

MASTER IN QUALITY CONTROL

Development of a Tool for the Assessment of the Quality of Food Raw Material, in a Contract Catering Company

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Abstract

Under the scope of the Master in Quality Control (QC), it was decided to develop a project during an internship within a food-related company. This opportunity was given by Eurest, a catering and food service solutions company whose main business area is collective catering. QC activities were performed from February to June 2021 within the Quality department (DQ), under the scope of received food raw material.

The DQ is highly involved in the core activities of the company, namely regarding food control through all the chain to ensure food quality and safety. A quality technician is every day present at the place of reception of cold/chilled raw material, carrying out QC activities, deciding on-the-spot whether the raw material is compliant (C), accepted but has an occurrence (O) or presents a nonconformity (NC) and, therefore, must be rejected.

The main objective of the project was to create a tool for the assessment of the quality of raw material, at reception, which would be used afterwards by Eurest in order to make a consistent and periodical evaluation of the products, as well as to improve the already existent suppliers assessment. Moreover, since food waste is a worldwide problem and Eurest has strict policies on this matter, there was a need to understand the real impact and efficacy of QC daily activities in the reduction and prevention of food waste, comprising a parallel objective of this work.

The assessment was performed taking into account the QC analyses of the first semester of the year, by general category of raw material. Received categories were 8 (dairy goods; eggs and egg products; fats and sauces; fish and fish products; fruits; meat and meat products; sugary products; vegetables) and QC parameters (temperature; packaging/transportation; labelling/authenticity; calibre; organoleptic characteristics: appearance, maturation/oxidation state, mould, pests) were analysed regarding defined requirements. The best assessed categories presented zero O/NC during the whole period. Category with the weakest valuation was meat and meat products. In relation to food waste, the obtained figures were 0.9% for total returned material at reception, and 3 times less for the amount wasted by the units. It was possible to conclude that QC procedures have an impact on the reduction of food waste. The main limitation of the two tasks was the need for manual work with limited automation. Nonetheless, this also comprises a window for improvement.

Strictness and little usefulness of the actual food systems is a concern, and the COVID-19 pandemic has contributed to also question the efficacy of some of the implemented policies. Therefore, changes to the actual systems must be in order, either regarding the circular economy, as well as the promotion of good use of food and the implementation of sustainable chains.

To sum up, this work allowed to understand the real impact and efficacy of QC, QC activities and QC technicians, namely within the contract catering sector, specifically in the promotion of health and food safety.

Keywords: quality control; contract catering; food raw material; food quality; food safety.

Resumo

No âmbito do Mestrado em Controlo da Qualidade (CQ), foi decidido desenvolver um projeto através de um estágio numa empresa do setor alimentar. Esta oportunidade foi dada pela Eurest, uma empresa de soluções de catering e serviços de alimentação, cuja principal área de negócio é a restauração coletiva. As atividades de CQ foram realizadas de fevereiro a junho de 2021 sob a Direção da Qualidade (DQ), no âmbito da matéria-prima alimentar, à receção.

A DQ está fortemente envolvida nas atividades nucleares da empresa, nomeadamente no que diz respeito ao controlo ao longo de toda a cadeia, de forma a garantir a qualidade e segurança alimentar dos produtos. Diariamente, um técnico da qualidade está presente no local de receção da matéria-prima congelada/refrigerada, executando as atividades de CQ e decidindo *in loco* se a matéria-prima está conforme (C), se é aceite mas apresenta alguma incidência (O) ou se apresenta uma não-conformidade (NC) e deve ser rejeitada.

O principal objetivo do projeto consistiu em criar uma ferramenta de avaliação da matéria-prima recebida. Esta seria posteriormente utilizada pela Eurest de forma consistente e periódica, além de passar a integrar a já existente avaliação de fornecedores. Além disso, sendo o desperdício alimentar um problema mundial para o qual a Eurest possui políticas rígidas, surgiu a necessidade de compreender o impacto real e a eficácia das atividades diárias do CQ na redução e prevenção do desperdício alimentar, constituindo assim um objetivo paralelo deste trabalho.

A avaliação foi realizada considerando as análises de CQ do primeiro semestre do ano, por categoria de matéria-prima. As categorias recebidas foram 8 (carne e derivados; frutas; gorduras e temperos; hortícolas; leite e derivados; ovos e ovoprodutos; peixe e derivados; produtos açucarados) e os parâmetros de avaliação (temperatura; embalagem/transporte; rotulagem/autenticidade; calibre; características organoléticas: aparência, estado de maturação/oxidação, bolor, praga) foram analisados tendo em conta requisitos definidos. As categorias mais bem avaliadas apresentaram zero O/NC durante este período. A categoria com avaliação mais fraca foi carne e derivados. Em relação ao desperdício alimentar, os valores obtidos foram de 0,9% para o total de matéria-prima devolvida à receção, e 3 vezes menos para a quantidade desperdiçada nas unidades. Foi possível concluir que os procedimentos de CQ têm impacto na redução do desperdício alimentar. A principal limitação das duas tarefas foi a pouca automação. No entanto, isso representa uma janela para melhorias.

