption of RTE meals and the Hungarian consumers' belief regarding the RTE meals' nutritional contents of fat (Chi^2 (4) = 21.35; p<0.001), energy (Chi^2 (4) = 10.6; p<0.05), sugar (Chi^2 (4) = 22.91; p<0.001), saturated fatty acids (Chi^2 (4) = 24.5; p<0.001), fiber (Chi^2 (4) = 17.53; p<0.05), protein (Chi^2 (4) = 12.28; p<0.05), micronutrients (Chi^2 (4) = 17.77; p<0.05) are dependent. The Hungarian non-consumers of RTE meals believe that RTE meals contain high fat, energy, sugar and saturated fatty acids more than the RTE consumers do (|AdjRes|>2). They also believe that RTE meals contain low amounts of fiber, protein, and micronutrients more than the RTE consumers do (|AdjRes|>2).

The consumption of RTE meals and the Hungarian consumers' belief regarding if RTE meals contains harmful ingredients (Chi^2 (4) = 29.27; p<0.001), safer than HM meals (Chi^2 (4) = 23.1; p<0.001), restaurants' meals (Chi^2 (4) = 31.3; p<0.001), and fast foods (Chi^2 (4) = 26.1; p<0.001) are dependent. The Hungarian non-consumer of RTE meals believes that RTE meals contain harmful ingredients and are less safe than HM, restaurants', and fast foods (|AdjRes|>2).

The consumption of RTE meals and the Hungarian consumers' belief regarding if RTE meals are sustainable are dependent (Chi^2 (4) = 17.3; p<0.05). The RTE meals' consumers believe that these meals are sustainable, which is the opposite of what the non-consumers believe in (|AdjRes|>2).

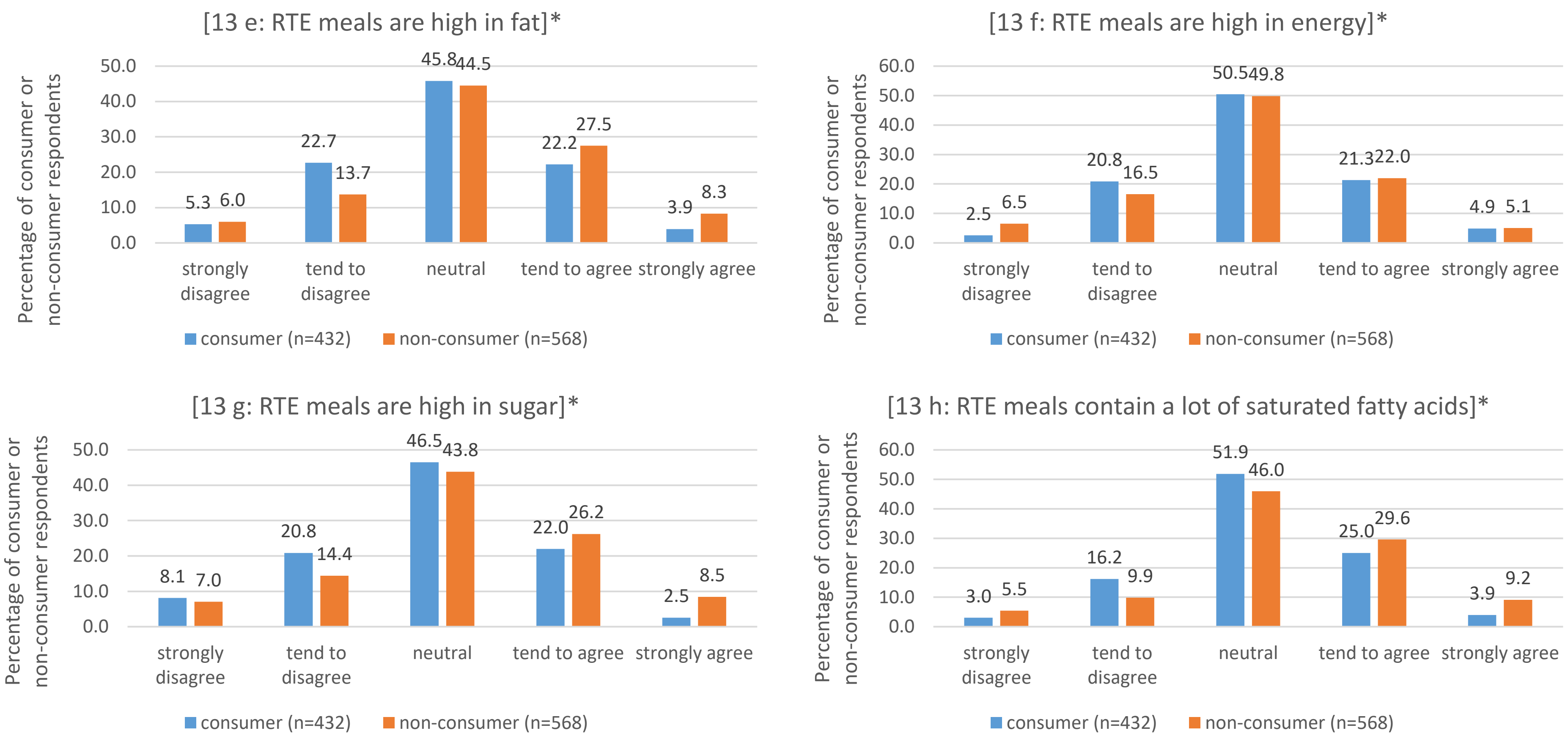
According to Ahlgren et al. (2004), 20% of ready meal consumers believe that eating ready meals is unhealthy. Those who regularly eat RTE meals tend to have a more favourable view of their nutritional profile than those who do not. Negative perceptions of RTE meals may come from their poor reputation, which can set low expectations that are easier to exceed. Low expectations, however, may also result in product rejection before even being tried, as noted by Deliza and MacFie (1996). A study of Irish consumers found that chilled ready meals with improved nutritional profiles were preferred, likely due to concerns about macronutrient and additive content (Sorensona and Henchiona, 2009). Ultimately, Hungarian consumers' views on the nutrition, healthfulness, and safety of RTE meals depend on whether they consume them or not.

In Figure 13, it can be noticed that the most frequent statement is the neutral point. The reason for this can be that most of the consumers and non-consumers of the RTE meals in Hungary are not concentrating on the nutritional values of the meal. The consumer does not consume it specifically because of its nutritional value. From figure 19, we can know that the majority of the RTE meals' consumers do not consider the macronutrients or ingredients of the meal when buying it. Also from figure 22, we can draw a conclusion that most of RTE meals consumers do not follow a special diet thus are not necessarily aware of their food choices.



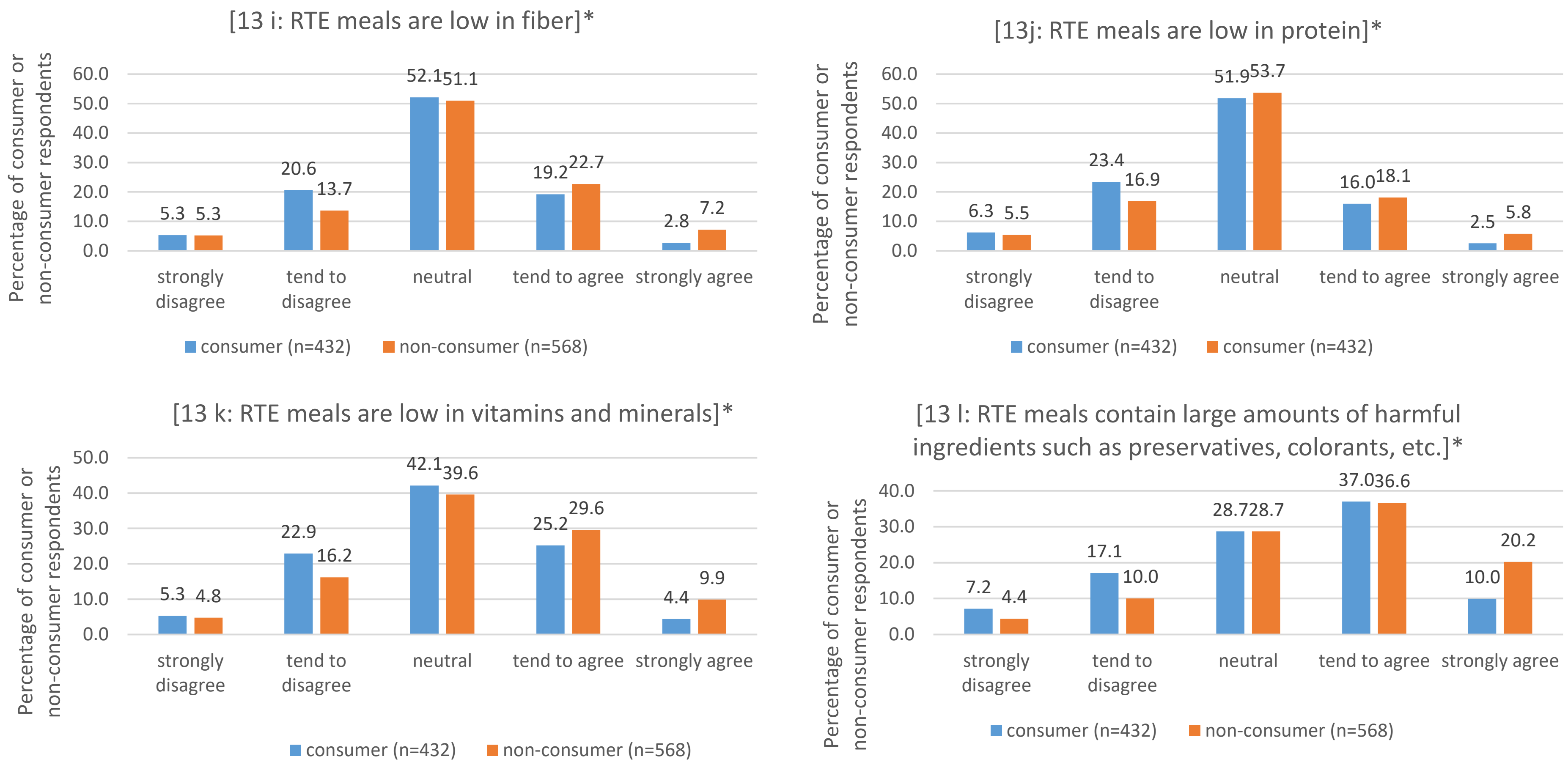
*Significant difference at P<0.05; results of χ^2 tests conducted on the consumers of RTE meals and non-consumers who agreed with the statements.

Figure 13 Hungarian consumers' belief regarding RTE meals' nutritional content, healthiness, and safety



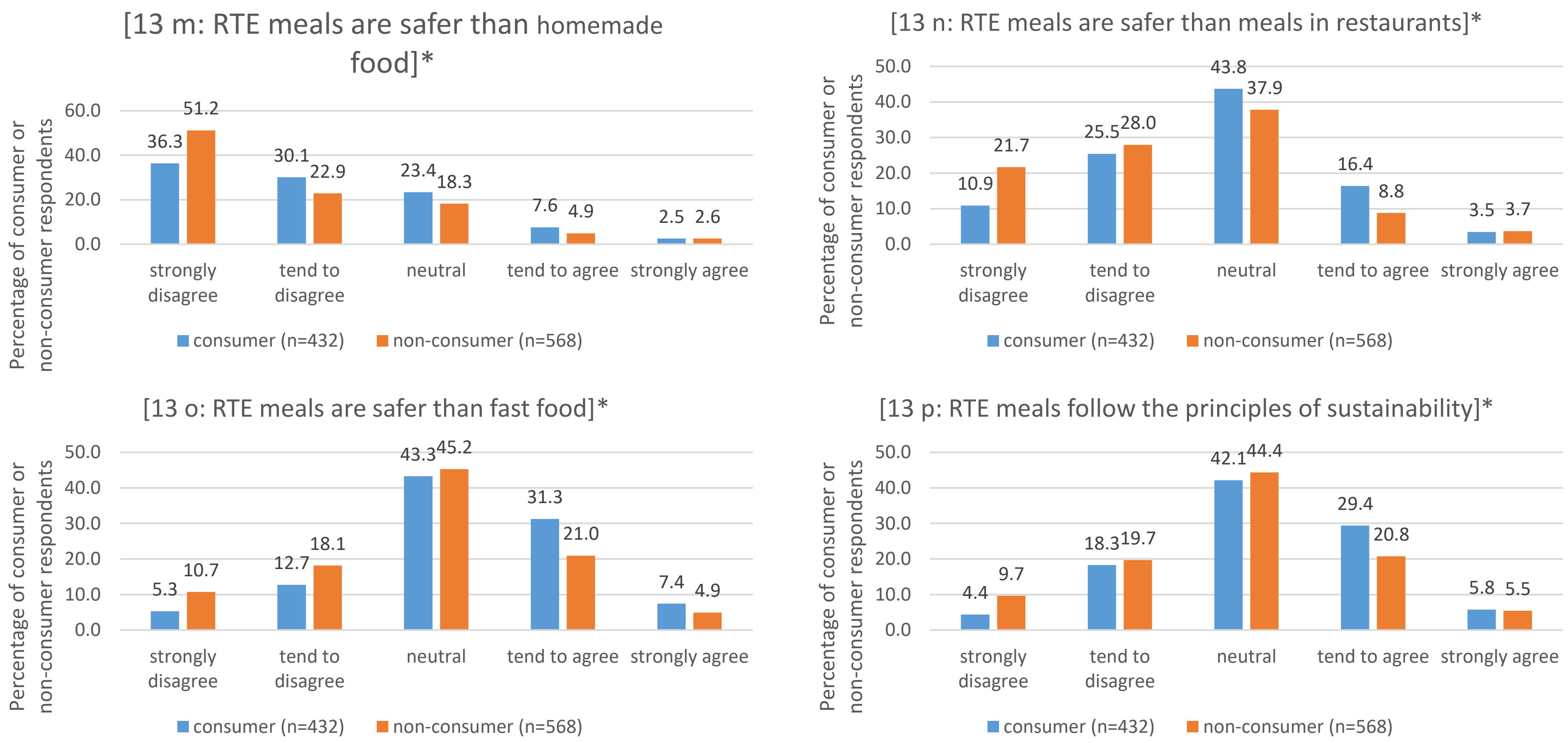
*Significant difference at P<0.05; results of χ^2 tests conducted on the consumers of RTE meals and non-consumers who agreed with the statements.

Figure 13 Hungarian consumers' belief regarding RTE meals' nutritional content, healthiness, and safety cont.



*Significant difference at P<0.05; results of χ^2 tests conducted on the consumers of RTE meals and non-consumers who agreed with the statements.

Figure 13 Hungarian consumers' belief regarding RTE meals' nutritional content, healthiness, and safety cont.



*Significant difference at $P<0.05$; results of χ^2 tests conducted on the consumers of RTE meals and non-consumers who agreed with the statements.

Figure 13 Hungarian consumers' belief regarding RTE meals' nutritional content, healthiness, and safety cont.

Figure 14 shows the numbers of the actual consumers of RTE meals after purchasing it. 50% of the consumers who purchase RTE meals eat it themselves, 44% consume it with their families. 3%, 2%, and 1% buy them for their partners, parents, and their children respectively.

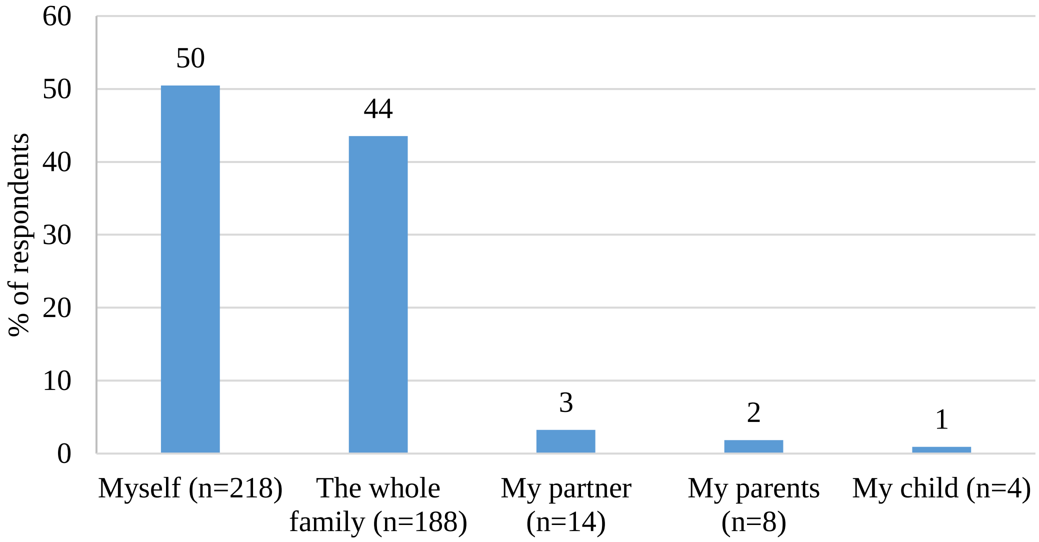


Figure 14 Responses to “If you order or buy RTE meals, who consumes it often?”

The findings of the Hungarian consumers’ (n=432) attitude and behaviour towards ready-to-eat meals are presented in Table 20. The participants were asked to assess their level of agreement with 14 statements related to ready meals. The statement that received the most agreement was that young children should not consume RTE meals. This result is consistent with a previous study that found that RTE meal consumers thought that ready meals should not be served to small children (Ahlgren et al., 2004). Hungarian consumers, however, believe that the quality of RTE meals has improved in recent years. It is not typical for them to serve ready meals to their friends, and they tend to avoid consuming such food when they are alone or in a stressful situation. This finding is consistent with another study that found that the characteristic of ‘Being alone’ was the most common reason cited by both ready meal consumers and non-consumers for not eating RTE meals. The study also found that sixty percent of ready meals consumers reported that they most often ate ready meals alone (Ahlgren et al., 2004).

Figure 15 shows where and when do Hungarian consumers consume RTE meals. 62% of consumers eat RTE meals when they are at home and 15% consume it when they are at the workplace. 23% eats RTE meals when they are either at home or the workplace. The RTE meals consumers that would eat the meals in any day count for 63%. 27% would eat it during the weekdays and 10% would eat it only in the weekends.

Figure 16 displays the reasons behind the consumption of RTE meals by Hungarian consumers, with 1325 answers collected. The most common reasons included time-saving, quickly satisfying hunger, and wanting to spend time on other activities instead of cooking. The least motivating factors were inadequate kitchen equipment and the perceived health benefits of RTE meals. Time scarcity is often a key factor in food choices, especially for "convenience foods" in industrialized nations, which is influenced by household employment status and poverty (Celnika et al., 2012). A study conducted in 2005 found similar results, with four out of the five most common characteristics of RTE meal consumers related to time shortage (Ahlgren et al., 2005). These findings are consistent with earlier studies (de Boer et al., 2004; Marshall et al., 1995, Verlegh and Candel, 1999; Gofton, 1995). Our results also confirmed that being pressed for time is the most important reason for Hungarian consumers to consume RTE meals.