A falta de flexibilidade e a pouca utilidade dos atuais sistemas alimentares é uma preocupação, e a pandemia de COVID-19 contribuiu também para questionar a eficácia de algumas políticas implementadas. São necessárias mudanças nos sistemas alimentares atuais, quer para responder à economia circular, quer na promoção do aproveitamento dos alimentos e na implementação de cadeias sustentáveis.

Em suma, este trabalho permitiu compreender o impacto real e a eficácia do CQ e dos técnicos de CQ, sobretudo no setor da restauração coletiva, na promoção da saúde e segurança alimentar.

Palavras-chave: controlo da qualidade; restauração coletiva; matéria-prima alimentar; qualidade alimentar; segurança alimentar.

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List of Abbreviations

C	Compliant
DQ	Quality Department
EC	European Community
EEC	European Economic Community
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FSMS	Food Safety Management System
GMOs	Genetically Modified Organisms
HACCP	Hazard Analysis and Critical Control Points
IR	Infrared
ISO	International Organization for Standardization
NC	Nonconformity
NP	<i>Norma Portuguesa</i> (PT designation of 'Portuguese Standard')
O	Occurrence
QC	Quality Control
UN	United Nations
WHO	World Health Organization

1 Introduction

Quality Control (QC), which can be defined as the operational part of quality management, focused on assessing if requirements of quality are being fulfilled, is an essential and socially significant thematic of nowadays (1). Its beginning is registered around 1920's, with the increase of mass production, when it became imperative to define the quality of products, as well as to find ways of controlling it. During the last century, a considerable development has been observed, and it has become clear that working harder for longer periods was not as profitable as working more efficiently while employing QC procedures (2).

The Master programme in Quality Control is intended to prepare researchers and to specialise professionals in cutting-edge areas of Physical Sciences, by means of both nuclear and specialty subjects, and comprising a strong laboratorial segment. The course culminates with a research project in which the students are expected to make the most of their abilities and acquired knowledge, apart from being able to develop extra techniques as well as to attain a high degree of autonomy. The aim is to train qualified and versatile professionals for the practice of analytical control of different products, related to life essentials and the well-being of people, such as foodstuff, cosmetics or medicinal drugs. For this reason, the idea of developing my project during an internship within a food-related company seemed the more advantageous option for my dissertation on the chosen QC specialty: Food and Water.

This internship opportunity was provided by the Quality department team of Eurest Portugal. Eurest is a collective catering company part of a global group which plays an important role within the national catering sector and, since its nuclear activities are related to food services, food handling and food safety, it was possible to do the internship under the scope of food QC. More precisely, the work was developed within the sphere of food raw materials, at the moment of their reception, as this comprises the start of the whole process of food treatment in Eurest. The main subjects covered were the evaluation of the received raw materials, in terms of quality and all the important parameters, as well as the misuse of this raw material, in close relation to the topic of food waste. These will be explained hereinafter, as well as some background information and relevant conclusions of the work done. Internship activities were carried out at the site of reception of raw material – a warehouse belonging to the logistics operator involved in Eurest activities –, started in February and finished by the end of June 2021, totalling 5 months of learning, practice and development of activities in order to obtain results and consequently achieve the project objectives.

2 Eurest Portugal

2.1 The sector and the company

Eurest Portugal (hereinafter referred to as 'Eurest') is a catering and food service solutions company based in Portugal, which is part of the global British group Compass Group. Its main areas of operation are: collective catering; public catering; fine dining and events. Eurest also makes use of its know-how, experience and relationship with providers to sell food raw materials to other clients, in order to facilitate their management. For the present work, the focus will be mainly on the first area, since it constitutes the major operational segment of the company.

Generally, 'collective catering' is the expression used for the concept of preparation and distribution of a large number of meals, intended to specific groups of people who need this kind of service, as they are far from home. It is, therefore, a catering of necessity, and not leisure-motivated, which has appeared as a result of a change in society. In fact, with industrialisation, workers employed in factories, in a first stage, and within the tertiary sector, in a second phase, needed to be provided with food service facilities, as the commuting distances to work kept growing, along with a crescent emancipation of women, who started to be incorporated into the labour market, decreasing their time at home as well (3). Moreover, the increasing aging of the population, the strictness of labour and school schedules, and general lifestyle changes have contributed to an increased development of the sector (4). For this reason, nowadays there are several forms of catering depending on the type of facility/organisation, including business – within companies; school – within schools, universities, training centres; socio-health – in hospitals, clinics, nursing homes; and community – in prisons, social institutions, etc.

These catering services are usually outsourced by the organisation to a specialised service provider and, therefore, the area is typically referred to as 'contract catering' (5). This allows companies to focus on their core business, placing trust in more experienced and skilled ones for managing their food services (6).

At a European level, today, the sector counts with 67 million consumers, accounting for 6 billion meals served every year (7). However, it is still a small sector with around 33,000 contract catering companies registered in 2015, employing slightly more than 800,000 people, which corresponded to 0.6% of total employment. Economically, its revenues were of over 20 billion euros (8). Moreover, it still has some potential since only 35% of EU organisations offering a social food service work with a contract catering company (5).

Eurest, in turn, has over 3,000 employees, who operate in schools, business and industry companies, hospitals and health care facilities. These comprise a total of almost 700 units corresponding to around 112,000 meals served every day.ⁱ

The company organisational structure is showed in Figure 1.

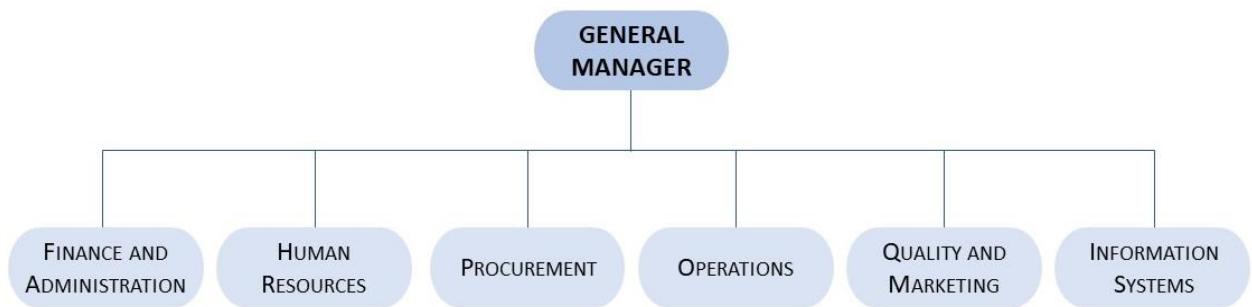


Figure 1. Eurest Portugal organisational chart.

2.2 Food safety and quality – legal requirements and certifications

As a consequence of the mentioned sector growth, it is comprehensible that contract catering companies have also increased in number and had to become more competent and qualified, not only to outstand themselves on the growing competitive market, but also in order to ensure compliance, regarding the tightened regulatory terms and requirements (6).

On the one hand, food law exists because citizens have the right to have access to safe and healthy foodstuff. In fact, serving fresh products present high risk to health since these perish quickly, which is associated with the development of microorganisms, many times pathogenic, which, in turn, may cause some type of foodborne illness, and therefore, safety of foods has to be ensured. Moreover, there may be other types of hazards, namely of physical or chemical nature, since the food we eat travels through a great number of intermediates, from the producers, to the packaging suppliers and the distribution staff and, thus, throughout this complex chain, protection must be guaranteed.

Legal obligations and standards may be specified at national, European or even international level, and may be transversal or sector-specific.

Internationally, under the Food and Agriculture Organisation of the United Nations (FAO) and the World Health Organization (WHO) supervision, the Codex Alimentarius Commission (typically 'CODEX') has been responsible for the development of a group of

ⁱ Numbers of 2018 (9).

standards, guidelines and recommendations on food trade and safety since 1962. In 1969, the *General principles of food hygiene* (10) were defined and have been recognised as the basic document on safety of foodstuff and prevention of hazards from food since then (11). In 1997 an annex on the Hazard Analysis and Critical Control Point principles, known as 'HACCP', was added (12). This system is globally recognised as a useful instrument for the control of risks of different natures, extensively adopted by food business operators throughout all stages of food service. CODEX texts (principles, standards and guidelines) are voluntary and, therefore, there is a need for their translation into legislation with the purpose of being enforced (13). As a matter of fact, European legislation has taken these and other international standards and guidelines into account, in addition to creating new specifications.

Regarding the current century and the "new European legislation", due to a set of foodborne illness events in the late 90's, the need for a new approach on food safety, including a clearer and stricter definition of principles and requirements on food law, was raised in Europe (14). Hence, in 2002, the pillar of European food law, the General Food Law Regulation (EC) No 178/2002 (15), came into force. This intended to guarantee strong protection of all consumers' health, and foodstuff safeness (16). In April 2004, the European Parliament and the Council of European Union, adopted the Regulation (EC) No 852/2004 (17) and Regulation (EC) No 853/2004 (18) on the hygiene of foodstuffs, which describe general and specific requirements for good practices during the whole chain, from production to distribution.

Generally, food law in Europe guarantees control of all the following principles: general legislation, hygiene of foodstuffs, food contamination, food labelling, substances added to food, animal and plant health, animal feed and feed labelling, novel foods and genetically modified organisms (GMOs) (19).

Catering companies must comply with the mentioned legislation, apart from other acts which comprise, mostly, more specific food requirements. Table 1 summarises these legal documents, both the ones previously mentioned, as well as all the other applicable laws that will be referred later on in this work.

Table 1. European food safety legislation – relevant acts covered throughout the present work.