Table 20 Hungarian consumers' attitude and behaver towards RTE meals

Statement	**Mean**	**SD**
When I host guests, I sometimes serve them ready-to-eat meals	1.72	0.96
The bad reputation of ready-to-eat meals is unreasonable	2.85	0.86
The quality of ready-to-eat meals has improved in recent years	2.98	0.78
I consume certain ready-to-eat meals because I like that food, but I can't make it myself	2.50	1.14
I usually eat ready-to-eat meals when I'm alone	2.13	1.06
I usually eat ready-to-eat meals in the company of others	2.11	1.04
Ready-to-eat meals are safe because the consumer knows what they are getting	2.62	0.87
The ready-to-eat meals are sufficiently nutritious	2.87	0.85
When I'm stressed, I eat ready-to-eat meals	1.82	0.96
I eat ready-to-eat meals when I want to relax	2.30	1.09
Buying a lot of ready-to-eat meals can indicate that the consumer has little interest in what he/she is eating	2.72	1.03
Young children should not eat ready-to-eat meals	3.21	1.19
Ready-to-eat meals can only be used in a microwave	2.22	0.95
I would be ashamed of myself if someone saw me eating ready-made food for lunch	2.07	1.12

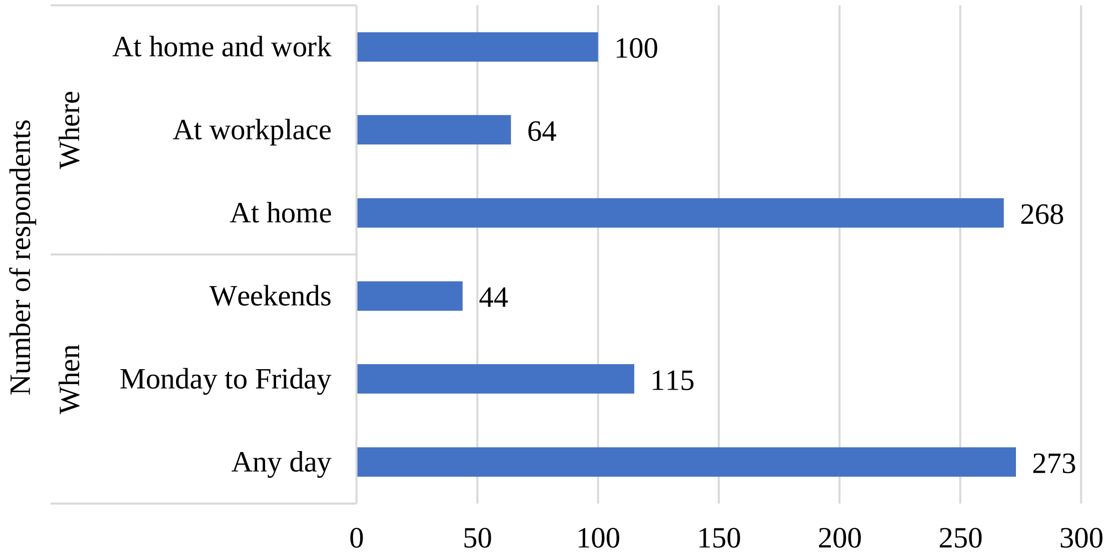


Figure 15 RTE consuming place and time (number of the respondents = 432)

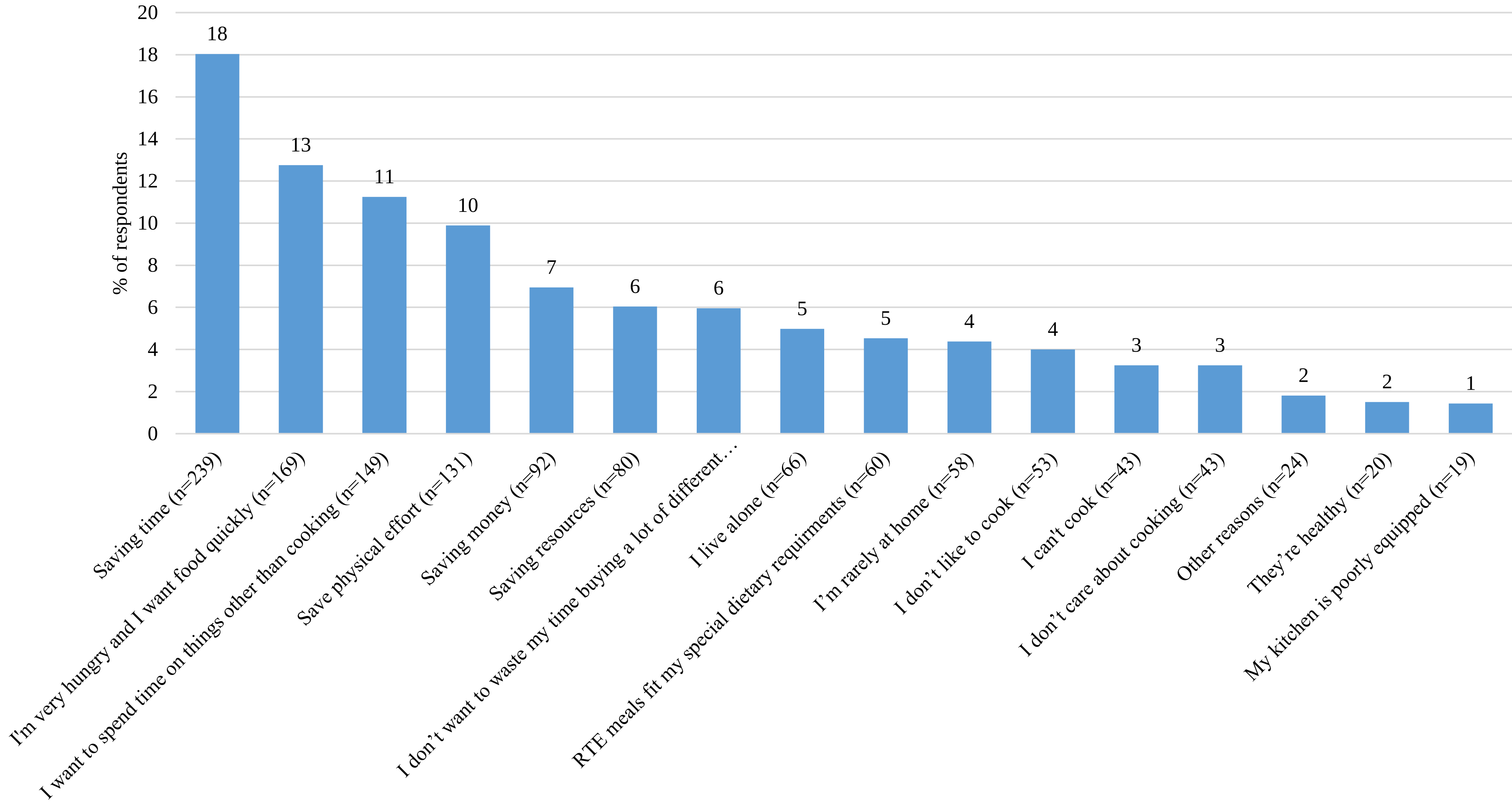


Figure 16 Reasons for RTE consumption (number of respondents = 432, % of total RTE consuming respondents)

According to Figure 17, more than 40% of consumers buy RTE meal in a grocery store 1-2 times a month. Canned RTE meals are popular, as 41,7% of consumers buy such products 1-2 times a week. A little more than a quarter of RTE meal consumers do not buy RTE meal from food delivery companies, another quarter annually or a few times a month and the fourth quarter consume RTE meals from food delivery companies at least once a week. 4% of consumers buy some RTE meal every day.

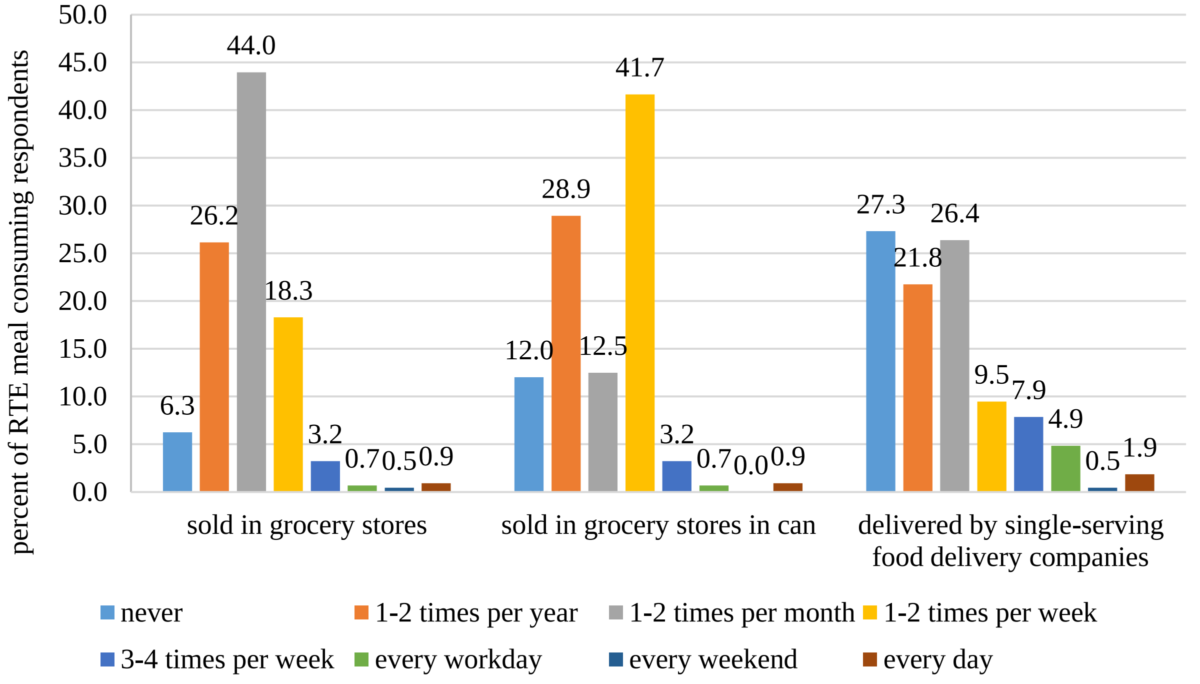


Figure 17 Frequency of RTE purchases among RTE meals' consumers (n=432) at different type of sale

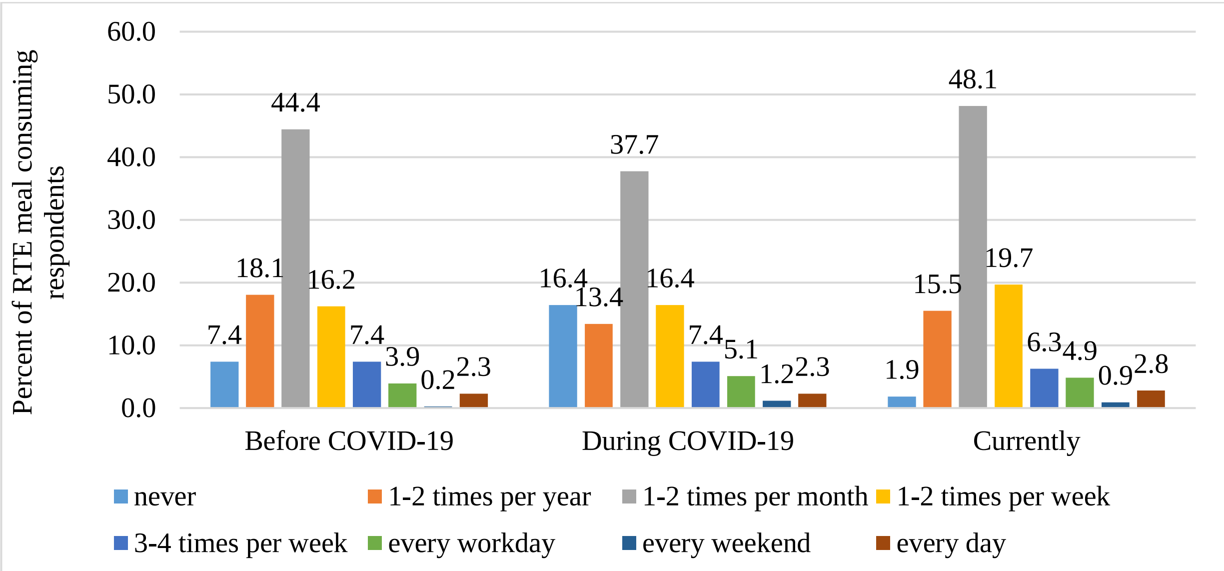


Figure 18 Frequency of RTE purchases among RTE meals' consumers (n=432) in connection with the COVID-19 epidemic

According to Figure 18, the popularity of RTE foods has decreased during the coronavirus. During the lockdown, they preferred to cook at home or order hot food from restaurants.

Attitudes of consumers towards information on labels of ready-to-eat meals, such as ingredients and nutrients, are displayed in Figure 19. When purchasing RTE meals, 51% of the Hungarian consumers check the ingredients list, which affects their decision, while 20% check it without it influencing their choice, and 29% do not check it. In contrast, only 35% of Hungarian consumers check the nutritional label, which affects their decision, while 20% check it without it influencing their choice, and 45% do not check it. These results are consistent with previous research by other authors. In a study conducted by Grunert et al. (2010), the use of nutrition information on food labels and understanding of guideline daily amount (GDA) front-of-pack nutrition labels were analyzed in six European countries, including Hungary (n=1804). The authors observed that Hungarian consumers spent an average of 47 seconds per product bought and bought 1.2 products in the aisle. The average time was highest when purchasing ready meals (43 seconds) and lowest for salty snacks (31 seconds). Additionally, 62.6% of respondents looked at the front of the package, while 7.7% looked elsewhere. When asked if they had sought nutrition information on the first product they had purchased in the aisle, 18.8% of Hungarian consumers answered affirmatively, while 15.8% answered yes when purchasing ready meals. Of these respondents, 33.4% were looking for calorie information, and 13.4% were looking for food additives. The authors concluded that the understanding of the concept of GDAs is more limited in Hungary. However, respondents were able to correctly compare products within the same category, whether in terms of single nutrients or overall healthiness. This finding is consistent with previous research (Grunert and Wills, 2007) and a recent study commissioned by the Food Standards Agency (Malam et al., 2009).

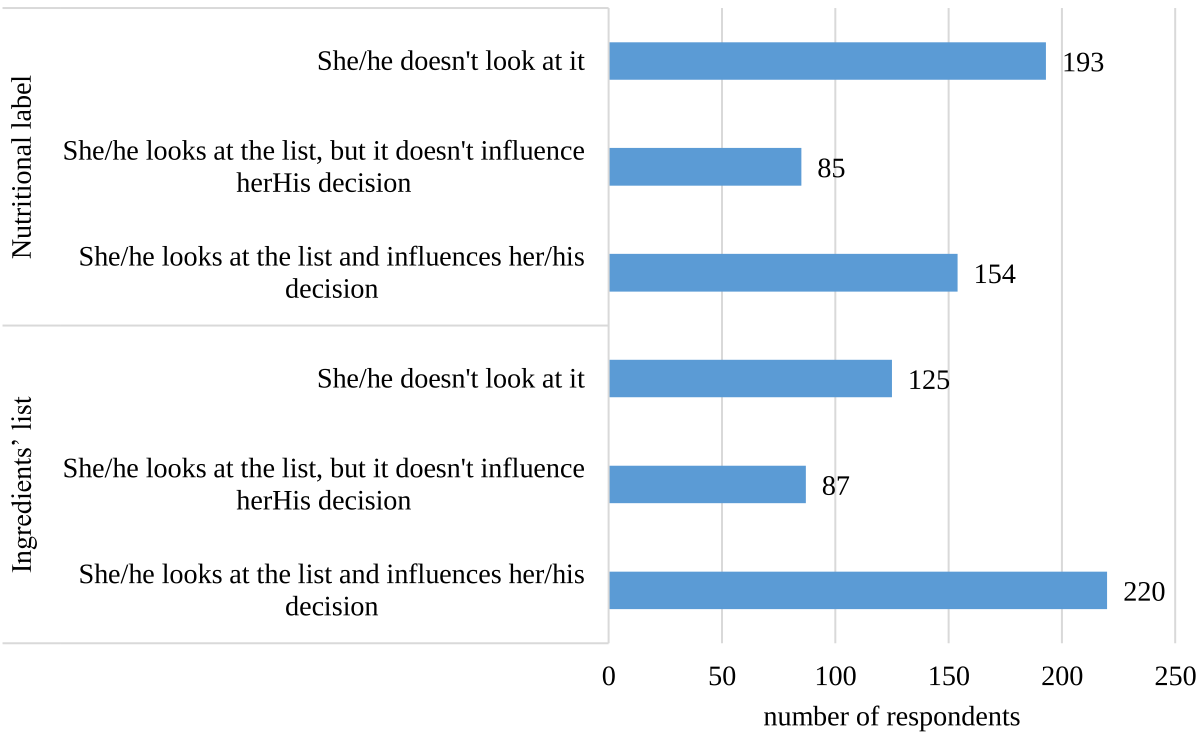


Figure 19 Number of RTE meal consumers in terms of how concerned they are with the ingredients and nutritional value of RTE meals

In a study, Grunert and his teammates (2010), across all product categories and countries, the most common main reason given for choosing this particular product was taste (52%) followed by 'this is what my family wants' (13.4%), price/special offer (10.7%) and health/nutrition (8%), this is similar to what we observed from the Hungarian customers. Table 21 shows opinions of RTE meal consuming respondents on how important certain features are to them when they buy RTE. The most important features to Hungarian consumers were taste and price, at the same time; they did not care if a coach or a famous chef promotes the product.

In their study, Imtiyaz and colleagues (2021) examined how 501 consumers' purchase intention, consumption, and satisfaction towards convenience food were influenced by sensory attraction, nutritional value, safety, and health factors. Their findings revealed that there was a favorable correlation between sensory attraction, nutritional quality, safety aspects, healthiness, and the intention to purchase convenience food. Furthermore, the researchers found that the primary determinant that influenced the purchase intention, consumption, and satisfaction of convenience food was sensory appeal. Specifically, the pleasant taste, attractive appearance, pleasant aroma, and desirable texture within sensory appeal were the most crucial factors that influenced consumers' purchase intention, consumption, and satisfaction of convenience food.

Table 21 Average scores given by RTE meals consumers on the importance of certain feature when purchasing RTE food (n=432, maximum score = 5)

Feature	Mean	SD
Nutritionally important features		
Contains diverse ingredients	3.22	1.14
Vegetables	3.18	1.19
Health claims	2.88	1.28
Fiber content	2.74	1.22
Sugar content	2.74	1.26
Energy content	2.71	1.21
Fat content	2.69	1.16
Salt content	2.67	1.22
Protein content	2.63	1.17
Source of protein	2.59	1.23
Saturated fatty acids content	2.54	1.17
Vitamins and minerals content	2.30	1.23
Gastronomy and sensory characteristics		
Taste	4.19	0.94
Food raw materials used	3.24	1.23
Local product	3.15	1.19
Gastronomy	2.63	1.19
Handling, marketing		
Price	4.01	0.99
Comfort	3.33	1.10
Easy to open	3.10	1.20
Packaging	2.56	1.11
Brand	2.47	1.17
Recommended by a dietitian	2.03	1.22
Made by a famous chef	1.74	1.09
Recommended by a coach	1.65	1.06
Recommended by a celebrity	1.60	1.04

Figure 20 shows the most famous RTE meals brans in Hungary. The most known and purchased brand to Hungarian customers was Globus. 52% of the respondents know this brand and already tried it. The most unknown brand to the Hungarian consumers was Pappudio, 92% of the respondents did not know this brand. The Globus Company has been present on the Hungarian market for a very long time, the first canning factory in Hungary was founded in 1882, which can be considered the predecessor of Globus. The factory has been called Globus since 1924. The company and its products are well-known among Hungarian consumers, in addition to canned vegetables, pâtés, and meatballs, they also produce ready-to-eat, canned foods.

Teletál is one of the best-known brands and food delivery companies which was established more than 20 years ago. It certainly owes its fame and popularity to the fact that a four-time Olympic champion master chef and master confectioner (László Benke), who popularized traditional Hungarian cuisine and was well-known among the Hungarian population (passed away a few years ago), gave his name and reputation to the company. Another positive feature of the company is that dietetic experts also contribute to the compilation of food recipes, as well as offering a very rich selection of food to consumers with special nutritional needs (gluten free, lactose free, no added sugar, etc.)