Act	Date	Type of act	Entity	Scope
Decree Law No 238/86 (20)	19/08/1986	Decree Law	Portuguese Government	Determines that information on the nature, characteristics and guarantees of goods or services offered to the public in the national market must be provided in Portuguese
Regulation (EC) No 1760/2000 (21)	17/07/2000	Regulation	European Parliament, Council of the EU	System for the identification and registration of bovine animals and regarding the labelling of beef and beef products
Regulation (EC) No 178/2002 (15)	28/01/2002	Regulation	European Parliament, Council of the EU	General principles and requirements of food law
Regulation (EC) No 852/2004 (17)	29/04/2004	Regulation	European Parliament, Council of the EU	Hygiene of foodstuffs
Regulation (EC) No 853/2004 (18)	29/04/2004	Regulation	European Parliament, Council of the EU	Specific hygiene rules on the hygiene of foodstuffs
Regulation (EC) No 1935/2004 (22)	27/10/2004	Regulation	European Parliament, Council of the EU	Materials and articles intended to come into contact with food
Commission Implementing Regulation (EU) No 543/2011 (23)	07/06/2011	Implementing Regulation	European Commission	Rules for the application of Council Regulation (EC) No 1234/2007, regarding fruit and vegetables and processed fruit and vegetables sectors Note: see notes of Regulation (EU) No 1308/2013

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Regulation (EU) No 1169/2011 (24)	25/10/2011	Regulation	European Parliament, Council of the EU	Food information to consumers Note: see notes of Commission Implementing Regulation (EU) No 1337/2013
Directive 2011/91/EU (25)	13/12/2011	Directive	European Parliament, Council of the EU	Indications or marks identifying the lot to which a foodstuff belongs Note: Decree Law No 26/2016 in Portugal
Regulation (EU) No 1379/2013 (26)	11/12/2013	Regulation	European Parliament, Council of the EU	Common organisation of the markets in fishery and aquaculture products
Commission Implementing Regulation (EU) No 1337/2013 (27)	13/12/2013	Implementing Regulation	European Commission	Rules for the application of Regulation (EU) No 1169/2011, regarding indication of the country of origin or place of provenance for fresh, chilled and frozen meat of swine, sheep, goats and poultry
Regulation (EU) No 1308/2013 (28)	17/12/2013	Regulation	European Parliament, Council of the EU	Common organisation of the markets in agricultural products Note: repeals Regulation (EC) No 1234/2007
Decree Law No 26/2016 (29)	09/06/2016	Decree Law	Portuguese Government	Ensures execution and compliance with Regulation (EU) No 1169/2011 and Commission Implementing Regulation (EU) No 1337/2013, and transposes Directive 2011/91/EU
Regulation (EU) No 2017/625 (30)	15/03/2017	Regulation	European Parliament, Council of the EU	Official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products
Directive (EU) 2018/851 (31)	30/05/2018	Directive	European Parliament, Council of the EU	Waste management Note: Decree Law No 102-D/2020 in Portugal
Decree Law No 102-D/2020 (32)	10/12/2020	Decree Law	Portuguese Government	General regime for waste management, legal regime for the disposal of waste in landfills and regime for the management of specific waste streams, transposing Directives (EU) 2018/849, 2018/850, 2018/851 and 2018/852

On the other hand, as contract catering companies started to offer other services, they became to concern themselves with additional aspects in terms of nutritional, hygiene, safety and quality perspectives, in order to attract attention among competitors. According to ISO 9000:2015 (1), which outlines fundamentals and vocabulary regarding Quality Management Systems, 'quality' is defined as the ability of something – product or service – with inherent characteristics, to fulfil its requirements. More specifically, for the customer of these products or services, they have to meet his necessities, but, preferably, exceed his expectations. Likewise, the contract catering sector deals with specific and somehow strict requirements in terms of quality and its procedures, in order to offer clients food services – and, consequently, food products – which meet their needs and desires, while not missing any regulatory terms. In fact, firstly, since competitors are countless, these companies have to guarantee a positive impression amongst final consumers, at the same time they pass on an idea of quality-consciousness. Secondly, as mentioned before, serving fresh products may lead to serious health risks and people nowadays are increasingly aware of this, since, for all of us, it is a daily life topic. Finally, these companies many times deal with groups of more vulnerable people, like children or elderly patients, for instance, which are associated with more necessities and susceptibility to diseases, demanding a more careful attention and which means, in turn, a need for adaptation of these organisations (6). Owing to all this, quality is a very important topic within contract catering.

Quality is, therefore, one of Eurest corporate values and, for that reason, the company invests in conformity with the standards and certification. Eurest is certified in 6 diversified areas, including Quality Management Systems, under ISO 9001:2015 (33). An implemented Quality Management System means that the organisation has its objectives well defined, as well as the processes and resources to achieve the expected results. It also means the organisation has good management tools and that all the processes are interconnected, in order to guarantee better efficiency with fewer costs, assuring added value to the company. Moreover, this certification denotes focus on the client and involvement of all employees in reaching quality standards. Additionally, its scope must be organised and reported as documented information, in the form of, for instance, a Quality Manual which systematizes its aim, objectives and the processes application and operation. Eurest Quality Manual comprises every document containing requirements and information in order to guarantee that procedures are standardised, services and food products are consistently controlled, produced and distributed according to quality standards within all Eurest units.