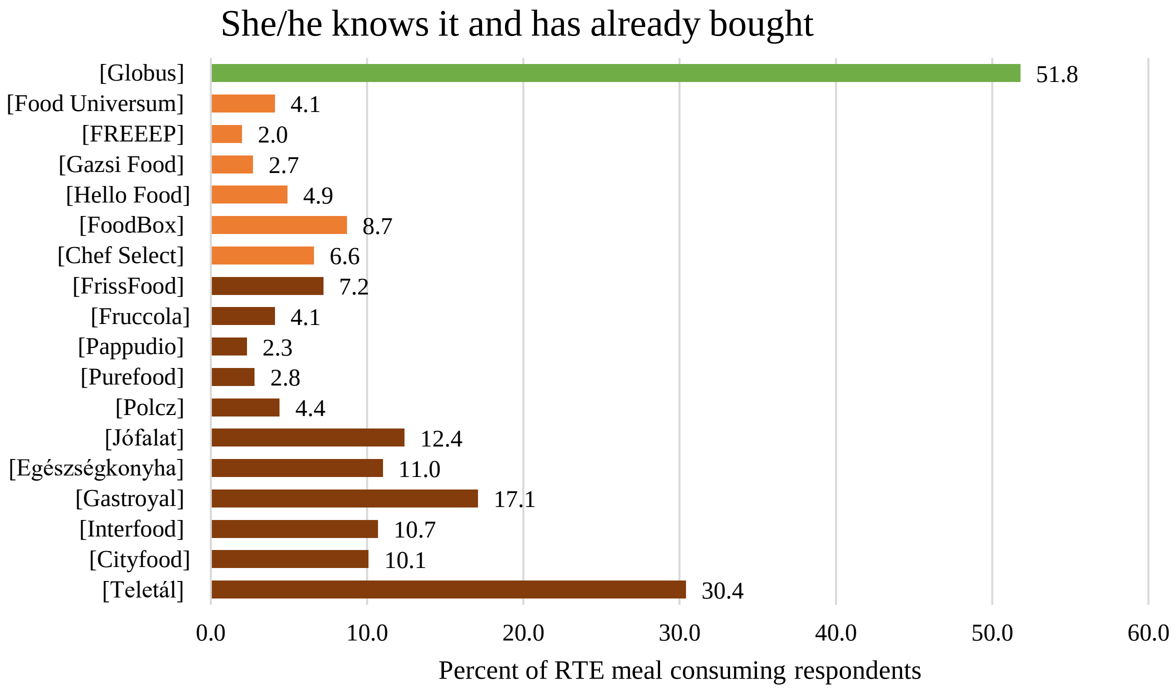
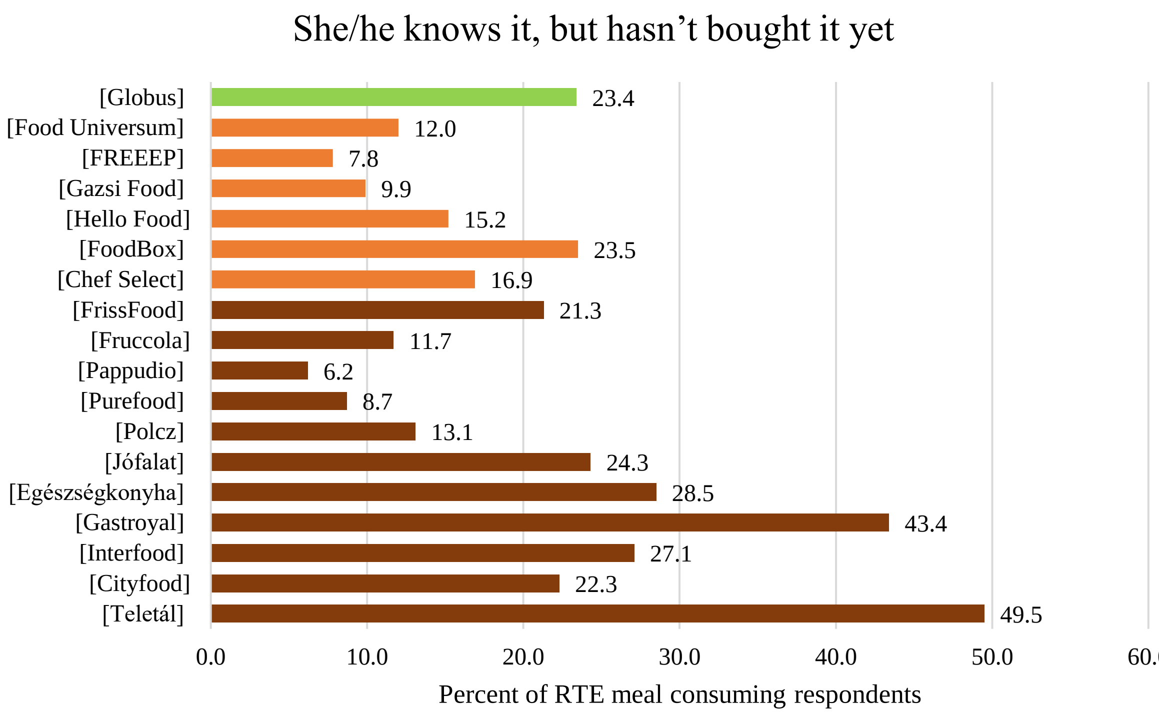


Figure 20 Awareness of different RTE brands

Brands with different colours are; green: traditional food company produced prepacked RTEs in tin, distributed via food retail, orange: food companies produced prepacked RTEs in innovative packages as plastic tray or paper box distributed via food retail, brown: companies produced non-prepacked food and distributed as single-dose delivery service



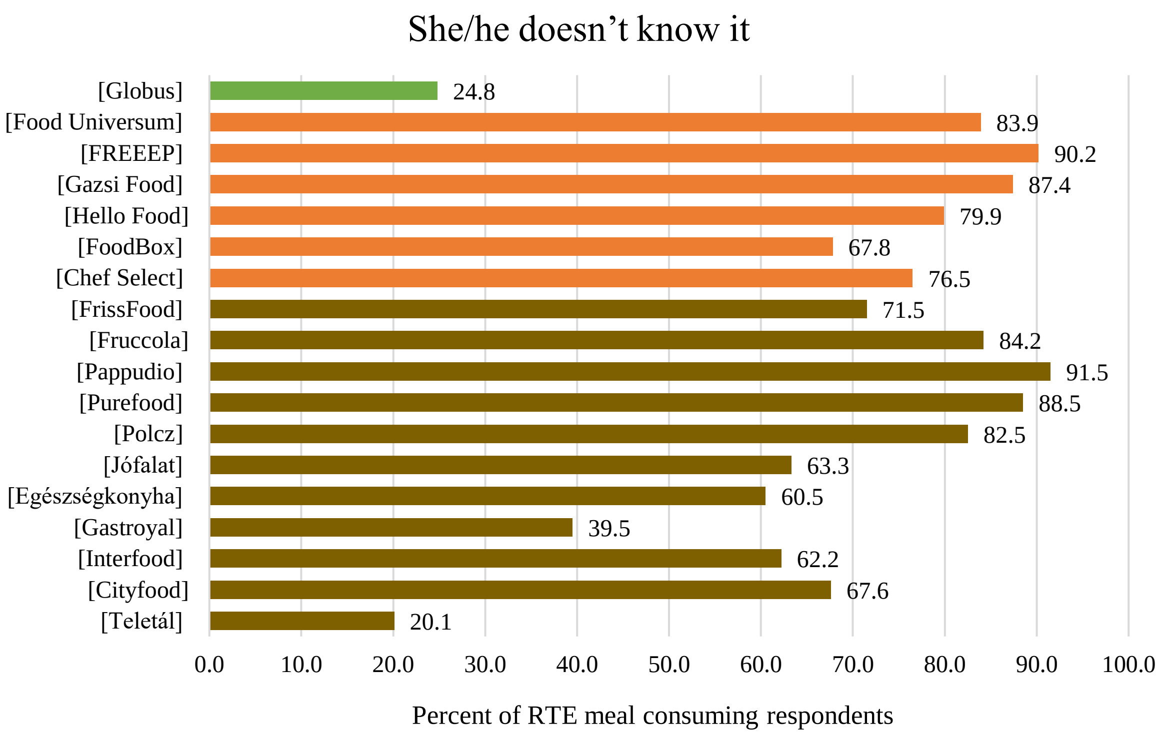


Figure 20 Awareness of different RTE brands cont.

Brands with different colours are; green: traditional food company produced prepacked RTEs in tin, distributed via food retail, orange: food companies produced prepacked RTEs in innovative packages as plastic tray or paper box distributed via food retail, brown: companies produced non-prepacked food and distributed as single-dose delivery service

Furthermore, we investigated if there are any relation between RTE meals consumption, BMI, gender, age, education, and income. The consumption of RTE meals in the Hungarian consumers were independent from the income (Chi^2 (9) = 15.35; p=0.082) and BMI (Chi^2 (3) = 7.14; p=0.068). However, there is a relation between ready meals consumption, and gender (Chi^2 (1) = 7.19; p<0.001) and RTE meals consumption and age (Chi^2 (2) = 8.87; p<0.001) as shown in Figure

21a and 21b. We found that Hungarian male consumes RTE meals more than the females according to the adjusted residuals (|AdjRes|>2). Additionally, we found that Hungarian consumers between 35-49 years old consumer more RTE meals (|AdjRes|>2). Moreover, the consumption of RTE meals in the Hungarian consumers were dependent on education (Chi^2 (4) = 24.12; p<0.001), Figure 21c. The Hungarian consumers who hold an elementary school education do not consume RTE meals more than consumers who is high school, university, college, or vocational school graduate and PhD or scientific degree holders (|AdjRes|>2). The Hungarian consumers who hold a university degree or college degree consume RTE meals more than other consumers with different educational backgrounds (|AdjRes|>2).

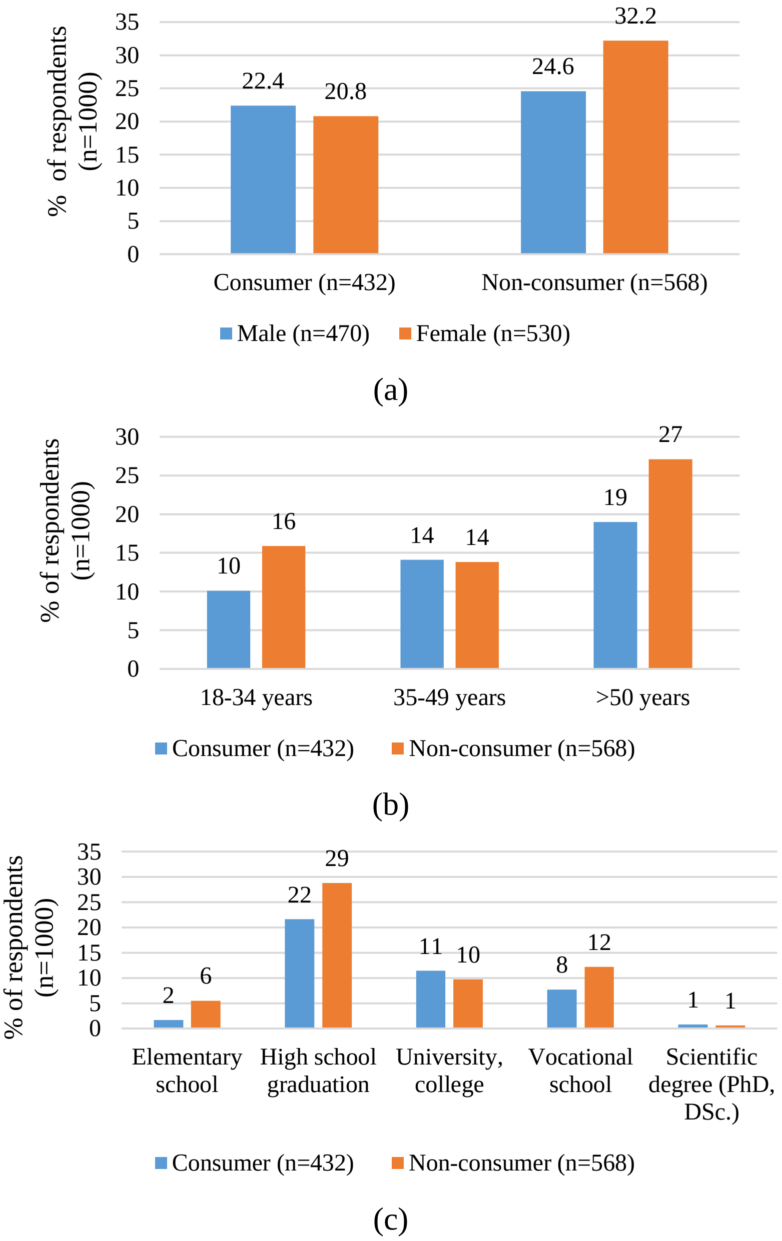


Figure 21 Results of χ^2 tests conducted on the consumption of RTE meals and gender, age, and educational background

Figure 22 shows how often Hungarian RTE consumers consume RTE meals for special dietary needs. Hungarian consumers purchase normal RTE meals mostly, then low fat, and low-sugar meals.

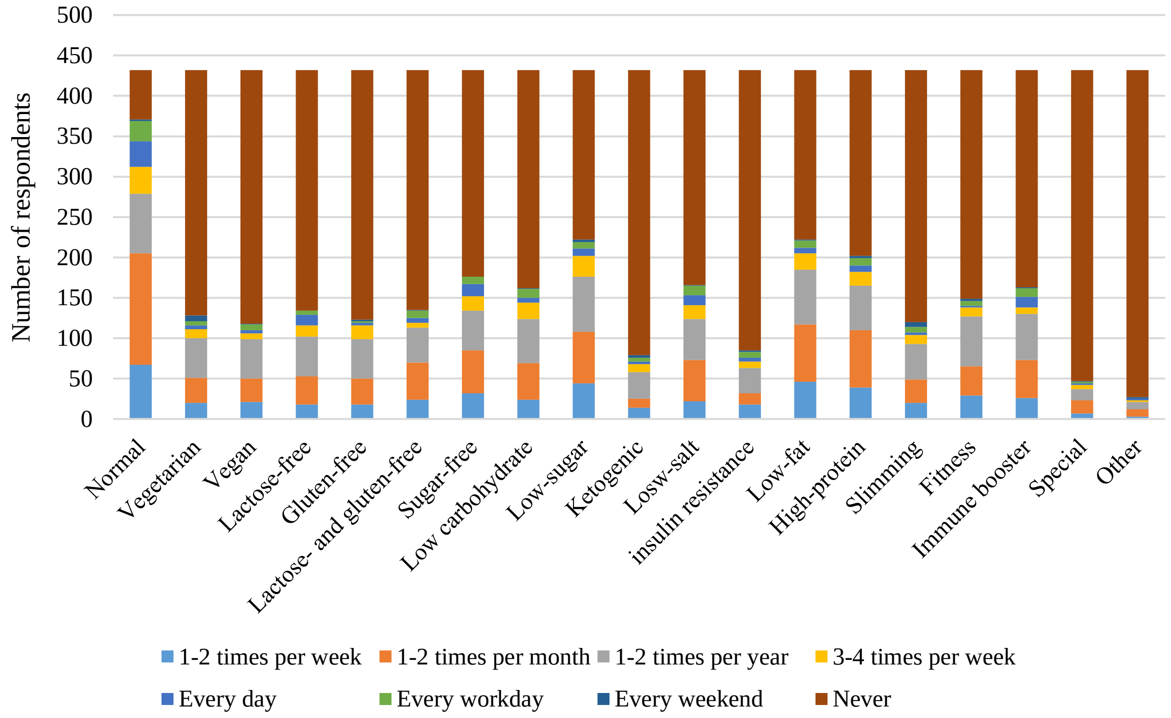


Figure 22 How often Hungarian RTE consumers consume RTE meals for special dietary needs (n=432)

Figure 23 shows in which form the Hungarian consumers consume RTE meals the most. As it shown in the figure, Hungarian consumers mostly eat RTE meals in the form of main course, pottage with toppings, and then salads and pickles. The least consumed form is a full day meal plan and hot or cold breakfast.

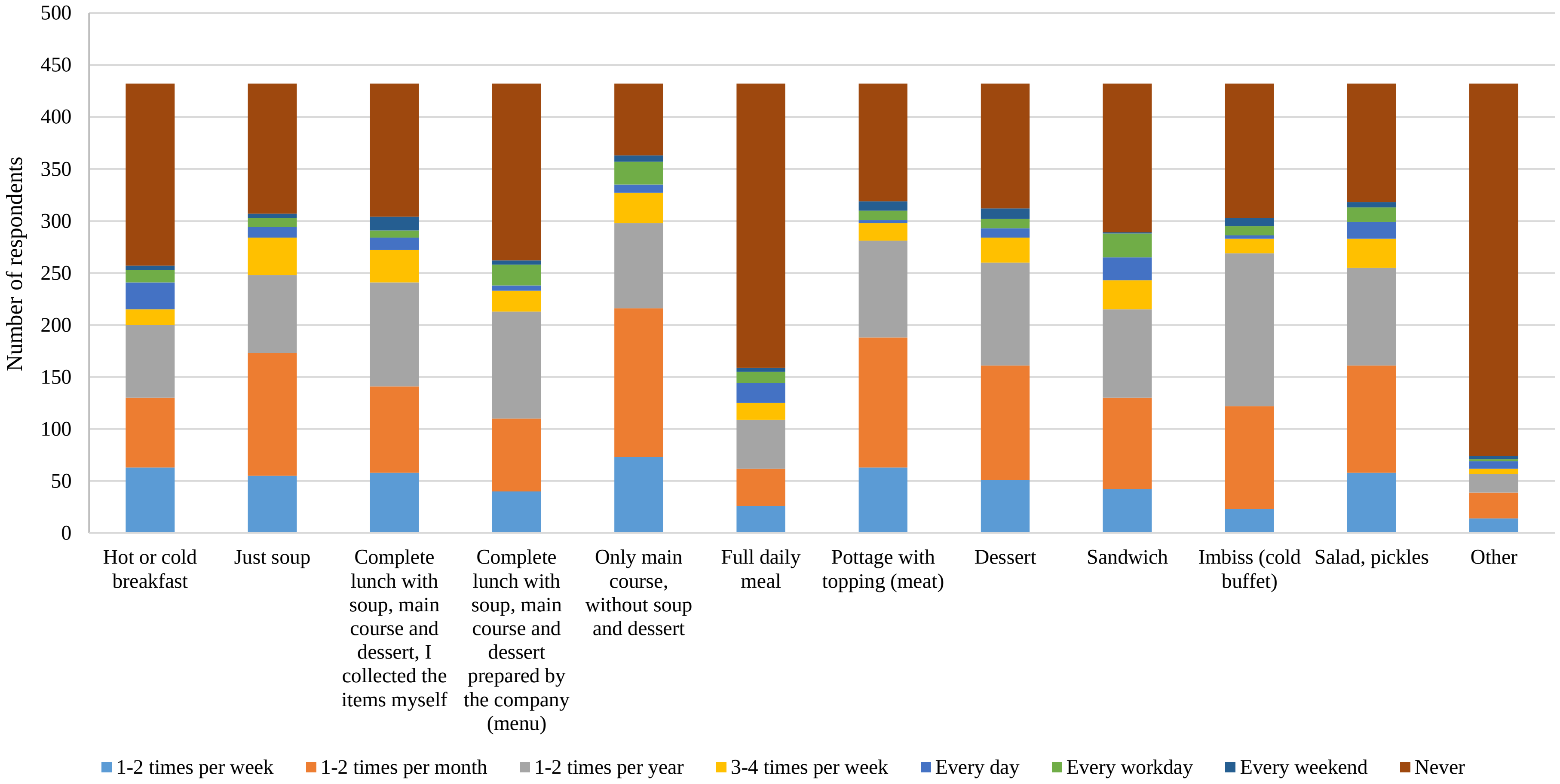


Figure 23 What form the Hungarian consumers consume RTE meals (n=432)

6. CONCLUSION AND RECOMMENDATIONS

Based on the data calculated from traditional recipes, neither Jordanian nor Hungarian traditional meals meet all the recommended nutritional requirements. Jordanian meals are low in carbohydrates and lack fiber, while having high protein, fat, and sodium content. Hungarian meals have lower carbohydrate and sugar content, but high protein, fat, and sodium content. Both cuisines require improvements in their nutritional value.