Another area of certification is Food Safety Management System (FSMS), which is described in ISO 22000:2018 (34) and, generally, it specifies a series of essential requirements for food businesses that ensure the safety of foodstuff throughout the whole food chain, until the final consumer.

Due to its core business nature, food safety is the basis for Eurest's activities and, similarly to ISO 9001:2015, a FSMS implementation means that every employee is involved and committed to ensure safety. It helps improving the organisation performance with regard to food safety, by assuring:

- The safety of procedures and foodstuff;
- Its compliance with rules and regulatory requirements;
- The application of good manufacturing practices;
- The identification of possible food hazards – taking into account the HACCP system;
- The establishment of preventive measures for achieving an accepted risk level.

Within Eurest, this FSMS refers to its collective catering services and takes into account every step of the process of the food service, as well as all categories of food raw material.ⁱⁱ The company ensures that teams from all units are continuously trained, food safety performance is monitored and that control exists from reception to distribution, traceability and microbiological analysis are guaranteed, and quality and safety audits are periodically performed.

Apart from the general certification of the company, 58 units are as well ISO 22000:2018 certified (9).

In terms of other type of certifications, Eurest also has ISO 14001:2015 for Environmental Management System (35), Occupational Health and Safety under ISO 45001:2018 (36), Social Responsibility Management System, under a Portuguese standard NP 4469:2019 (37), and Reconciliation of work, family and private life, one more Portuguese standard NP 4552:2016 (38).

Since all the mentioned documents represent management systems in several diversified scopes, Eurest has defined an Integrated Management System that combines the whole list of standards, as well as multiple aspects of the company operations, at the same time it has into account the aims and strategies of the organisation, in order to ensure that processes and expected results are fulfilled.

Unlike legal requirements, all these certifications are voluntary. However, these contain very important concepts within nowadays society, and comprise a way of building trust around customers as well as cultivating recognition within the sector.

ⁱⁱ The FSMS – HACCP defined categories of raw material due to the large list of possible products, and in order to make it easier to organise them as well as to perform the analysis of hazards, when needed.

2.3 Flowchart of raw material

In order to guarantee compliance with the mentioned quality standards, Eurest Quality and Marketing department (hereafter DQ, which corresponds to the Portuguese designation of 'Quality Department') is highly involved in the several procedures related to units, that is, with the food service provided, and which are described within the Quality Manual, as well as in the processes associated with suppliers and their raw material. The DQ consist of, mainly, nutritionists, as well as health and safety technicians, which form altogether the group of quality technicians. Each technician is assigned several units and is responsible for monitoring their processes, perform audits and provide training related to procedures of the Quality Manual, such as quality and food safety requirements. In relation to suppliers, members of the DQ participate in the process of referencing, auditing and selecting providers of raw material according to defined parameters, as well as take part in their periodic evaluation. In regard to raw material, DQ has a major importance in the process of acceptance and supervision through all the chain, from its reception to the serving of finished meals it is used for.

The process of reception of the raw material is schematised in Figure 2.

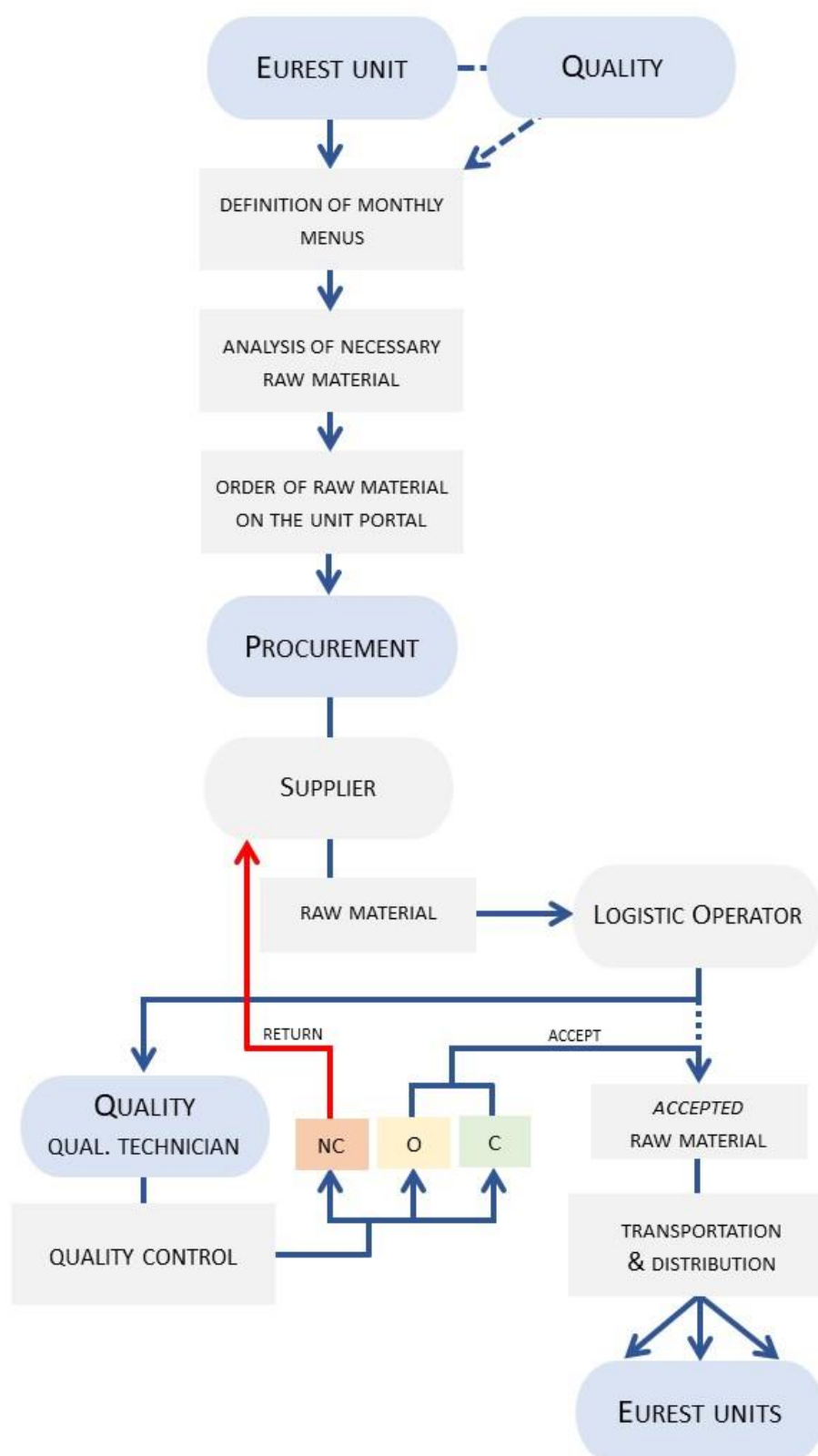


Figure 2. Flowchart describing the process of order, reception and distribution of raw material of Eurest Portugal.

The pathway starts within the unit, with the definition of the material needed, according to what is defined in the monthly menus designed by the unit responsible, together with the respective nutrition technician of the DQ. These menus are made taken into account eventual contractual requirements of the client, as well as legal obligations or guidelines, established with nutritional purposes. After that, the order of the chosen material is placed through the Unit Portal – an internal online platform used with several purposes by each unit, and to which both the DQ and Procurement department have access. The Procurement compiles, subsequently, all the orders of the several units and proceed with the purchase of the raw material, in turn, to the suppliers, according to the list of existing sellers, available raw materials and their suitability, and, of course, set of prices. The total amount of raw material ordered by Eurest for its operation is centralised and, therefore, all the commodities are received by one single intermediary, termed the 'logistic operator'. The logistic operator manages, therefore, at a logistic level, the process of reception and storage of the materials within its storage facilities. In Portugal, the chosen logistic operator has two sites of operation, being one of the facilities more specialised in cold foods and the other in grocery products. The logistic operator has information about the several orders and deliveries that will occur, and the suppliers deliver the products at the respective warehouse. At reception, a quality technician from Eurest is present (only at the warehouse of cold foods) and carries out activities of QC, monitoring the quality of the raw materials according to defined parameters and characteristics. These are related to the temperature of the materials at reception, package and/or transport conditions, labelling and authenticity, calibre and organoleptic characteristics, namely appearance, maturation or oxidation state, presence of mould, pests. As the quality technician receives the raw material, he checks the products by sampling and decides on-the-spot which destination this must take. Food products may be:

- accepted – if all the parameters are in accordance with the requirements, products are compliant (C);
- accepted with reservations – being called an 'occurrence' (O) if a requirement for one or more parameters is slightly inadequate, although this does not compromise the integrity and safety of the product. The technician advises the supplier of the detected faults, so it can improve the situation in the future;
- not accepted and returned to the supplier – being called a 'nonconformity' (NC) if the requirements have not been fulfilled and the quality and safety of the product is compromised.

The raw material is, thus, either carried back into the truck or stored within the facilities, transported and distributed across units, aiming to its final purpose of meals preparation.

2.4 Food waste and the impact of quality control

By definition, 'food waste' is the declining in quantity or quality of available food due to actions by food service providers, retailers and consumers. A slightly different concept is 'food loss', which is associated with the earlier stages of the food supply chain, namely from post-harvest to distribution. This might happen in many ways and for many reasons but, independently of the situation, it is a reflection of poor resources management that leads to a negative impact on climate, economy and people's livelihood (39). Food waste is a worldwide problem which became priority in the last years and which tends to become even more important due to the exponential rise of world population and the consequent need for far better food management.