When comparing traditional and innovative ready-to-eat meals in Hungary, it was found that neither the prepacked nor the non-prepacked type fully met the WHO nutrient intake goals for preventing diet-related diseases. The traditional meals contained more energy, fat, saturated fatty acid, and sodium content, while the innovative meals had higher energy derived from carbohydrates, sugar, and protein. Both types of meals had more protein content than recommended, while only a small proportion met the recommended fiber intake. The innovative meals had a higher percentage of meals that met the recommendations for energy, fat, carbohydrate, and sodium, while the traditional meals had a higher percentage that met the recommendation for protein. It is evident that further improvements are required to make ready-to-eat meals in Hungary more nutritionally balanced, as per the findings of the study.

Regarding the study that compared the taste and nutrition of non-prepacked ready meals and homemade meals in Hungary. Homemade meals were more enjoyable, but there was no significant nutritional difference. Both met regulations for trans fats but lacked sufficient EPA, DHA, and alpha-linolenic acid. Ready meals had less trans fats, but otherwise, both types were similar. Labels on ready meals did not match nutritional content, highlighting a need for better food quality measurement and EU regulatory adherence.

Furthermore, based on our survey for chefs and consumers in Hungary; we can draw the idea that chefs and cooks in Hungary require more nutritional training. Also, the main reason why the consumers refuse to consume RTE meals was that they like to prepare their own food. On the other hands, the most common reasons for the Hungarian consumers to consume RTE meals are time-saving. In general, Hungarian consumers' views on the nutrition, healthfulness, and safety of RTE meals depend on whether they consume them or not.

Gastronomy, in general, plays an important role in determining the palatability and nutritional content of the foods consumed. More research should be done to determine the effect of gastronomy and cooking techniques on the micronutrient content of meals and their bioavailability. Furthermore, rather than viewing ready meals as a part of the problem, future research should focus on strategies to improve them and include them as a solution to combat non-communicable disease.

7. NEW SCIENTIFIC RESULTS

This research represents the first comprehensive investigation of its kind conducted in Hungary, focusing on the nutritional content of mixed dishes, as well as RTE meals, in comparison to nutritional recommendations within the context of gastronomy. It is also the first study to analyze the nutritional composition of RTE meals in a laboratory setting and compare them with homemade meals, while simultaneously assessing their organoleptic properties. Furthermore, this research pioneers the examination of chefs' and culinary personnel's awareness and nutritional knowledge, recognizing their crucial role in menu design and its impact on public health. Additionally, this study breaks new ground by exploring Hungarian consumers' attitudes and beliefs towards RTE meals, shedding light on an important aspect of their dietary choices. Overall, this research represents a pioneering effort in Hungary to address the multifaceted aspects of nutritional gastronomy and its implications for public health. The new scientific results of each research in this thesis are showing below:

I. Nutritional profile of traditional and modern meals

   Our findings revealed that no Jordanian or Hungarian meals met all nutritional recommendations. Jordanian meals have significantly lower carbohydrate content, while protein and fat content exceed recommendations. Hungarian meals deviate from recommendations in the same way, with lower carbohydrate and sugar ratios and higher protein and fat content.

II. Nutritional evaluation of ready-to-eat meals

   We found that none of the evaluated 177 prepacked ready-to-eat (RTE) meals (104 traditional and 73 innovative) met the nutrient intake goals recommended by the World Health Organization (WHO) for preventing diet-related diseases. The RTE meals had higher fat, saturated fatty acids, and protein content and lower carbohydrate content than the recommended value. There were significant differences between the traditional and innovative RTE meals. The innovative meals had a higher proportion of fat and carbohydrates that complied with the recommendations, while the traditional RTE meals had a higher proportion of foods that met the recommendation for protein content.

III. Comparison of homemade and RTE meals

   When determining the nutritional and sensory characteristics of Hungarian homemade and RTE meals, we found that homemade meals scored significantly higher than RTE meals. While the difference in nutritional content between the two meals was not significant. Both homemade and RTE meals have appropriate levels of saturated and trans fatty acids but low levels of essential fatty acids.

IV. Chefs' perceptions of health and nutrition

   Our survey results revealed no significant differences in nutrition in menu planning based on the backgrounds of chefs and culinary personnel (i.e., gender, age, position, educational level, work experience, and type and location of establishment). Managers and owners, on the other hand, prioritize health over chefs and cooks. Additional nutritional training for chefs and cooks in Hungary would be beneficial.

V. Hungarian consumers' beliefs and attitudes:

Over half of the 1000 respondents said they don't eat RTE meals because they prefer homemade food and are concerned about the cost and preservatives. In comparison to homemade and restaurant meals, non-consumers believe RTE meals are less healthy, contain harmful ingredients, and are less safe. More than one-third of respondents have been eating this type of food for a long time, and the most common reasons for doing so are time savings, quickly satisfying hunger, and wanting to spend time doing other things rather than cooking.

8. SUMMARY

This thesis focuses on nutritional gastronomy and its impact on recent food sector trends and a growing industry market, ready-to-eat meals and how healthy their nutritional profile, with a special emphasis on the Hungarian cuisine. Furthermore, it focuses on chefs' perceptions of health and nutrition because of their important role in gastronomy and public health.

Due to their convenience and ease of preparation, convenience foods such as ready-to-eat meals have become increasingly popular. These meals are pre-packaged and designed to be cooked quickly and easily, requiring little effort from the consumer. However, they are often high in calories, fat, salt, and added sugars, and may lack essential nutrients such as fiber, vitamins, and minerals. Additionally, ready meals may contain preservatives, artificial flavours, and other additives that can have adverse health effects. Regular consumption of these meals has been linked to an increased risk of obesity, type 2 diabetes, and other chronic diseases. This may be due to the fact that ready meals are often consumed as a substitute for fresh, home-cooked meals, which are generally more nutritious and lower in calories. Despite their disadvantages, busy individuals who lack the time or energy to prepare meals from scratch may find ready meals to be a convenient option.

The critical role of chefs in shaping food systems and influencing consumers' dietary intake cannot be overstated. The rise of outside food sources has led to an increase in metabolic disorders like diabetes, heart diseases, and obesity, making it imperative for chefs to promote healthier diets and sustainable food systems. By ensuring the nutritional value of food consumed outside the home, chefs can positively impact consumers' dietary choices. However, promoting healthy alternatives has been challenging for chefs, given the customers' preference for high-calorie, less nutritious items, lack of staff skills and knowledge for preparing healthier options, and higher ingredient costs that affect the profitability of healthier items. Despite these obstacles, chefs have a unique opportunity to provide healthier options and shape the culinary landscape. The emergence of celebrity chefs has expanded their reach beyond the kitchen, affecting public attitudes, corporate interests, and government policies on nutrition and sustainability. The growing number of food service centers adds to the challenge of providing healthy and delicious food while balancing economic feasibility.

Thus, the objective of the thesis was to evaluate the healthiness of ready-to-eat meals in Hungary as a recent trend in the food industry based on their nutritional profile, the effect of gastronomy traditions on ready-to-eat meals in terms of palatability and nutritional profile, and chefs' perceptions on health and nutrition. Furthermore, I evaluated the attitudes and beliefs of ready meals consumers in Hungary. Several investigations were conducted with the following specific objectives to achieve this overall aim.

I. *Comparing the energy content and macronutrients of forty main popular traditional and modern meals in both Jordan and Hungary with the national and international recommendations, where nutrients were calculated using two different nutrient calculation software (ESHA and NutriComp) and based on known recipes of the meals.* Our results showed that no Jordanian and Hungarian meals met all nutritional recommendations. The Jordanian meals' carbohydrate content is significantly lower than the recommendation's lower end, while the sugar content meets the recommendation of less than 10% energy. The protein content of meals is significantly higher than 15% of energy. The fat content significantly exceeds the upper limit of the recommendation, and the energy derived from saturated fatty acids is greater than the scientifically acceptable level. Jordanian meals do not meet the recommendations for

sodium and fiber, based on data calculated from recipes. Whereas in the Hungarian meals, the median of carbohydrate and sugar energy ratio for main dishes was significantly lower than the recommended lower limit, while the energy ratios of protein and fat content were significantly higher than the upper limit of the recommendation. However, the median for saturated fatty acids, fiber, and sodium did not significantly differ from the recommendation. With the exception of energy, the nutrients in Hungarian dishes deviate from the recommendation as much and in the same direction as Jordanian ones.

II. *Comparing the energy, macronutrients, salt, and fiber contents of ready-to-eat meals sold in groceries and delivered by catering services in Hungary with the nutritional guidelines published by the World Health Organization according to gastronomic backgrounds.* The nutritional information was obtained from the product label.

- We evaluated 177 prepacked ready-to-eat (RTE) meals sold in grocery stores and categorized them as traditional (n=104) and innovative (n=73) meals. We found that the innovative meals contained significantly higher energy, carbohydrate, and protein per portion than the traditional meals, while the fat and sodium content was significantly lower. The differences in saturated fatty acids and sugar content were not statistically significant. None of the meals met the nutrient intake goals recommended by the World Health Organization (WHO) for preventing diet-related diseases. The RTE meals exceeded the WHO intake goals for fat, saturated fatty acids, and protein. Both traditional and innovative meals had lower carbohydrate content than the recommended value. Only innovative meals met the recommended value for sugar intake. There were significant differences between the traditional and innovative RTE meals in meeting the recommendations for fat, carbohydrates, and protein. The innovative meals had a higher proportion of fat and carbohydrates that complied with the recommendations, while the traditional RTE meals had a higher proportion of foods that met the recommendation for protein content.
- We assessed 1017 non-prepacked ready-to-eat meals delivered by food services, dividing them into traditional (n=477) and innovative (n=540) meals. The traditional Hungarian meals had higher energy content (as a percentage of the daily recommended value of 2000 kcal), as well as energy derived from fat, saturated fatty acid, and sodium, compared to innovative meals. Conversely, innovative meals had significantly higher energy derived from carbohydrates, sugar, and protein. However, the difference for fiber per energy unit between the two meal types was not significant. Our results indicated significant differences between traditional and innovative meals in meeting the recommendations for energy, fat, carbohydrate, protein, and sodium. Innovative meals had a higher proportion of meals that met the recommendations for energy, fat, carbohydrate, and sodium, whereas traditional meals had a higher proportion of meals that met the recommendation for protein content. Both traditional and innovative meals did not fully comply with the WHO nutrient intake goals for preventing diet-related diseases. The percentage of energy derived from daily reference intake (% of 2000 kcal), fat, and sodium content (expressed as g/MJ) exceeded the recommendations. Additionally, energy derived from carbohydrates fell below the recommendation for both types of meals. Energy from protein exceeded the recommendation, while only a small proportion of meals met the recommendation for fiber content. Both traditional and innovative meals met the recommendations for sugar and saturated fatty acid contents.

III. Determining if the nutritional and sensory characteristics of homemade meals are healthier and better than RTE meals where the nutrient content was determined by laboratory tests. Regarding the comparison of organoleptic characteristics of non-prepacked ready and homemade meals; homemade received significantly higher scores than the ready ones.

Whereas the difference in the nutritional content of both meals was not significant. The nutritional content of RTE and HM meals regarding trans-fatty acids is not significant. The predominant trans-fatty acid is elaidic acid, which is not detectable in all samples. Other trans fatty acids detected were C18:2 9t12t, C18:2 9c12t, C18:2 9t12c, and C18:1 11t (n-9) as trans vaccenic acid. Both meals contain less than 2 g of trans fatty acids for every 100g of the total fat content, thus they meet the Hungarian Decree recommendations regarding trans fatty acids. Therefore, the RTE meals' Trans fats content can be considered good. On the other hands, the main saturated fatty acids present in all meals in both meals were palmitic acid (C16:0) and stearic acid (C18:0). The high content of palmitic acid can be explained by the usage of sunflower oil in cooking all of these meals. The average of the used sunflower oil in the HM meals was 18.8 g/portion +/- 6.8 g as the standard deviation. For the ready meals, we could not find the exact amount of the used oil. For monounsaturated, polyunsaturated, the dominant fatty acids in both meals from PUFA and MUFA are linoleic acid and oleic acid, respectively. Such fatty acid profiles can be explained by the type of fats used in cooking these meals. Alpha-linolenic acid content in ready meals was 25.3 mg/g of meal, which is considered a low amount taking into account EFSA recommendations (2-3 g/day for energy intakes of 1800-2700 kcal/day). The same thing goes for their contents of EPA and DHA. Ready meals contained traces amount of these fatty acids <0.01% mg/100 g of meal. On the other hand, the meals' content of n-6 accounts for 20% of what EFSA's panel proposed as labelling reference intake value (10 g). The homemade meals contained also a low amount of alpha-linolenic acid (23.2 mg/100 g of meal), a traces (<0.01% mg/100 g of meal) of EPA and DHA, and the same amount of n-6 as the ready ones. In general, both meals in Hungary contain an appropriate amount of saturated fatty acids and trans fatty acids. Nevertheless, they contain a low amount of EPA, DHA and alpha-linolenic acid. Ready meals contain less trans fats than homemade meals, and are equal in EPA, DHA, and alpha-linolenic acid. Moreover, the accuracy of food labelling in the Hungarian catering industry was evaluated in this thesis. There were significant differences between the value listed on the ready meals' labels and the analytical values regarding weight, energy, carbohydrate, and fat content. The actual weight of the meals was less than the one listed on the label. The analytical values of energy, carbohydrate, and fat contents were less than the labelled ones. Food caterers need to implement additional food quality measurements, and relevant authorities must take more stringent action to meet EU regulation No. 1169/2011's mandatory nutritional labelling requirements.

IV. *Evaluating chefs' perception on health and nutrition using a self-created questionnaire.* The responses to our survey showed no significant differences related to nutrition in menu planning based on chefs' and culinary personnel backgrounds (i.e., gender, age, position, educational level, work experience, and type and location of establishment). However, managers and owners consider health more than chefs and cooks. Personnel with more than 15 years of experience consider health aspects more than those with less than 15 years. We can draw the idea that chefs and cooks in Hungary require more nutritional training.

V. *Evaluating the Hungarian population's beliefs and attitude regarding the healthiness and nutritional content of ready meals in the framework of a representative questionnaire survey.* We had 1000 complete responses from Hungarian consumers. 23.74% of respondents never consumed RTE, 32.9% of them used to consume it but stopped. Thus, at the time of the survey, 56.8% of the respondents were not consumers of RTE. More than one third of the respondents (35.3%) have been consuming this type of food for a long time, and another 7.9% have recently added this type of convenience product to their diet. The main reason why the consumers (who never consumed and who stopped consumed recently) refuse to consume RTE meals was that they like to prepare their own food, followed by the opinion that RTE meals are expensive, and full of preservatives. On the other hands, the most common reasons for the Hungarian consumers to consume RTE meals are time-saving, quickly satisfying hunger, and wanting to spend time on other activities instead of cooking. Moreover, The Hungarian that do not consumer ready meals believe that ready meals are not healthier than homemade and restaurants' meals more than the Hungarian ready meals' consumers. Also, The RTE meals non consumers believes that RTE meals contain high fat, energy, sugar, saturated fatty acids, harmful ingredients and are less safe than HM, restaurants', and fast foods. Ultimately, Hungarian consumers' views on the nutrition, healthfulness, and safety of RTE meals depend on whether they consume them or not. Furthermore, we found that Hungarian males consumes RTE meals more often than the females, Hungarian consumers between 35-49 years old consume more RTE meals than the other age categories. Moreover, the Hungarian consumers who hold an elementary school education do not consume RTE meals more often than consumers who is high school, university, college, or vocational school graduates and PhD or scientific degree holders. The Hungarian consumers who hold a university degree or college degree consume RTE meals more often than other consumers with different educational backgrounds.

In conclusion, traditional Jordanian and Hungarian meals do not meet all the recommended nutritional requirements, and there is a need for improvements in their nutritional value. Ready-to-eat meals in Hungary, both traditional and innovative, also do not fully comply with WHO nutrient intake goals for preventing diet-related diseases. Homemade meals were found to be more enjoyable than ready meals, but both lacked sufficient essential fatty acids. Chefs in Hungary require more nutritional training. Moreover, the labelling on ready meals needs to match the nutritional content. Gastronomy plays an important role in determining the palatability and nutritional content of consumed foods, and further research is needed to investigate its effect on micronutrient content and bioavailability. Strategies should focus on improving ready meals and including them as a solution to fight non-communicable diseases, instead of viewing them as part of the problem.

PUBLICATIONS RELATED TO THE SUBJECT OF THE THESIS

Journal articles publications

AlOudat, M., Papp, A., Magyar, N., Simon Sarkadi, L., Lugasi, A. (2020). Nutritional value of traditional and modern meals: Jordan and Hungary, Acta Alimentaria, 49(4), 491-497. doi: https://doi.org/10.1556/066.2020.49.4.15 (IF: 0,61; citation:2)

AlOudat, M., Magyar, N., Simon Sarkadi, L., Lugasi, A. (2021). Nutritional content of ready-to-eat meals sold in groceries in Hungary. International Journal of Gastronomy and Food Science, 24, 100318. doi: https://doi.org/10.1016/j.ijgfs.2021.100318 (IF: 3,194; citation: 12)

AlOudat, M., Magyar, N., Simon Sarkadi, L., Shaikh, A.M., Lugasi, A. (2022). Nutrient content of single-dose ready-to-eat meals delivered by catering industry in Hungary, Journal of Culinary Science Technology, doi: https://doi.org/10.1080/15428052.2022.2091071 (IF: 1,28)

Conference publications

AlOudat M., Papp, A., Lugasi, A., Magyar, N., Simon Sarkadi L. (2019). Nutritional analysis of traditional meals: Jordan and Hungary. In: Fodor, Marietta; Bodor, Péter (eds.) SZIENtific meeting for young researchers, Gödöllő, Hungary, Szent István University, pp. 13-19. 2019.

AlOudat, M., Magyar, N., Simon Sarkadi, L., Lugasi, A. (2020). Nutritional content of ready-to-eat meals sold in groceries in Hungary. Scientific Meeting of Young Researchers, Szent István University Budapest, 7th December 2020, ISBN 978-963-269-937-0, pp. 57-65.

Conferences

AlOudat M., Papp A., Lugasi A., Sarkadi L: Application of nutritional analysis software for comparison of nutritional value of traditional meals: Jordan and Hungary. XLIV. Congress of the Hungarian Society of Nutrition, Székesfehérvár 3-5 October 2019.

AlOudat M., Norbert M., Simon Sarkadi L., Lugasi A.: Nutritional content of ready-to-eat meals sold in groceries. IV. SZIEntific Meeting for Young Researchers, 7th December 2020.

Aloudat M., Magyar N., Sarkadi L., Lugasi A.: Nutritional content of ready-to-eat meals in Hungary. X. PhD online Conference of the Hungarian Society of Nutrition Budapest, 5th November 2020.

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APPENDIXES

Appendix (A): Hungarian recipes (n=40)

1. Kettle goulash

Ingredients: neck of beef, onion, lard, paprika, green pepper, tomato, salt, potatoes

Side dish: nipped pasta (ingredients: flour and egg)

Table A1 Nutritional composition of kettle goulash

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	615	562
Protein (g)	42.5	47.2
Fat (g)	25.4	20.6
Saturated fatty acids (g)	7.6	3.0
Carbohydrate (g)	53.2	51.2
Fiber (g)	8.0	6.1
Sugar (g)	7.5	3.1
Sodium (mg)	709	712

2. Beef in gravy

Ingredients: eye of round, smoked bacon, flour, lard, sugar, vinegar, mustard, sour cream, carrots, parsnips, onion, black pepper corns, bay leaves, salt

Side dish: bread dumplings (ingredients: roll, lard, milk, flour, egg, salt)

Table A2 Nutritional composition of beef in gravy

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1351	1196
Protein (g)	56.0	66.8
Fat (g)	78.1	51.2
Saturated fatty acids (g)	21.3	30.8
Carbohydrate (g)	104	111
Fiber (g)	7.0	6.3
Sugar (g)	10.0	9.6
Sodium (mg)	1797	1175

3. Veal stew

Ingredients: knuckle of veal, lard, onion, paprika, salt, tomato paste, green pepper

Side dish: small gnocchi (ingredients: lard, eggs, salt, flour)

Table A3 Nutritional composition of veal stew

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1164	1186
Protein (g)	62.3	61.9
Fat (g)	47.1	47.5
Saturated fatty acids (g)	18.0	17.5
Carbohydrate (g)	121	122
Fiber (g)	8.1	6.0
Sugar (g)	5.5	3.9
Sodium (mg)	1258	1330

4. Wiener schnitzel
Ingredients: leg or rib of veal, salt, eggs, flour, bread crumbs, vegetable oil

Side dish: boiled potatoes (ingredients: potatoes, salt)

Table A4 Nutritional composition of Wiener schnitzel

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	755	721
Protein (g)	61.7	66.5
Fat (g)	18.6	15.9
Saturated fatty acids (g)	4.0	5.5
Carbohydrate (g)	84.2	79.8
Fiber (g)	7.7	6.1
Sugar (g)	5.5	2.9
Sodium (mg)	1753	1613

5. Stuffed green peppers
Ingredients: green peppers, leg or shoulder of pork, onion, lard, rice, tomato, flour, sugar, salt

Side dish: boiled potatoes (ingredients: potatoes, salt)

Table A5 Nutritional composition of stuffed green peppers

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	875	749
Protein (g)	36.7	35.4
Fat (g)	44.9	32.7
Saturated fatty acids (g)	11.3	15.5
Carbohydrate (g)	80.0	87.2
Fiber (g)	19.0	13.6
Sugar (g)	23.6	9.6
Sodium (mg)	1306	1256

6. Black pepper fricassee
Ingredients: round of beef (blade, sirloin), smoked bacon, lard, onion, tomato, black pepper, salt, green pepper

Side dish: boiled potatoes (ingredients: potatoes, salt)

Table A6 Nutritional composition of black pepper fricassee

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	883	685
Protein (g)	41.1	71.0
Fat (g)	60.1	29.5
Saturated fatty acids (g)	11.4	23.0
Carbohydrate (g)	43.1	41.1
Fiber (g)	7.1	5.2
Sugar (g)	6.9	2.71
Sodium (mg)	1490	1813

7. Stefánia style meat loaf
Ingredients: leg or shoulder pork, roll, eggs, onion, lard, black pepper, salt

Side dish: none

Table A7 Nutritional composition of Stefánia style meat loaf

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	628	508
Protein (g)	31.7	32.9
Fat (g)	**52.3**	**38.4**
Saturated fatty acids (g)	13.3	18.4
Carbohydrate (g)	7.0	6.4
Fiber (g)	0.38	0.29
Sugar (g)	0.66	0.57
Sodium (mg)	807	766

8. Paprika chicken
Ingredients: whole chicken, lard, onion, paprika, green pepper, tomato, salt, flour, sour cream

Side dish: small gnocchi (ingredients: lard, eggs, milk, salt, flour)

Table A8 Nutritional composition of paprika chicken

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1476	1437
Protein (g)	68.3	66.7
Fat (g)	78.2	71.7
Saturated fatty acids (g)	25.3	27. 9
Carbohydrate (g)	123	123.1
Fiber (g)	8.7	5.4
Sugar (g)	6.3	4.70
Sodium (mg)	1426	1396

9. Serbian carp
Ingredients: potatoes, bacon, carp, lard, salt, onion, paprika, green pepper, tomatoes, sour cream

Side dish: none

Table A9 Nutritional composition of Serbian carp

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	939	762
Protein (g)	59.7	67.0
Fat (g)	50.3	30.2
Saturated fatty acids (g)	10.32	16.0
Carbohydrate (g)	60.6	60.0
Fiber (g)	11.62	8.3
Sugar (g)	16.1	7.0
Sodium (mg)	940	948

10. Green pepper and tomato stew
Ingredients: green peppers, tomatoes, onion, lard, salt

Side dish: boiled potatoes (potatoes, salt)

Table A10 Nutritional composition of green pepper and tomato stew

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	368	327
Protein (g)	10.2	8.9
Fat (g)	11.5	10.9
Saturated fatty acids (g)	4.4	3.8
Carbohydrate (g)	55.5	58.7
Fiber (g)	14.5	10.7
Sugar (g)	17.9	6.2
Sodium (mg)	1211	1177

11. Stuffed cabbage
Ingredients: smoked pork rib chops, pork shouldered or flank, onion, lard, rice, sauerkraut, sour cabbage leaves, black pepper, salt, egg, flour, sour cream

Side dish: none

Table A11 Nutritional composition of stuffed cabbage

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	877	558
Protein (g)	38.2	37.1
Fat (g)	68.3	29.6
Saturated fatty acids (g)	13.6	26.5
Carbohydrate (g)	26.2	27.9
Fiber (g)	7.3	8.2
Sugar (g)	3.5	2.7
Sodium (mg)	3313	3148

12. Braised squash
Ingredients: yellow squash, salt, lard, flour, paprika, onion, tomato, sweet green paprika pepper, curd, fresh dill

Side dish: none

Table A12 Nutritional composition of braised squash

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	538	355
Protein (g)	9.1	8.5
Fat (g)	27.1	23.9
Saturated fatty acids (g)	13.0	11.4
Carbohydrate (g)	63.8	28.0
Fiber (g)	4.4	4.2
Sugar (g)	11.2	16.3
Sodium (mg)	643	728

13. Ragout countryside style
Ingredients: lean pork shoulder, smoked bacon, vegetable oil, green peppers, tomato, sour cream, flour, sweet paprika, salt

Side dish: buttered dumplings (butter, eggs, flour)

Table A13 Nutritional composition of ragout countryside style

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1008	954
Protein (g)	47.8	49.4
Fat (g)	63.7	56.1
Saturated fatty acids (g)	25.4	24.6
Carbohydrate (g)	59.7	58.6
Fiber (g)	4.3	3.3
Sugar (g)	3.5	4.4
Sodium (mg)	1135	1280

14. Sweet and sour pork
Ingredients: stewing pork (hocks, tail, liver, heart), vegetable oil, onions, bay leaves, sour cream, flour, mustard, sugar, lemon juice, grated lemon rind, salt, fresh grounded pepper

Side dish: bread dumplings (roll, vegetable oil, onion, parsley, flour, egg, salt)

Table A14 Nutritional composition of sweet and sour pork

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1102	1127
Protein (g)	54.0	58.2
Fat (g)	71.4	70.
Saturated fatty acids (g)	22.7	21.9
Carbohydrate (g)	59.3	59.0
Fiber (g)	3.70	2.4
Sugar (g)	13.4	10.6
Sodium (mg)	1103	950

15. Saddle of hare in piquant sauce
Ingredients: hare, smoked bacon, vegetable oil, carrots, parsnips, onion, capers, thyme, bay leaves, sugar, dry white wine, sour cream, flour, lemon juice, mustard, stock, salt, peppercorns, celeriac, garlic

Side dish: none

Table A15 Nutritional composition of saddle of hare in piquant sauce

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1177	1332
Protein (g)	87.4	87.6
Fat (g)	50.4	64.4
Saturated fatty acids (g)	17.2	14.5
Carbohydrate (g)	87.2	93.3
Fiber (g)	10.4	7.4
Sugar (g)	26.9	21.8
Sodium (mg)	2731	2948

16. Szeged style chicken with egg barley

Ingredients: chicken breast, vegetable oil, onions, garlic, egg barley, tomatoes, parsley, paprika, salt

Side dish: none

Table A16 Nutritional composition of Szeged style chicken with egg barley

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1451	1475
Protein (g)	75.1	61.7
Fat (g)	103	95.7
Saturated fatty acids (g)	16.2	26.6
Carbohydrate (g)	52.5	95.8
Fiber (g)	8.2	10.0
Sugar (g)	11.7	8.53
Sodium (mg)	1185	2600

17. Goose and rice casserole

Ingredients: goose drumsticks, carrots, parsnips, onions, garlic, goose fat, celeriac, rice, mushrooms, parsley, goose liver, salt, peppercorns, pepper, ginger

Side dish: none

Table A17 Nutritional composition of goose and rice casserole

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1373	1113
Protein (g)	80.3	90.1
Fat (g)	86.2	51.7
Saturated fatty acids (g)	17.3	31.2
Carbohydrate (g)	65.9	71.5
Fiber (g)	10.9	7.0
Sugar (g)	7.7	4.45
Sodium (mg)	1150	1023

18. Palóc soup

Ingredients: vegetable oil, onions, paprika, roast lamb shoulder blade, garlic, caraway seeds, bay leaf, salt, potato, green beans, baking soda, sour cream, flour, dill

Side dish: none

Table A18 Nutritional composition of Palóc soup

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	430	511
Protein (g)	22.2	23.9
Fat (g)	25.0	33.3
Saturated fatty acids (g)	12.0	8.1
Carbohydrate (g)	28.3	28.9
Fiber (g)	5.4	4.9
Sugar (g)	7.2	5.2
Sodium (mg)	762	730

19. Stuffed kohlrabies

Ingredients: kohlrabies, parsley, roll, chicken broth, heavy cream, veal, egg, salt, white pepper, unsalted butter, flour, milk

Side dish: none

Table A19 Nutritional composition of stuffed kohlrabies

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	530	596
Protein (g)	35	31.7
Fat (g)	25.7	36.5
Saturated fatty acids (g)	20.2	12.5
Carbohydrate (g)	38.9	36.3
Fiber (g)	4.6	5.1
Sugar (g)	12.3	9.5
Sodium (mg)	1257	1259

20. Gundel ragout

Ingredients: unsalted butter, onions, mushroom, parsley, salt, white pepper, red wine, carrots, parsnip, celery stalk, tomato, veal stock, flour, white asparagus, green beans, baking soda, beef tenderloin, goose liver, vegetable oil, potato, egg yolk, fresh nutmeg, dried white bread crumbs

Side dish: none

Table A20 Nutritional composition of Gundel ragout

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1123	865
Protein (g)	61.4	67.6
Fat (g)	72.8	48.2
Saturated fatty acids (g)	12.5	19.8
Carbohydrate (g)	42.2	42.2
Fiber (g)	7.6	5.3
Sugar (g)	6.3	3.8
Sodium (mg)	2115	2164

21. Grape leaves stuffed with lamb in capers sauce

Ingredients: rice, water, salt, tomato, olive oil, pepper, oregano, salt, lemon juice, onion, garlic, parsley, dill, minced lamb shoulder, cinnamon, grape leaves, peels of tomatoes, sunflower oil, butter, flour, vegetable stock, capers (canned), egg, leek, carrot, turnip, celery, fresh ginger, thyme, bay leaf

Side dish: none

Table A21 Nutritional composition of grape leaves stuffed with lamb in capers sauce

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	522	6390
Protein (g)	7.7	23.0
Fat (g)	36.7	43.0
Saturated fatty acids (g)	8.3	11.0
Carbohydrate (g)	42.1	41.0
Fiber (g)	7.1	7.5
Sugar (g)	5.3	4.6
Sodium (mg)	1084	1176

22. Veal knuckle of Sevilla '92

Ingredients: veal knuckles, onions, garlic, extra virgin olive oil, butter, salt, thyme, rosemary, purple onion, courgette, tomato puree, tomato, stoned green olives, pinto bean, dry white wine, meat stock, bay, salt, ground pepper, potatoes, sunflower oil

Side dish: none

Table A22 Nutritional composition of veal knuckle of Sevilla '92

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	783	930
Protein (g)	25.9	39.0
Fat (g)	60.2	63.5
Saturated fatty acids (g)	13.3	13.2
Carbohydrate (g)	35.4	45.5
Fiber (g)	5.5	12.0
Sugar (g)	6.0	4.6
Sodium (mg)	1428	1392

23. Pork fillet Lombardy style with red wine sauce, ham and Parmesan rice stuffed in tomato with basil and marinated cucumber

Ingredients: pork tenderloin fillet, extra virgin olive oil, fresh rosemary, salt, pepper, sugar, sunflower oil, carrot, turnip, celeriac (root), onion, fresh thyme, tomato puree, water, dry red wine, parsley stalk, pepper, bay leaf, cucumber, white wine vinegar, garlic, champignon, lemon juice, tomato, fresh basil, rice, onion, thyme, butter, ham, parmesan cheese

Side dish: none

Table A23 Nutritional composition of pork fillet Lombardy style with red wine sauce, ham and Parmesan rice stuffed in tomato with basil and marinated cucumber

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	940	820
Protein (g)	38.0	45.5
Fat (g)	64.5	51.0
Saturated fatty acids (g)	16.9	13.0
Carbohydrate (g)	50.2	39.0
Fiber (g)	5.8	6.0
Sugar (g)	11.2	6.1
Sodium (mg)	2397	1160

24. Ginger-garlic chicken skewers with saffron chicken veloute, mushroom buckwheat and courgette

Ingredients: chicken thigh fillet, fresh ginger, garlic, milk, salt, flour, sunflower oil, onion, buckwheat, champignon, mushroom, ground pepper, parsley, butter, leek, chicken stock, mushroom stalk, bay leaf, parsley, fresh thyme, ground white pepper, saffron, zucchini, lemon juice, dill, chicken bone, carrot, turnip, celery, whole pepper, fresh ginger

Side dish: none

Table A24 Nutritional composition of ginger-garlic chicken skewers with saffron chicken veloute, mushroom buckwheat and courgette

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	921	924
Protein (g)	42.6	46.0
Fat (g)	52.6	53.0
Saturated fatty acids (g)	12.6	12.5
Carbohydrate (g)	73.8	65.0
Fiber (g)	8.7	6.5
Sugar (g)	5.9	4.4
Sodium (mg)	1044	972

25. Asparagus and paprika chicken from Öttömös with cottage cheese lasagne, asparagus puree and crispy bacon pasta

Ingredients: chicken thigh fillet, onion, lard, paprika, salt, Hungarian wax pepper sweet, tomato, spicy green peppers, sour cream, flour, green asparagus, sugar, 30% fat cream, bacon, lasagna pasta, cottage cheese, butter, asparagus

Side dish: none

Table A25 Nutritional composition of asparagus and paprika chicken from Öttömös with cottage cheese lasagne, asparagus puree and crispy bacon pasta

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1173	1187
Protein (g)	85.6	62.0
Fat (g)	68.8	78.0
Saturated fatty acids (g)	30.2	32.0
Carbohydrate (g)	72.3	59.0
Fiber (g)	7.4	5.0
Sugar (g)	13.6	8.3
Sodium (mg)	1898	1463

26. Beef stew in red wine with vegetables, wild mushrooms and potatoes braised in rosemary-lemon butter

Ingredients: beef shoulder, carrot, celery, shallot, dry red wine, meat stock, , fresh thyme, fresh rosemary, bay leaves, whole pepper, star anise, salt, ground pepper, porcini mushroom, blewit, chanterelle, olive oil, butter, parsley, garlic, potato, lemon juice, lemon zest

Side dish: none

Table A26 Nutritional composition of beef stew in red wine with vegetables, wild mushrooms and potatoes braised in rosemary-lemon butter

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	505	479
Protein (g)	27.8	30.0
Fat (g)	14.2	15.0
Saturated fatty acids (g)	6.2	6.0
Carbohydrate (g)	49.9	31.0
Fiber (g)	6.6	11.0
Sugar (g)	7.7	4.8
Sodium (mg)	2264	959

27. Duck breast served on potato disc with pear in red wine, prunes and roasted leeks

Ingredients: duck breast, salt, freshly ground pepper, potato, duck fat, leeks, pear, red wine, sugar, lemon juice, lemon zest, star anise, prunes, onion, carrot, celeriac, tomato puree, pepper, thyme

Side dish: none

Table A27 Nutritional composition of Duck breast served on potato disc with pear in red wine, prunes and roasted leeks

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	479	588
Protein (g)	33.5	33.0
Fat (g)	11.7	24.0
Saturated fatty acids (g)	3.4	9.0
Carbohydrate (g)	46.6	37.0
Fiber (g)	6.0	8.5
Sugar (g)	17.5	15.9
Sodium (mg)	1702	1053

28. Czifray style Christmas veal tenderloin

Ingredients: veal tenderloin, chives, basil, parsley, sunflower oil, salt, ground pepper, sugar, carrots, turnip, celeriac, onion, fresh thyme, tomato puree, water, Portugieser (from Villány, Hungary), stalk of parsley, mushroom, pepper, bay leaf, butter, shallot, champignon, carrot, frozen whole chestnuts without the shell, apple, goose liver, fresh rosemary, potato, milk, yeast, flour, egg yolks, ground nutmeg, ground white pepper, courgette, buckwheat, corn grits

Side dish: none

Table A28 Nutritional composition of Czifray style Christmas veal tenderloin

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1522	1650
Protein (g)	51.9	59.0
Fat (g)	79.4	78.0
Saturated fatty acids (g)	29.2	28.00
Carbohydrate (g)	156	148
Fiber (g)	17.1	18.0
Sugar (g)	23.0	18.1
Sodium (mg)	1421	1507

29. Rabbit pate with cranberry sauce, pumpkin, courgette and carrot julienne

Ingredients: rabbit thighs fillet, loin fillet of rabbit, minced lean meat, smoked lard, rabbit liver, cleaned pistachio, 30% fat cream, fresh thyme, salt, ground mixed pepper, vegetable oil, sliced bacon, blueberry jam, fresh blueberries, orange juice, salt, lemon juice, cayenne pepper, pumpkin or sweet potato, ground ginger, zucchini, carrot, butter, garlic, fresh oregano, basil

Side dish: none

Table A29 Nutritional composition of Rabbit pate with cranberry sauce, pumpkin, courgette and carrot julienne

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	933	871
Protein (g)	40.8	35.0
Fat (g)	72.0	61.0
Saturated fatty acids (g)	31.7	24.0
Carbohydrate (g)	29.6	45.0
Fiber (g)	4.3	4.0
Sugar (g)	17.2	26.7
Sodium (mg)	1994	1569

30. Stroganov beef fillet with potato croquette

Ingredients: fillet of beef, grape seed oil, shallots, mushrooms (*Boletus edulis*, porcin), champignon, pickles, mustard, 30% fat cream, parsley, salt, mixed pepper, cucumber, water, white wine vinegar, sugar, potatoes, flour, eggs, ground nutmeg, vegetable oil, panko crumb

Side dish: none

Table A30 Nutritional composition of Stroganov beef fillet with potato croquette

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	976	1028
Protein (g)	51.7	55.0
Fat (g)	31.9	44.5
Saturated fatty acids (g)	5.9	16.0
Carbohydrate (g)	116	101
Fiber (g)	7.5	14.0
Sugar (g)	12.6	6.3
Sodium (mg)	1854	1603