In fact, FAO estimated that approximately 1/3 of the world food is wasted or lost every year, which is associated with 143,000 million euros of both environmental and economic costs (40). For this reason, in 2015 the 193 Member States of the United Nations (UN) included this indicator in one of the 17 goals for the Sustainable Development, the Responsible Consumption and Production goal. These objectives, aimed to achieve by 2030, are intended to create a fairer, more peaceful and greener world, topics that are rising in importance over the years, in order to provide ourselves a better future (41).

In the EU and Portugal, measures are, of course, being implemented since. Numbers of food waste percentage lie around 20% and 17% of total production, respectively. In 2016, the Portuguese Government approved the creation of the National Commission for Combating Food Waste and, in 2018, the National Strategy to Combat Food Waste was presented, with a "zero food waste" vision and 3 core strategies: prevent, reduce and monitor. These include actions such as raising awareness among population, training companies of the food supply chain or creating innovative processes, in order to connect the whole supply chain, from producers to consumers, improving everyone's consciousness and enhancing global results. As a matter of fact, studies have shown that for every 1 US dollar invested in reducing food waste, companies save up to 14 US dollars in operational costs (42). Decree Law No 102-D/2020 (32) in force transposes the current EU Directive on waste management [Directive (EU) 2018/851 (31)].

Eurest has a strict policy on this topic, related to both economic and environmental sustainability objectives. Its food waste reduction strategy is focused essentially on prevention, but also on the promotion of a circular economy, and there are numerous projects being developed towards this goal (9).

Throughout Eurest entire process and food chain, there are several critical points where food waste is a reality. For example, in the final stage, when prepared meals are consumed within the units, many times some food waste is observed, being associated with food that

is not eaten and is simply disposed of by the consumers. The company may try to eliminate or reduce this practice through sensibilisation actions that are part of prevention strategies, although, ultimately, this is beyond Eurest control. Also in relation to prepared foodstuff, there is another situation within the units, when, at the end of mealtime, there is still some prepared meals left, which will not be consumed but cannot be kept, having to be discarded. In the present time, Eurest and all the units work hardly together in order to find the best way of avoiding preparing food that will eventually become waste, trying to reach the perfect balance between two undesirable circumstances: lack of meals and excess of food.

However, the food waste topic that is hereinafter discussed is related to raw material, instead of prepared foodstuff, since that has been the scope of this work.

Two main situations may happen, to be regarded as waste of raw material. On one hand, when units return the materials to the logistic operator facilities because it is in excess of present need. This is a rare scenario, since units have the responsibility to perform the order of material based on a careful analysis of quantities, with the purpose of preventing this from happening. However, sometimes unexpected situations occur and units cannot avoid it. One example of that has been the period of COVID-19 pandemic, when many enterprises, industries and schools closed doors without notice. The raw material coming from those units was returned to the logistic operator and Eurest needed to find alternative treatments and new purposes for those products, although this was not always easy or possible, leading to some food waste (see Figure 3).

Another, and more usual, situation happens when units receive raw material that is not in good condition to prepare and serve to the consumers and, therefore, cannot be used, being left aside. This last situation represents a specific concept of food waste, named 'qualitative food waste', which corresponds to the decrease in quality attributes of a product due to some non-compliant quality standards and that decreases, in turn, its value, either nutritional or economic (43). Although named 'food waste', this situation is created by decisions and actions taken, mainly, by food suppliers and distributors, as the catering company has no influence on this outcome and is the most affected part. The first step is for units to fill in a record of the nonconformity at the Unit Portal, and, afterwards, typically this material is returned to the supplier, since the nonconformity and the fact that the product is not in good condition is usually their responsibility. Though, few times the product (or a part of it) is in truly bad condition and it is disposed of at the unit. Alternatively, if the nonconformity is believed to be related to the transportation or storage of the raw material, it must be the logistic operator to take accountability for the situation and reimburse Eurest. However, despite some type of reimbursement is usually comprised in the process and, therefore, Eurest is slightly impaired, there is always some waste along the process, either food, money or time related, which must be avoided.



Figure 3. Raw material returned by the units that were closed, due to the COVID-19 pandemic, and did not have the need to prepare meals.ⁱⁱⁱ

A good way for achieving this is the QC procedure made at reception, in which the quality of the raw material is assessed on a first stage, prior to a second transportation or storage, that is, before the raw material is re-submitted to any variations of environment. At this stage, and as previously explained, the quality technician evaluates the product and gives his decision about its course. If the product is returned, this is not delivered to the units and, naturally, some nonconformities are avoided. The raw material is immediately returned to the supplier, which usually has a defined procedure and destination for this type of material (cattle or other animals feeding, for example, which is not considered food lost or waste), preventing a more severe misuse from happening (43). Similarly, if the technician finds something that must be considered, the supplier is informed of the observation, since this could lead to some nonconformity later on, if the encountered problems are more serious or transversal within the lot.