31. Salmon, sweet potato, pearl barley

Ingredients: salmon fillet, salt, sugar, lemon zest, orange zest, olive oil, sweet potato, butter, 30% fat cream, curly kale, lemon juice, pearl barley, orange flesh, parsley, coriander leaves, chives

Side dish: none

Table A31 Nutritional composition of salmon, sweet potato, pearl barley

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1187	1250
Protein (g)	42.7	43.0
Fat (g)	65.5	80.0
Saturated fatty acids (g)	28.1	29.0
Carbohydrate (g)	105	88.5
Fiber (g)	16.3	13.0
Sugar (g)	10.5	13.6
Sodium (mg)	1259	1007

32. Confit salmon fillet, parsnip puree, almond crumb, marinated carrot, Savoy cabbage, pumpkin seed oil

Ingredients: salmon fillet, olive oil, grounded almond without its peel, flour, butter, savoy cabbage, salt, ground mixed pepper, parsnip, onion, vegetable stock, ground pepper, 30% fat cream, carrot, white wine vinegar, water, sugar, pumpkin seed oil, Maldon salt

Side dish: none

Table A32 Nutritional composition of confit salmon fillet, parsnip puree, almond crumb, marinated carrot, Savoy cabbage, pumpkin seed oil

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	791	886
Protein (g)	38.2	39.0
Fat (g)	57.0	67.0
Saturated fatty acids (g)	16.1	17.0
Carbohydrate (g)	30.7	29.0
Fiber (g)	6.7	8.5
Sugar (g)	6.2	5.7
Sodium (mg)	999	961

33. Poached halibut and garlic-butter shrimp with spinach gnocchi, vegetable and fruit rolls and citrus sauce

Ingredients: lemon, lime, orange, allspice, frozen spinach, ricotta, parmesan, egg yolk, wheat starch, salt, grated nutmeg, flour, water, butter, rosemary, chives, carrot, celeriac, apple, balsamic vinegar, blossom honey, parsley, chives, extra virgin olive oil, ice cubes, halibut fillet, orange zest, lime zest, black tiger shrimp, garlic

Side dish: none

Table A33 Nutritional composition of poached halibut and garlic-butter shrimp with spinach gnocchi, vegetable and fruit rolls and citrus sauce

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	976	787
Protein (g)	60.2	58.3
Fat (g)	59.8	44.2
Saturated fatty acids (g)	29.1	21.0
Carbohydrate (g)	48.7	34.0
Fiber (g)	7.2	7.0
Sugar (g)	16.8	14.3
Sodium (mg)	1901	1660

34. Mustard-seeded lamb with breaded cakes

Ingredients: leg of lamb, elderberry syrup, meat stock, dry white wine, garlic, apple vinegar, onions, bay leaf, mustard seeds, lard, mixed pepper, salt, flour, milk, yeast, sugar, egg yolks, bacon, sour cream, lukewarm water, lard

Side dish: none

Table A34 Nutritional composition of mustard-seeded lamb with breaded cakes

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1299	1234
Protein (g)	60.1	57.0
Fat (g)	66.3	63.0
Saturated fatty acids (g)	29.3	27.0
Carbohydrate (g)	99.8	97.0
Fiber (g)	6.6	7.5
Sugar (g)	15.8	13.7
Sodium (mg)	3103	2154

35. Turbot with carabineros, cauliflower, shrimp tartare served in pasta basket, bisque and lettuce sauce

Ingredients: turbot, lime zest, butter, salt, Carabineros (shrimp form Sicily), olive oil, garlic, parsley, turbot bones, Carabineros shell, onion, celeriac, leek, dry white wine, bay leaf, cilantro stems, parsley stems, 30% fat cream, shrimp, lime peel, lime juice, coriander, dill, shallots, ginger, cucumber, green apple, wonton pasta, salt, cauliflower, milk, orange juice, agar-agar, sunflower oil, romaine lettuce, cream, fresh spinach, potatoes, balsamic vinegar, sugar, lemon juice

Side dish: none

Table A35 Nutritional composition of turbot with carabineros, cauliflower, shrimp tartare served in pasta basket, bisque and lettuce sauce

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1748	1710
Protein (g)	76.0	95.0
Fat (g)	111	93.0
Saturated fatty acids (g)	57.2	39.0
Carbohydrate (g)	96.7	102
Fiber (g)	9.7	16.0
Sugar (g)	27.1	24.3
Sodium (mg)	2730	1983

36. Veal tenderloin in green herb crust, curry carrot puree

Ingredients: veal tenderloin, butter, salt, pepper, panko crumb, Dijon mustard, parsley, coriander, beefsteak rump bone, chicken wings, carrot, turnip, onion, whole black pepper, fresh ginger, dry red wine, Daikon radish, white icicle radish, vinegar containing, 10% of acetic acid, water, sugar, olive oil, shallots, garlic, yellow curry paste, lemon

Side dish: none

Table A36 Nutritional composition of veal tenderloin in green herb crust, curry carrot puree

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	817	645.0
Protein (g)	36.8	38.0
Fat (g)	39.3	26.0
Saturated fatty acids (g)	15.7	10.0
Carbohydrate (g)	82.0	60.0
Fiber (g)	10.4	10.0
Sugar (g)	37.1	7.8
Sodium (mg)	1052	1599

37. Turmeric pasta with shrimps, cashew nuts and chickpeas

Ingredients: shrimp, olive oil, garlic, salt, flour, egg, turmeric, water, eggplant, tomato, onion, courgette, purified cashew nuts, chickpeas, vegetable stock, sunflower oil, ground pepper, ginger, chili, mint leaves, lemon grass, lime, coriander leaves

Side dish: none

Table A37 Nutritional composition of turmeric pasta with shrimps, cashew nuts and chickpeas

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	640	724
Protein (g)	44.5	56.0
Fat (g)	24.5	29.0
Saturated fatty acids (g)	4.3	5.0
Carbohydrate (g)	65.3	60.0
Fiber (g)	13.4	9.0
Sugar (g)	14.6	10.4
Sodium (mg)	1956	2095

38. Carp from Akasztó with Jerusalem artichoke and dill variations

Ingredients: carp fillet, olive oil, butter, Jerusalem artichoke, milk, salt, dill stems, orange juice, lemon juice, gelatine sheet, peel of Jerusalem artichoke

Side dish: none

Table A38 Nutritional composition of carp from Akasztó with Jerusalem artichoke and dill variations

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	984	920
Protein (g)	46.2	76.5
Fat (g)	67.2	57.0
Saturated fatty acids (g)	30.6	14.5
Carbohydrate (g)	48.2	23.0
Fiber (g)	4.1	32.0
Sugar (g)	29.0	11.7
Sodium (mg)	1320	1199

39. Sturgeon with mazzancolle, ravioli and fennel tartare

Ingredients: sturgeon fillets, olive oil, salt, mazzancolle, white wine, bay leaf, whole pepper, lemon, onion, carrot, celery, shrimp shell, butter, tomato puree, orange juice, lemon juice, cooking cream, sturgeon trimmings, tincture of squid, parsley, pepper, tuber of fennel, green apple, lime, blossom honey, cauliflower, thyme, flour, egg, basil

Side dish: none

Table A39 Nutritional composition of sturgeon with mazzancolle, ravioli and fennel tartare

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	763	759
Protein (g)	57.1	52.0
Fat (g)	39.1	41.0
Saturated fatty acids (g)	12.3	12.0
Carbohydrate (g)	43.3	42.0
Fiber (g)	5.5	7.0
Sugar (g)	14.2	12.4
Sodium (mg)	1512	1470

40. Catfish steak with Japanese jasmine rice omelette and sweet chili sauce

Ingredients: African catfish fillet, salt, mixed pepper, sunflower oil, butter, carrot, red bell pepper, courgette, broccoli, stems of green asparagus, shallots, garlic, chili pepper, jasmine rice, ground turmeric, juniper berries, clove, cardamom, whole black pepper, cinnamon stick, bay leaf, star anise, sugar, eggs, apple vinegar, water, blossom honey, yellow, green and red chili peppers, chilli flakes, tapioca starch, spring onions, coriander, chili

Side dish: none

Table A40 Nutritional composition of catfish steak with Japanese jasmine rice omelette and sweet chili sauce

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	631	569
Protein (g)	32.7	34.0
Fat (g)	21.2	16.0
Saturated fatty acids (g)	6.1	5.0
Carbohydrate (g)	80.4	72.0
Fiber (g)	4.0	4.0
Sugar (g)	40.8	33.0
Sodium (mg)	1034	1038

Appendix (B): Jordanian recipes (n=40)

1. Manndi with meat

Ingredients: rose water, saffron, basmati rice, curry, mixed spices (cumin, coriander, cinnamon, turmeric, black pepper and lime), ground cardamom, hot sauce, turmeric, lamb meat, onion, green pepper bell, whole cardamom, ground cloves, black peppers, ground cinnamon, bay leaves, salt, corn oil, garlic, ginger

Side dish: yogurt

Table B1 Nutritional composition of Manndi with meat

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1149	1351
Protein (g)	52.1	63.9
Fat (g)	42.4	61.6
Saturated fatty acids (g)	31.7	18.8
Carbohydrate (g)	132	135
Fiber (g)	6.0	8.4
Sugar (g)	17.2	2.8
Sodium (mg)	1882	2045

2. Fattat hummus with meat and pine

Ingredients: chickpeas, tahini, lemon juice, garlic, salt, Arabic (pita) bread, yoghurt, ground garlic, lamb meat, corn oil, pine

Side dish: Arabic bread

Table B2 Nutritional composition of Fattat hummus with meat and pine

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	455	567
Protein (g)	18.7	27
Fat (g)	25.4	30.3
Saturated fatty acids (g)	4.9	6.20
Carbohydrate (g)	39.8	47.5
Fiber (g)	6.7	8.7
Sugar (g)	11.0	4.30
Sodium (mg)	1319	1392

3. Chicken with lentils

Ingredients: chicken breast, corn oil, onion, garlic, ginger, garam masala, turmeric, hot sauce, chicken broth, red lentils, salt, black pepper, coriander, lemon juice, Arabic (pita) bread

Side dish: none

Table B3 Nutritional composition of chicken with lentils

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	994	611
Protein (g)	52.3	76.1
Fat (g)	51.2	14.4
Saturated fatty acids (g)	9.7	2.2
Carbohydrate (g)	81.6	44.3
Fiber (g)	11.0	6.6
Sugar (g)	4.1	3.0
Sodium (mg)	2786	1617

4. Majbos with meat

Ingredients: lamb, margarine, onions, garlic, salt, turmeric, cinnamon, coriander, ground black pepper, ground cardamom, saffron, whole cardamom, whole black peppers, cinnamon, lime, tomatoes, basmati rice, lemon

Side dish: yogurt

Table B4 Nutritional composition of Majbos with meat

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	765	861
Protein (g)	36.0	43.1
Fat (g)	23.9	33.3
Saturated fatty acids (g)	7.1	4.8
Carbohydrate (g)	98.5	97.4
Fiber (g)	5.5	9.1
Sugar (g)	6.3	3.8
Sodium (mg)	1967	2023

5. Grilled chicken

Ingredients: whole chicken, yoghurt, garlic, onion, mixed spices (cumin, coriander, cinnamon, turmeric, black pepper and lime), salt, black pepper, parsley

Side dish: hummus (chickpeas, tahini, salt, cumin, black pepper, lemon juice, ground garlic, onion)

Table B5 Nutritional composition of grilled chicken

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	614	615
Protein (g)	48.5	44.5
Fat (g)	36.0	44.1
Saturated fatty acids (g)	10.7	15.3
Carbohydrate (g)	20.5	9.2
Fiber (g)	1.3	1.8
Sugar (g)	16.0	5.2
Sodium (mg)	829	865

6. Steak with basil sauce

Ingredients: steaks (rib, lean), vinegar, olive oil, garlic cloves, oregano, hot sauce, salt, black pepper, basil leaves, pines, olive oil, salt, parmesan cheese

Side dish: none

Table B6 Nutritional composition of steak with basil sauce

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	832.85	706.00
Protein (g)	68.40	45.90
Fat (g)	54.62	56.70
Saturated fatty acids (g)	16.19	15.80
Carbohydrate (g)	16.86	4.30
Fiber (g)	4.86	0.80
Sugar (g)	0.69	0.90
Sodium (mg)	1049.65	588.00

7. Shrimp with sauce

Ingredients: butter, flour, onion, garlic, green pepper bell, red pepper bell, fish broth, shrimp, salt, black pepper, hot sauce, lemon juice, parsley

Side dish: none

Table B7 Nutritional composition of shrimp with sauce

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	440	481
Protein (g)	25.8	34.3
Fat (g)	33.1	32.3
Saturated fatty acids (g)	20.0	15.0
Carbohydrate (g)	9.7	11.5
Fiber (g)	1.2	1.4
Sugar (g)	2.0	2.0
Sodium (mg)	1842	1458

8. Grilled geder

Ingredients: lamb, onion, vegetable oil, saffron, whole cardamom, stick cinnamon, mixed spices (cumin, coriander, cinnamon, turmeric, black pepper and lime), salt, turmeric, potatoes, tomatoes, basmati rice, eggs

Side dish: none

Table B8 Nutritional composition of grilled geder

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	772	924
Protein (g)	39.1	46.7
Fat (g)	20.5	34.8
Saturated fatty acids (g)	6.4	12.0
Carbohydrate (g)	104	105
Fiber (g)	3.8	7.1
Sugar (g)	3.4	2.1
Sodium (mg)	1125	990

9. Torly belreesh

Ingredients: lamb meat, potatoes, zucchini, carrots, onions, mushrooms, tomatoes, peas, okra, green fava beans, salt, black pepper, mixed spices (cumin, coriander, cinnamon, turmeric, black pepper and lime), tomato paste, lemon juice, vegetable oil

Side dish: none

Table B9 Nutritional composition of Torly Belreesh

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	400	602
Protein (g)	32.4	32.8
Fat (g)	16.7	29.3
Saturated fatty acids (g)	6.4	10.7
Carbohydrate (g)	32.2	40.8
Fiber (g)	8.3	11.0
Sugar (g)	3.4	6.3
Sodium (mg)	1309	1421

10. Chicken curry with pepper
Ingredients: vegetable oil, onion, garlic, ginger, curry, chicken thigh, tomatoes, tomato paste, salt, black pepper, green hot peppers, cream, coriander

Side dish: none

Table B10 Nutritional composition of chicken curry with pepper

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	527	550
Protein (g)	31.6	30.7
Fat (g)	39.4	41.4
Saturated fatty acids (g)	11.3	13.3
Carbohydrate (g)	12.3	10.7
Fiber (g)	3.2	3.1
Sugar (g)	6.0	4.0
Sodium (mg)	583	757

11. Chicken stuffed with mushroom
Ingredients: whole chicken, salt, coriander, paprika, black pepper, butter, onion, garlic, mushroom, toasted bread, parsley, egg white

Side dish: rice, yoghurt

Table B11 Nutritional composition of chicken stuffed with mushroom

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	815	854
Protein (g)	53.0	52.3
Fat (g)	47.3	54.1
Saturated fatty acids (g)	17.4	19.8
Carbohydrate (g)	42.5	37.2
Fiber (g)	3.0	4.1
Sugar (g)	3.3	3.0
Sodium (mg)	1225	1269

12. Egg eyes with meat
Ingredients: corn oil, lamb meat, onion, green pepper bell, tomato, salt, black pepper, ginger, cinnamon, eggs

Side dish: Arabic bread

Table B12 Nutritional composition of egg eyes with meat

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	224	309
Protein (g)	19.6	23.9
Fat (g)	13.9	21.4
Saturated fatty acids (g)	4.4	7.1
Carbohydrate (g)	4.7	5.0
Fiber (g)	1.3	1.8
Sugar (g)	2.3	1.5
Sodium (mg)	885	938

13. Foleyah with meat and chard
Ingredients: lamb meat, onion, bay leaves, cardamoms, cinnamon, salt, fava green beans, chard, vegetable oils, garlic, coriander

Side dish: none

Table B13 Nutritional composition of Foleyah with meat and chard

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	549	805
Protein (g)	53.0	65.0
Fat (g)	21.6	39.9
Saturated fatty acids (g)	7.8	15.7
Carbohydrate (g)	35.7	45.6
Fiber (g)	12.2	17.1
Sugar (g)	1.7	6.5
Sodium (mg)	1417	1426

14. Shrimp curry
Ingredients: shrimp, salt, curry, turmeric, paprika, hot sauce, coriander, cardamom, black pepper, corn oil, onion, garlic, ginger, hot red pepper, hot green pepper, tomatoes, tomato paste, flour, yoghurt, milk

Side dish: basmati rice

Table B14 Nutritional composition of shrimp curry

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	488	557
Protein (g)	43.2	55.4
Fat (g)	19.5	21.5
Saturated fatty acids (g)	4.1	4.5
Carbohydrate (g)	35.5	31.2
Fiber (g)	4.3	5.7
Sugar (g)	21.3	11.1
Sodium (mg)	2441	2744

15. Salonah Stromateus fish
Ingredients: Stromateus fish, corn oil, onion, garlic, cumin, coriander, dry lime, salt, tomatoes, tomato paste

Side dish: yoghurt, rice

Table B15 Nutritional composition of Salonah Stromateus fish

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	172	172
Protein (g)	12.4	11.6
Fat (g)	10.6	10.3
Saturated fatty acids (g)	2.8	1.9
Carbohydrate (g)	7.8	8.1
Fiber (g)	2.1	2.5
Sugar (g)	3.6	2.6
Sodium (mg)	839	863

16. Rosto meat with potatoes

Ingredients: lamb meat, garlic, salt, black pepper, cumin, bay leaves, cardamoms, mastic (Arabic gum), onion, green pepper bell, carrot, potatoes, corn oil, parsley

Side dish: none

Table B16 Nutritional composition of Rosto meat with potatoes

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	412	630
Protein (g)	40.5	51.7
Fat (g)	20.3	39.0
Saturated fatty acids (g)	7.5	15.7
Carbohydrate (g)	16.1	17.2
Fiber (g)	3.5	3.1
Sugar (g)	2.8	1.9
Sodium (mg)	1006	1128

17. Vermicelli with chicken

Ingredients: vermicelli, chicken thighs, onion, garlic, carrot, stick celery, olive oil, thyme, rosemary, bay leaves, salt, black pepper, tomato paste, chicken broth, chickpeas, potatoes, parsley

Side dish: none

Table B17 Nutritional composition of Vermicelli with chicken

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1344.46	1383.00
Protein (g)	62.53	45.90
Fat (g)	48.0	46.6
Saturated fatty acids (g)	11.3	13.2
Carbohydrate (g)	169	188
Fiber (g)	13.4	7.6
Sugar (g)	11.9	3.2
Sodium (mg)	1883	2136

18. Chicken with pumpkin

Ingredients: vegetable oil, onion, garlic, chicken breast, pumpkin, salt, mixed spices (cumin, coriander, cinnamon, turmeric, black pepper and lime), black pepper, cardamom, cinnamon, tomato paste, chickpeas

Side dish: none

Table B18 Nutritional composition of chicken with pumpkin

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	551	417
Protein (g)	24.4	37.0
Fat (g)	31.5	13.7
Saturated fatty acids (g)	5.8	1.8
Carbohydrate (g)	45.6	36.0
Fiber (g)	7.0	2.4
Sugar (g)	8.5	7.9
Sodium (mg)	1286	754

19. Stuffed cabbage with meat and vegetables

Ingredients: rice, lamb meat, onion, garlic, carrots, parsley, salt, black pepper, dried mint, whole cabbage, tomato paste

Side dish: none

Table B19 Nutritional composition of stuffed cabbage with meat and vegetables

Nutrients/portion	**ESHA**	**NutriComp**
Energy (kcal)	371	442
Protein (g)	18.2	22.6
Fat (g)	4.0	9.9
Saturated fatty acids (g)	1.9	4.1
Carbohydrate (g)	67.7	64.0
Fiber (g)	10.8	11.9
Sugar (g)	14.7	7.7
Sodium (mg)	1299	1377

20. Spaghetti with shrimps and paprika sauce

Ingredients: spaghetti, olive oil, shrimp, onion, garlic, paprika, hot sauce, mushroom, chicken broth, cream, salt, black pepper, parmesan cheese

Side dish: none

Table B20 Nutritional composition of spaghetti with shrimps and paprika sauce

Nutrients/portion	**ESHA**	**NutriComp**
Energy (kcal)	404	432
Protein (g)	19.8	25.7
Fat (g)	12.8	14.1
Saturated fatty acids (g)	3.8	4.0
Carbohydrate (g)	51.3	50.1
Fiber (g)	2.6	2.9
Sugar (g)	3.4	1.7
Sodium (mg)	912	1028

21. Mansaf

Ingredients: basmati rice, yoghurt, Jameed, onion, lamb meat, cardamom, salt, black pepper, turmeric, parsley, whole almonds

Side dish: none

Table B21 Nutritional composition of Mansaf

Nutrients/portion	**ESHA**	**NutriComp**
Energy (kcal)	1419	1334
Protein (g)	83.0	73.8
Fat (g)	46.3	44.9
Saturated fatty acids (g)	16.0	18.0
Carbohydrate (g)	174	156
Fiber (g)	7.3	5.0
Sugar (g)	3.5	0.83
Sodium (mg)	861	1004

22. Maqqlubah eggplant

Ingredients: eggplant, salt, potatoes, short rice, basmati rice, lamb, curry, black pepper, turmeric, cumin, coriander, mixed spices (cumin, coriander, cinnamon, turmeric, black pepper, dried lime), vegetable oil, water

Side dish: yoghurt

Table B22 Nutritional composition of Maqqlubah eggplant

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	830	767
Protein (g)	52.4	43.6
Fat (g)	30.0	27.2
Saturated fatty acids (g)	11.0	10.5
Carbohydrate (g)	88.3	86.2
Fiber (g)	10.2	5.5
Sugar (g)	5.6	0.45
Sodium (mg)	894	952

23. Mujaddarah with onion

Ingredients: onion, basmati rice, brown lentils, corn oil, chicken broth, salt, black pepper, cumin, water

Side dish: yoghurt, mixed salad (tomato, cucumber, green pepper, lemon juice, olive oil, coriander, onion, ground garlic, salt)

Table B23 Nutritional composition of Mujaddarah with onion

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1042	1095
Protein (g)	26.9	33.4
Fat (g)	30.0	27.2
Saturated fatty acids (g)	4.2	3.5
Carbohydrate (g)	178	178
Fiber (g)	5.4	12.4
Sugar (g)	4.0	3.2
Sodium (mg)	2212	1794

24. Kabsah

Ingredients: whole chicken, green pepper, red pepper, garlic, vegetable oil, cumin, turmeric, mixed spices (cumin, coriander, cinnamon, turmeric, black pepper, dried lime), tomato sauce, salt, resins, basmati rice, water

Side dish: yoghurt, mixed salad (tomato, cucumber, green pepper, lemon juice, olive oil, coriander, onion, ground garlic, salt)

Table B24 Nutritional composition of Kabsah

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1094	866
Protein (g)	54.6	66.7
Fat (g)	53.1	21.2
Saturated fatty acids (g)	12.6	3.4
Carbohydrate (g)	104	101
Fiber (g)	4.2	3.2
Sugar (g)	8.7	8.1
Sodium (mg)	792	824

25. Dawali/Dolma

Ingredients: rape leaves, parsley, onion, tomato, lime, olive oil, short rice, salt, black pepper, lime

Side dish: none

Table B25 Nutritional composition of Dawali/Dolma

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	251	199
Protein (g)	3.6	4.6
Fat (g)	14.7	7.5
Saturated fatty acids (g)	2.1	1.0
Carbohydrate (g)	27.4	28.5
Fiber (g)	3.8	4.2
Sugar (g)	3.1	3.0
Sodium (mg)	311	311

26. Shawrma

Ingredients: garlic, lime, olive oil, curry, salt, black pepper, garlic souse, Arabic bread, chicken breast, pickle, potatoes

Side dish: none

Table B26 Nutritional composition of Shawrma

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	722	504
Protein (g)	25.6	39.0
Fat (g)	40.6	20.9
Saturated fatty acids (g)	7.1	3.0
Carbohydrate (g)	59.7	38.2
Fiber (g)	3.3	1.6
Sugar (g)	0.94	4.1
Sodium (mg)	1682	1140

27. Mahshi Kosa

Ingredients: short rice, squash, onion, minced lamb meat, salt, black pepper, mixed spices (cumin, coriander, cinnamon, turmeric, black pepper, dried lime), turmeric, tomato sauce, tomato, garlic, dried mint

Side dish: none

Table B27 Nutritional composition of Mahshi Kosa

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	223	249
Protein (g)	13.4	12.3
Fat (g)	5.8	5.0
Saturated fatty acids (g)	2.2	2.0
Carbohydrate (g)	30.2	38.2
Fiber (g)	3.6	6.0
Sugar (g)	6.02	8.1
Sodium (mg)	947	989

28. Malfuf mahshi/suffed cabbage

Ingredients: short rice, lamb meat, onion, garlic, carrot, parsley, salt, black pepper, dried mint, cabbage, tomato sauce

Side dish: none

Table B28 Nutritional composition of Malfuf mahshi/suffed cabbage

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	432	439
Protein (g)	24.4	28.8
Fat (g)	9.6	9.2
Saturated fatty acids (g)	3.8	3.9
Carbohydrate (g)	64.1	59.6
Fiber (g)	9.4	17.3
Sugar (g)	13.0	5.7
Sodium (mg)	694	848

29. Kuffta

Ingredients: soy sauce, lamb meat, parsley, garlic, onion, cumin, oregano, black pepper, salt

Side dish: none

Table B29 Nutritional composition of Kuffta

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	358	291
Protein (g)	37.0	28.3
Fat (g)	18.6	16.1
Saturated fatty acids (g)	7.5	7.4
Carbohydrate (g)	11.0	7.7
Fiber (g)	3.0	2.0
Sugar (g)	4.9	2.6
Sodium (mg)	2340	1967

30. Mlukeiah with chicken

Ingredients: chicken breasts, onion, cinnamon, whole cardamoms, laurel paper, salt, Mulukhiyah*, garlic, coriander, basmati rice

Side dish: none

Table B30 Nutritional composition of Mlukeiah with chicken

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	16848	1308
Protein (g)	54.3	71.4
Fat (g)	47.8	14.7
Saturated fatty acids (g)	8.2	1.6
Carbohydrate (g)	244	208
Fiber (g)	13.2	10.8
Sugar (g)	14.1	1.2
Sodium (mg)	4541	2451

*stew made from the leaves of *Corchorus olitorius*

31. Lentil soup

Ingredients: corn oil, onion, garlic, red lentils, carrot, potato, salt, cumin, black pepper.

Side dish: Arabic bread.

Table B31 Nutritional composition of Lentil soup

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	312	319
Protein (g)	14.7	13.6
Fat (g)	11.7	11.8
Saturated fatty acids (g)	1.5	1.5
Carbohydrate (g)	41.0	40.6
Fiber (g)	9.6	8.3
Sugar (g)	5.5	2.8
Sodium (mg)	610	637

32. Shlfato/Bulgur with tomato

Ingredients: bulgur, olive oil, onion, garlic, red pepper, green pepper, can tomato sauce, mixed spices (cumin, coriander, cinnamon, turmeric, black pepper, dried lime), cumin, coriander, cinnamon, salt, black pepper, water

Side dish: none

Table B32 Nutritional composition of Shlfato/Bulgur with tomato

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	185	196
Protein (g)	5.2	5.6
Fat (g)	5.4	5.5
Saturated fatty acids (g)	0.77	0.75
Carbohydrate (g)	31.8	33.0
Fiber (g)	7.9	5.9
Sugar (g)	2.1	3.6
Sodium (mg)	463	477

33. Aruz BelSha'eriah

Ingredients: basmati rice, vegetable oil, vermicelli, salt, water

Side dish: yoghurt

Table B33 Nutritional composition of Aruz BelSha'eriah

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	605	659
Protein (g)	10.0	14.5
Fat (g)	14.8	15.6
Saturated fatty acids (g)	1.7	0.37
Carbohydrate (g)	116	114
Fiber (g)	3.9	2.8
Sugar (g)	1.2	0.16
Sodium (mg)	147	241

34. Maqqlubah potatoes

Ingredients: short rice, chicken breasts, cinnamon, laurel leaves, onion, cardamom, black pepper, salt, tomato, potato, garlic, green pepper, mixed spices, turmeric, vegetable oil

Side dish: yoghurt, mixed salad (tomato, cucumber, green pepper, lemon juice, olive oil, coriander, onion, ground garlic, salt)

Table B34 Nutritional composition of Maqqlubah potatoes

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	949	1194
Protein (g)	34.1	58.4
Fat (g)	37.1	15.5
Saturated fatty acids (g)	6.7	14.5
Carbohydrate (g)	120	204
Fiber (g)	10.6	10.4
Sugar (g)	5.7	18.2
Sodium (mg)	2320	1728

35. Maqqlubah Zahrah & jazar/cauliflower & carrot

Ingredients: short rice, corn oil, cauliflower, carrot, onion, garlic, chickpeas, chicken breasts, chicken broth, salt, black pepper, cumin, turmeric

Side dish: yoghurt, mixed salad (tomato, cucumber, green pepper, lemon juice, olive oil, coriander, onion, ground garlic, salt)

Table B35 Nutritional composition of Maqqlubah Zahrah & jazar/cauliflower & carrot

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1246	855
Protein (g)	50.0	68.5
Fat (g)	53.7	20.2
Saturated fatty acids (g)	10.1	13.4
Carbohydrate (g)	140	98.5
Fiber (g)	12.8	9.3
Sugar (g)	11.4	16.1
Sodium (mg)	3061	1442

36. Shakshukah

Ingredients: vegetable oil, onion, garlic, ginger, potato, carrot, red pepper, green pepper, cauliflower, chili red pepper, salt, mixed spices (cumin, coriander, cinnamon, turmeric, black pepper, dried lime), turmeric, cardamom, chicken broth

Side dish: Arabic bread

Table B36 Nutritional composition of Shakshukah

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	138	173
Protein (g)	3.1	5.0
Fat (g)	7.5	7.8
Saturated fatty acids (g)	0.80	0.90
Carbohydrate (g)	18.1	20.6
Fiber (g)	3.5	6.5
Sugar (g)	5.2	3.2
Sodium (mg)	567	436

37. Mahshi patata/stuffed potato
Ingredients: potatoes, olive oil, lamb meat, onion, garlic, mixed spices, salt, black pepper, turmeric, parsley, pine, tomato, dried mint

Side dish: none

Table B37 Nutritional composition of Mahshi patata/stuffed potato

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	449	456
Protein (g)	29.5	23.9
Fat (g)	19.0	19.9
Saturated fatty acids (g)	5.8	5.9
Carbohydrate (g)	46.4	45.6
Fiber (g)	8.9	8.5
Sugar (g)	8.5	3.6
Sodium (mg)	47	488

38. Stuffed chicken
Ingredients: short rice, whole chicken, salt, black pepper, saffron, mixed spices, cinnamon, coriander, corn oil, almond, pine, onion, garlic, lamb meat, peas

Side dish: yoghurt

Table B38 Nutritional composition of stuffed chicken

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	868	818
Protein (g)	49.3	70.3
Fat (g)	41.5	21.0
Saturated fatty acids (g)	10.8	3.9
Carbohydrate (g)	70.8	86.2
Fiber (g)	5.2	4.5
Sugar (g)	3.3	1.9
Sodium (mg)	642	815

39. Stuffed tomato
Ingredients: short rice, tomatoes, minced lamb meat, onion, garlic, green pepper, tomato sauce, olive oil, mixed spices (cumin, coriander, cinnamon, turmeric, black pepper, dried lime), salt, black pepper, dried mint

Side dish: none

Table B39 Nutritional composition of stuffed tomato

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	312	294
Protein (g)	13.0	12.3
Fat (g)	10.6	9.9
Saturated fatty acids (g)	2.7	2.8
Carbohydrate (g)	40.7	38.4
Fiber (g)	3.2	5.6
Sugar (g)	7.7	3.9
Sodium (mg)	44	472

40. Kubbah belaban

Ingredients: bulgur, onion, lamb meat, salt, black pepper, cumin, marjoram, corn oil, mixed spices, yoghurt, egg, starch, pine

Side dish: none

Table B40 Nutritional composition of Kubbah belaban

Nutrients/portion	ESHA	NutriComp
Energy (kcal)	1088	1144
Protein (g)	59.6	61.8
Fat (g)	30.4	39.2
Saturated fatty acids (g)	9.3	11.0
Carbohydrate (g)	149	145
Fiber (g)	26.6	22.3
Sugar (g)	5.7	8.1
Sodium (mg)	810	1183

Appendix (C): Ready-to-eat meals sold in supermarkets in Hungary

Pasta (lasagne) with pork, tomato sauce and béchamel sauce, 400 g

Spaghetti pasta with cheese sauce and smoked bacon, 400 g

“Székely” cabbage, 350 g

Mediterranean lasagna with vegetables, 900 g

Asian chicken with curry and steamed rice, 350 g

Farfalle with Ceddar cheese and spinach, 330 g

Oven roasted spicy chicken breast with vegetables, 350 g

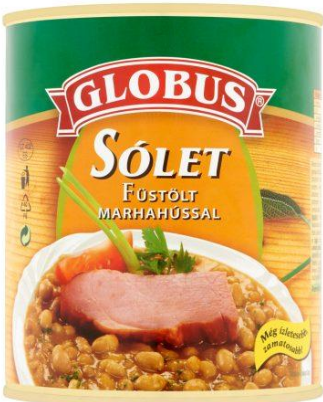
Meat with rice in Bácska style, 330 g

Chicken paella, 330 g

Turkey stew in Brasow style, 400 g

Turkey bites with green peas, 400 g

Casserole, 400 g



Sólet with smoked beef, 860 g

Lentil pottage with sausage, 400 g

Cabbage casserole, 400 g

”Székely” cabbage, 400 g

Chicken ragout with vegetables, 350 g

Sólet with spicy sausage, 400 g

Lentil pottage with sausage, 400 g

Cabbage casserole, 400 g

Meatballs in tomato sauce, 400 g

Yellow pea pottage with sausage, 400 g

Bean soup with sausage 400 g

Sólet with spicy sausage, 400 g

“Székely” cabbage 400g

Bean pottage with sausage, 400 g

Appendix (D): Ready-to-eat meals delivered by single-dose delivery services in Hungary

Meat with small dry noodles (tarhonya), 510 g

Viennese schnitzel in a spicy coat, with mashed potato, 495 g

Catfish fillet in bristle dough, baking potato, 500 g

Stuffed loin in Csaba style, stewed cabbage, potato with parsley, 500 g

Budavári pork chops (pork loin with garlic, mustard with roasted bacon) potato with parsley, braised cabbage, 440 g

Viennese chicken breast stuffed with cheese, rice with pear, 430 g

Roasted chicken thighs, rice with corn, 440 g

Alföld style bowl (sausage, pork loin, chicken liver), rive with pears, 480 g

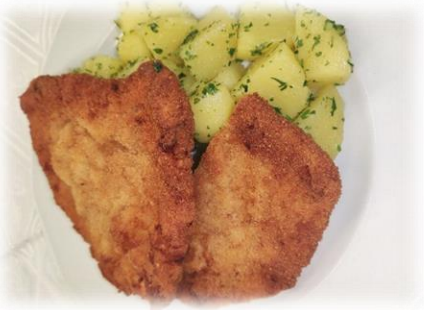
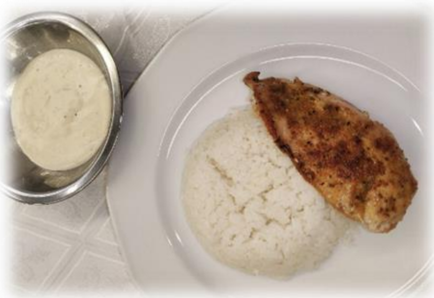
Veal stew, noodles 480 g

Turkey breast baked in mustard sour cream, baked potatoes, 420 g

Chicken breast in Hawai style (pineapple, grated cheese), rice with corn, 415 g

Spicy Sichuan chicken breast, fried pasta with vegetables, 550 g

Appendix (E): Ready-to-eat meals and homemade meals

Meals	Ready-to-eat meals	Homemade meals
Fried pork ribs with sour cream, grated cheese and potatoes with parsley (RS)		
African catfish fillet in fresh basil sauce, potato croquette (AH)		
Brasov stew (BAP)		
Broccoli layered with chicken, cheese and eggs (CSTB)		
Grilled chicken breast, cream cheese sauce, jasmine rice (GCS)		

Meat casserole with cauliflower (HRK)

Roasted chicken liver with boiled potatoes (CSM)

Székely cabbage (SZK)

Vasi steak with mashed potatoes and onions (VPHT)

Beef stew with red wine and eggs barley (VM)

Appendix (F): Individual assessment sheet for RTE meals

Annexes
M1.

INDIVIDUAL ASSESSMENT SHEET
READY-TO-EAT MEALS
FOR 20-POINT SCORING BASED ON WEIGHTING FACTOR, SENSORY TESTING AND CERTIFICATION

Name of reviewer	*Time of assessment*
No. of sample	*Place of assessment*
Testing method **MSZ ISO 6658:2007 5.3.6.**	*Name of sample*

Group of properties	Identified property	Points to be awarded	Weighting factor
APPEARANCE		5	1,2
		4	
		3	
		2	
		1	
		0	
CONSISTENCY		5	0,8
		4	
		3	
		2	
		1	
		0	
SCENT		5	0,8
		4	
		3	
		2	
		1	
		0	
TASTE		5	1,2
		4	
		3	
		2	
		1	
		0	

Assessing procedure: write your name, date of assessment, name and number of sample in the appropriate box on the sheet. Carry out the test according to the appropriate standard judging specification, record the properties found and write them on the appropriate line of the sheet. Enter the score for the group of properties you have tested. The attached guide (with the scores and associated requirements, positive attributes, defects and deficiencies) will help you to formulate the attributes identified. If you score 0 for a group of properties, please inform the leading reviewer immediately.

I declare that I feel physically and mentally fit to judge, that I am in good health and that there is nothing to prevent me from performing this task.

…………………………………………… ……………………………………………

Signature of reviewer Signature of leading reviewer

Weighting factor of meal	Comment

Appendix (G): Chefs' questionnaire

1. Your present position:
   a. Chef
   b. Owners of establishment
   c. Worker or major cook
   d. Other …. (please write your answer here)

2. Gender:
   a. Male
   b. Female

3. Your age is: ….. years

4. Your highest level of education:
   a. Primary school
   b. Secondary school with qualification of cookery
   c. Undergraduate
   d. Other: … (please write your answer here)

5. Your work experience:
   a. < 5 years
   b. 5-10 years
   c. 10-15 years
   d. > 15 years

6. Type of the establishment:
   a. Restaurant in a hotel
   b. Independent restaurant
   c. Special Hungarian unit as csárda
   d. Bistro
   e. Pizzeria
   f. Other…… (please write your answer here)

7. Location of the establishment:
   a. Capital

b. City

c. Small town

d. Village

e. Other … (please write your answer here)

8. Characteristic of the consumers/guests according to their nationality:

   a. Mainly Hungarian

   b. Mainly foreigners

   c. Both Hungarians and foreigners

9. Characteristics of the consumers/guests according to the age group. The most common age group who visits the restaurant:

   a. <18 year

   b. 18-34 year

   c. 35-55 year

   d. >56 year

10. Please choose the level of your agreement with the following statements (1. Strongly disagree, 2. Disagree, 3. Neutral, 4. Agree, and 5. Strongly agree):

A. Perception of health

- Low-fat meals are good for maintaining body weight and health
- High-fat meals increase bad blood cholesterol and the risk of heart diseases
- Diabetic consumers need more vegetables and less fat and energy-dense foods
- Milk and milk products are a good source of quality proteins and calcium and are always good for health and growth
- Fish, prawns, and seafood are better for health than meat products
- Wrong nutrition plays an important role in the development of diabetes, cancer, and heart diseases
- In my own diet, I try to cut down my fat intake

B. Perception of nutrition

- Eggs, chicken, and meat provide a high amount of quality protein and iron
- Salads provide essential vitamins and fiber
- A combination of cereals and legumes enhances the nutritive value of a meal
- Germination and fermentation of foods increase the nutritive value in terms of protein and vitamin C
- Dishes like Gulyás soup, stuffed cabbage, and Hungarian stew from pork knuckle are nutritious and good for health

C. Perception of nutrition practices

- In my work, nutrition principles are followed every day in food selection and menu planning
- In my work, selecting nutritious food is important in menu planning
- In my work, preparing low-fat meals is a challenging task
- Suitable cooking methods are considered in the selection of recipes and menus
- A suitable color combination is considered in the selection of recipes and menus
- Suitable nutritive values are considered in the selection of recipes and menus
- Quality standards are followed in the preparation and serving of meals
- I like the challenge of making a low-fat meal delicious
- In my opinion, cooking a low-fat meal is more work than it is worth
- A low-fat meal does not taste as good as a high-fat one

D. Perception of consumer concern

- Customers consider nutrition when selecting a restaurant
- Consumers do take nutrition into consideration while ordering from the menu
- Consumers are concerned about fat intake
- The frequency of restaurant eating will have an impact on individual nutritional health status
- All the recipes are prepared considering different types of consumers and their health conditions
- Quality holds more importance than quantity in the maintenance of one's health
- The number of consumer requests for special menu items is increasing
- Customers with special nutritional needs can select appropriate items from our menu

Appendix (H): Hungarian consumers' attitude and behaviour towards RTE meals survey

1. To what extent do you agree with the following statements*? (1. Strongly disagree, 2. Tend to disagree, 3. Neutral, 4. Tend to agree, 5. Strongly agree)

*Please think here of the traditional ready-to-eat foods shown at the beginning of the questionnaire and do not take into account foods that are used in various special diets, medically indicated or voluntarily followed diets (e.g. gluten- or lactose-free, vegan, Palaeolithic, ketogenic, etc.).

Ready-to-eat meals…

- are healthy.
- are healthier than home-cooked meals.
- are healthier than restaurants' meals.
- are healthier than fast food.
- are high in fat.
- are high in energy.
- are high in sugar.
- contain a lot of saturated fatty acids.
- are low in fiber.
- are low in protein.
- are low in vitamins and minerals.
- contain large amounts of harmful ingredients such as preservatives, colorants, etc.
- are safer than homemade meals.
- are safer than restaurants' meals.
- are safer than fast food.
- sustainable.

2. Have you ever consumed any of the ready-to-eat meals' types that are characterised in the definition?
- Yes
- No

If yes, please continue with question 4.

3. Why don't you eat ready-to-eat meals? You can give more than one answer.
- Not healthy
- Expensive
- It tastes bad
- It looks bad
- Full of preservatives
- Too greasy
- Too salty
- Small portion
- Large portion
- I like to prepare my own food
- It tastes like an artificial food
- Not appetizing

- Not comfortable
- Unsustainable
- Unsafe
- Difficult to access
- Difficult to handle in my situation
- I have to follow a special diet and do not trust ready-to-eat meals
- Other (please describe): …

4. If you order / buy a ready-to-eat meal, who consumes it most often? You can give more than one answer.
- Myself
- The whole family
- My parents
- My partner
- My child
- Other (please describe): …

5. To what extent do you agree with the following statements? (1. Strongly disagree, 2. Tend to disagree, 3. Neutral, 4. Tend to agree, 5. Strongly agree):
- When I host guests, I sometimes serve them ready-to-eat meals.
- The bad reputation of ready-to-eat meals is unreasonable.
- The quality of ready-to-eat meals has improved in recent years.
- I consume certain ready-to-eat meals because I like that food, but I can't make it myself.
- I usually eat ready-to-eat meals when I'm alone.
- I usually eat ready-to-eat meals in the company of others.
- Ready-to-eat meals are safe because the consumer knows what they are getting.
- The ready-to-eat meals are sufficiently nutritious.
- When I'm stressed, I eat ready-to-eat meals.
- I eat ready-to-eat meals when I want to relax.
- Buying a lot of ready-to-eat meals can indicate that the consumer has little interest in what they are eating.
- Young children should not eat ready-to-eat meals.
- Ready-to-eat meals can only be used in a microwave.
- I would be ashamed of myself if someone saw me eating ready-made food for lunch.

6. What time of week do you usually consume ready-to-eat meals?
- Monday to Friday
- Saturday and Sunday
- Any day

7. Where do you consume ready-to-eat meals most often?
- At home
- At workplace
- Both at home and at work
- Other (please, describe): …

8. Why do you eat / choose ready meals? You can check more than one answer.
- I save my time with it.
- I save resources with it.
- I cannot cook.
- My kitchen is poorly equipped to make good food.

- I don't care about cooking.
- I'm too tired to cook.
- I want to spend time on things other than cooking.
- I'm very hungry and I want to eat something fast.
- I'm rarely at home.
- I don't want to waste my time buying a lot of different ingredients.
- They're healthy.
- It's cheaper than cooking food at home.
- I don't like to cook.
- I live alone, it's not worth cooking.
- I can buy ready-made food at an affordable price that adapts to my special diet.
- I don't consume ready-to-eat meals
- Other (please describe): ….

9. Please mark your answers in the table:

Table H1 Situations and frequency of RTE meals consumption

Situation	**never**	**1-2 times per year**	**1-2 times per month**	**1-2 times per week**	**3-4 times per week**	**every workday**	**every weekend**	**every day**
How often do you consume *ready-to-eat meals* sold in grocery stores?								
How often do you consume ready-to-eat *canned food* sold in grocery stores?								
How often do you consume ready-to-eat meals sold and delivered *by single-serving* food delivery companies?								
How often did you eat ready-to-eat meals before COVID-19 epidemic?								
How often did you eat ready-to-eat food during COVID-19 epidemic?								
How often do you eat ready-to-eat meals these days?								

10. How often do you consume ready-to-eat meals a week?
    - Never
    - Once
    - 2 times
    - 3 times
    - 4 times
    - 5 times
    - >5 times

11. Which meal do you eat most often?
    - Breakfast
    - Snack at 10 o’clock
    - Lunch
    - Snack afternoon
    - Dinner
    - I don't consume ready-to-eat meals
    - Other (please, describe)…

12. Do you look at the ingredients’ list of the ready-to-eat food on the product label or on the company’s website before buying and does it influence your decision?
    - I look at it, but it does not affect my decision
    - I look at it and if I don't like it, I choose another food
    - No
    - I don't consume ready-to-eat meals

13. Do you look at the nutrition labelling (amount of nutrients) on the product label or on the company’s website before buying a ready-to-eat food and does it influence your decision?
    - I look at it, but it does not affect my decision
    - I look at it and if I don't like it, I choose another food
    - No
    - I don't consume ready-to-eat meals

14. What types of cuisine’ RTE meal do you consume most often? You can choose more than one answer.
    - Traditional Hungarian
    - Innovative / fine-dining*
    - World cuisine, (please, specify the most frequently consumed national cuisines, e. g Chinese, Italian, Arabic)
    - I don't consume ready-to-eat meals

*a meals based on innovation and creativity, made with the harmonious use of fresh, high-quality, sometimes unusual ingredients, modern, but gentle kitchen technologies, artistic in its appearance, special in its taste

15. How often do you consume from different types of ready meals?

Table H2 Consumption of different types of ready meals

Type of meals	**never**	**1-2 times per year**	**1-2 times per month**	**1-2 times per week**	**3-4 times per week**	**every workday**	**every weekend**	**every day**
Hot or cold breakfast								
Just soup								
Complete lunch with soup, main course and dessert, I collected the items myself								
Complete lunch with soup, main course and dessert prepared by the company (menu)								
Only main course, without soup and dessert								
Full daily meal								
Dessert								
Sandwich								
Imbiss (cold buffet)								
Salad, pickles								
Other (please describe): …								

16. How often do you consume ready meals classified into different diets?

Table H3 Consumption of ready meals that are classified into different diets

Diet types	**never**	**1-2 times per year**	**1-2 times per month**	**1-2 times per week**	**3-4 times per week**	**every workday**	**every weekend**	**every day**
Normal, mixed, without restrictions								
Vegetarian								
Vegan								
Lactose free								
Gluten free								
free of lactose and gluten								
Sugar free								
Reduced or precisely adjusted carbohydrate content								
With reduced sugar content								
Ketogenic								
Low in salt								
IR (formulated for insulin resistance)								
Low in fat								
High in protein								
Slimming								
Fitness								
Immune booster								
Special (please describe): …								
Other (e.g. paleo, Atkins, please describe): …								

17. How often do you order small portions for foods served by single-serving food delivery companies?
    - I always order small portion if there is one on the menu
    - I never order a small dose
    - I just want a small portion of the soup
    - I just want a small portion of the main course

- I just want a small portion of dessert
- Why, is there a small portion?
- I don't order ready-to-eat meals
- Other (please describe): …

18. How important are the following features to you when buying ready meals? (1. Not important at all, 2. Slightly important, 3. Moderately important, 4. Very important, 5. Extremely important):
    - Health claims on the label or on the website (eg low carb, low fat, low salt, etc.)
    - Energy content
    - Fat content
    - Saturated fatty acid content
    - Sugar content
    - Salinity
    - Fiber content
    - Protein content
    - Source of protein (animal or vegetable)
    - Contains vegetables / fruits
    - Contains various ingredients
    - Vitamin and mineral content
    - Taste
    - Price
    - Type of packaging
    - Easy to open
    - Gastronomy (type of national cuisine)
    - Food raw materials used
    - Comfort
    - Hungarian product
    - Brand
    - Recommended by a coach
    - Recommended by a dietitian
    - Recommended by a celebrity
    - Made by a famous chef
    - I don't buy ready-to-eat meals

19. Have you ever had a bad experience with any ready-made meal in terms of its organoleptic, food safety or nutritional characteristics? You can choose more than one answer.

    - I've never had a problem
    - It was too salty
    - It was too unsalted
    - it was tasteless
    - the ingredients were scattered
    - the ingredients were too hard
    - it was too greasy
    - it was too sweet
    - there were too many garnishes and few toppings
    - the meat was too greasy
    - it was tasteless
    - it was spoiled
    - I don't buy ready-to-eat meals
    - Other (please describe): …

20. Have you ever decided to consume a ready-to-eat meal based on whether it was recommended by a famous person (chef, sportsmen, actor, etc.)?
    - Yes
    - No

21. Please mark the brands of ready-to-eat meals you know:

Table H4 Most popular RTE meals' brands in Hungary

Company	1 - I know it and have tried it	2 - I know it, but haven't tried it yet	3 - I don't know it
Teletál			
Cityfood			
Interfood			
Gastroyal			
Egészségkonyha			
Food Universum			
Jófalat			
Chef Select			
Globus			
FoodBox			
Hello Food			
Gazsi Food			
Polcz			
Purefood			
Pappudio			
Fruccola			
FREEEP!			
FrissFood			

22. What is your gender?
    - Male
    - Female
    - I do not want to answer

23. What is your age? … years

24. What is your weight? …. kg*

25. What is your height? … cm*

* Body weight and height data are required to calculate body mass index (BMI). If you do not want to provide this information, you do not need to do so.

26. What is your highest level of education completed?
    - Elementary school
    - Vocational school
    - High school graduation
    - University, college
    - Scientific degree (PhD, DSc.)

27. What is your income situation?
    - It is hard living from my income
    - I can live from my income, but I can't put it aside
    - I can live from my income, and I can put a little aside
    - I have significant savings

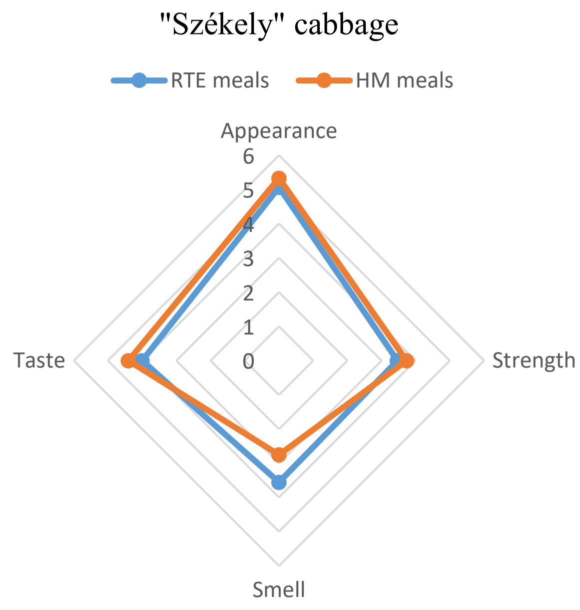
28. Where do you live?
    - Capital
    - City, town
    - Village
    - Other (please describe): …

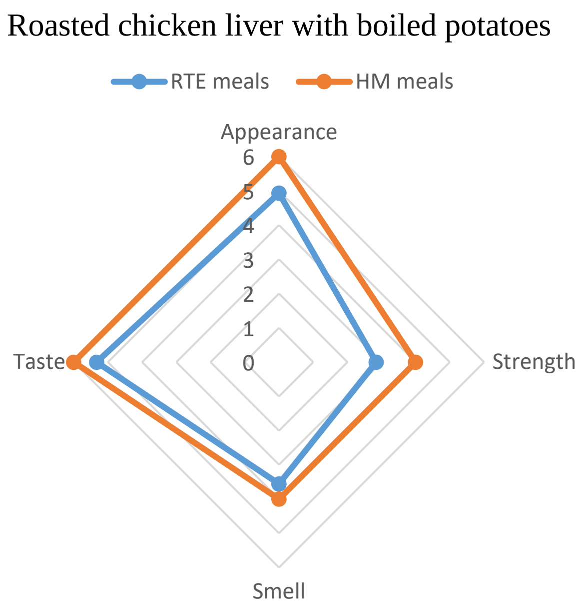
29. What is the characteristic of your occupation?
    - Self-employed
    - Business owner
    - Employee
    - Retired
    - Student, college / university student
    - I don't work at a workplace, I'm at home, my partner works
    - Unemployed
    - Other (please describe): …

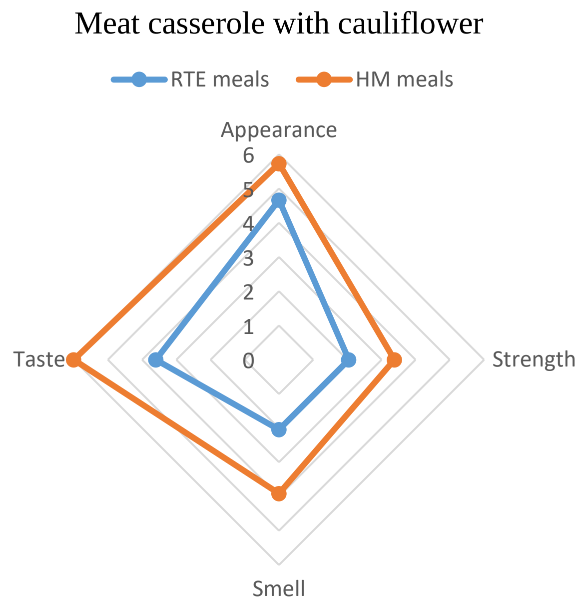
Appendix (I): Sensory characteristics of each individual RTE and HM meals

Fried pork ribs with sour cream, grated cheese and potatoes with parsley

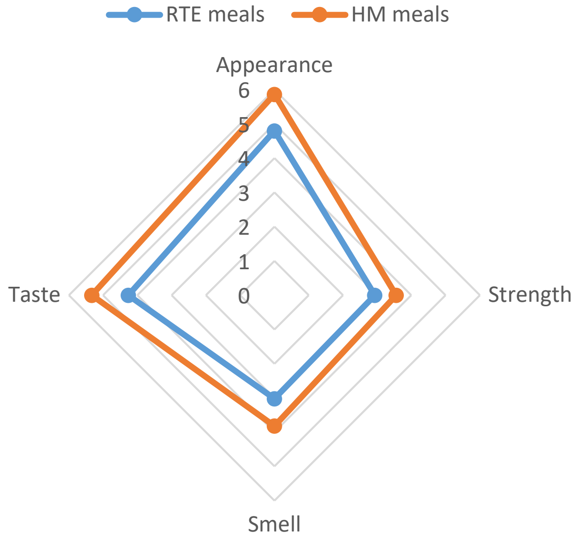
Beef stew with red wine and tarragon


"Székely" cabbage
RTE meals
HM meals
Appearance
6
5
4
3
2
1
0
Strength
Smell
Taste

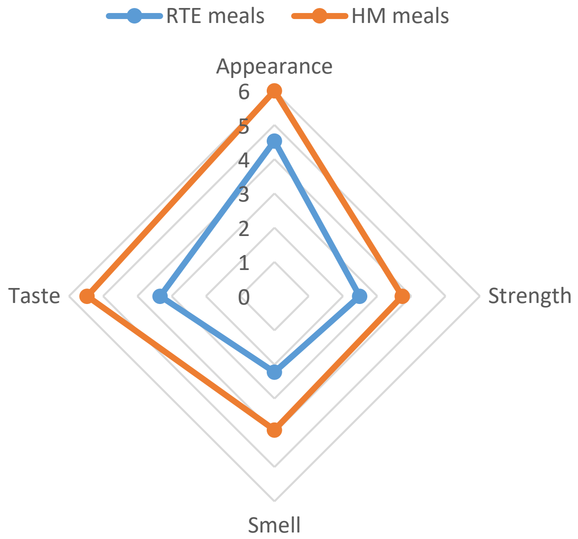

Roasted chicken liver with boiled potatoes
RTE meals
HM meals
Appearance
6
5
4
3
2
1
0
Strength
Smell
Taste


Meat casserole with cauliflower
RTE meals
HM meals
Appearance
6
5
4
3
2
1
0
Strength
Smell
Taste

"Vasi" steak with mashed potatoes and onions

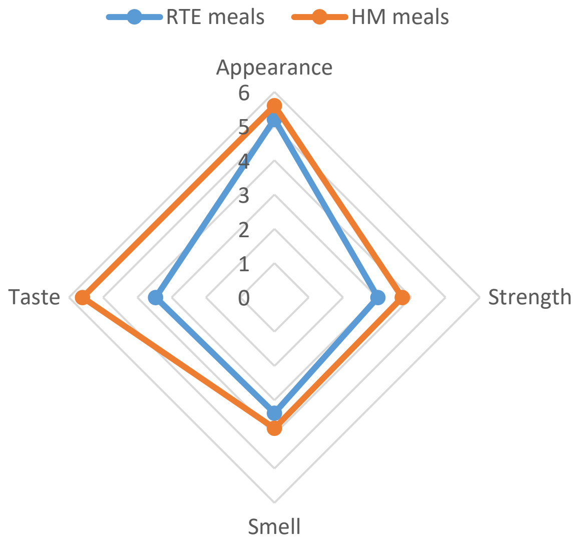


Broccoli layered with chicken, cheese and eggs



"Brasov" stew

Grilled chicken breast, cream cheese sauce, jasmine rice



African catfish fillet in fresh basil sauce, potato croquette