Eurest strict policies on food waste prevention, in association with food safety and quality certifications and concerns, undoubtedly make this an extremely important topic. Moreover, it becomes clear that the DQ and, more precisely, QC activities play a crucial role in guaranteeing that Eurest receives the best raw material possible, in improving numbers associated with food waste, as well as in promoting a smooth flow of the whole activity and company's processes.

ⁱⁱⁱ Picture taken at the beginning of February 2021 (following closely the second lockdown in Portugal).

3 Aims and objectives

The main objective of the work was chosen considering two main factors: the scope of activities that were to be developed, that is, considering the work carried out within the area of raw materials reception; and the necessities detected by Eurest. The company, namely the DQ, recognised that:

- a procedure for controlling the quality of the raw material based on several quality criteria was carried out, at the moment of reception in the warehouse of the logistics operator, on a daily basis and done by sampling by a quality technician – which could lead to accepting (compliant, C), accepting with reservations (occurrence, O), or returning the products to the supplier (nonconformity, NC);
- the elaboration of a general analysis, at the end of the year, of all the returned products and complaints was performed;
- a valuation of the raw material was made by the different units through an annual survey;
- there was also a system for assessing the suppliers, both before the selection and afterwards, with defined regularity, and according to defined criteria, each with a defined weight – audits and classification, history of products recalls, score of service levels.

However, there was a lack of evident assessment of the raw material. Namely, not only the simple recording of the daily occurrences and nonconformities did not provide the means for a continuous evaluation of the received products, but also the valuation carried out by the units consisted merely of an estimate based on their perception of the overall condition of the received raw materials, by general categories, not describing the specific product or supplier. Therefore, this improvement on the assessment of raw material was considered necessary, both in order to make a periodical assessment based on the different products received, including the clarification of causes for returning, the details of observed occurrences and a measurable evaluation of the quality of raw material, as well as, subsequently on a second stage, aiming to be taken into account in the suppliers evaluation.

For this reason, the main aim of the work was to develop a tool for Eurest that would allow to maintain a regular and consistent assessment of the received food raw material.

Another important objective of the present work was related to the misuse of the raw material, that is, related to food waste of raw material within Eurest. As previously mentioned, daily QC activities are connected to the prevention of qualitative food waste that occurs when raw material received by the units is not compliant for some reason, and,

consequently, cannot be used for preparation of the meals. Therefore, this step carried out by the quality technician is believed to help simplifying the food chain and avoid food waste. However, as also mentioned, this practice is done by sampling and, naturally, there is still some raw material that is accepted which may be found to be not compliant afterwards, at the unit. Owing to this, the DQ found important to make a comparison between the raw material returned to the supplier by the quality technician, upstream, at the logistic operator, and the raw material that has been wasted/returned by Eurest units after a non-compliant product was detected. With this, the aim was not only to be able to understand the dimension of qualitative food waste from Eurest units, but also and more importantly, to analyse the efficacy and impact of the QC procedure on the prevention of food waste and nonconformities.

4 Methodology

4.1 Assessment of received raw material

Regarding the main aim of the work, from February to June a methodology for the evaluation of the food raw material was developed, by making daily recordings of the causes for the observed occurrences and identified nonconformities detected by the quality technician, followed by a monthly compilation, at the end of each month, using a Microsoft Excel spreadsheet. In order to have more data, it was decided to also include the month of January, being added afterwards based on the database kept by the quality technician, and making up 6 complete months of information.

As said before, the mentioned QC procedure occurs only within the warehouse focused on cold foods, since grocery products are less perishable and harder to examine. Due to their nature, packaging and/or treatments, these may be kept at room temperature and are termed shelf-stable, since their microbiological activity is inexistent, being in good condition for years (39). Therefore, daily QC was performed with not-shelf-stable products, which need some kind of conservation step, such as controlled temperature. These products comprise the following eight categories of raw material defined in Eurest Quality Manual, specifically under the FSMS – HACCP: dairy goods; eggs and egg products; fats and sauces; fish and fish products; fruits; meat and meat products; sugary products; vegetables. As to the evaluation parameters, the criteria considered were based on the ones used *in loco*, on the QC of the products: temperature of the materials, at reception; package and/or transport conditions; labelling and authenticity of the raw material; calibre; organoleptic characteristics, namely appearance, maturation or oxidation state, presence of mould, pests.

On the daily recordings spreadsheet, firstly, the specific product and its supplier were stated, indicating the category to which the raw material corresponded. Each supplier was identified by a code (S1, S2, S3, etc) due to data privacy issues. The parameter identified not to be fulfilled was indicated, stating whether the observation led to accepting with some reservation (O) or, on the other hand, to returning the material (NC) being, in this case, the amount returned to the supplier also recorded in the tool of assessment, in kilograms.

Afterwards, at the end of the month, a data analysis was performed. By category, the number of O and NC was summed up, separated by parameter of assessment. If a category had not had any observance that month, the sum was presented as a hyphen (-), while if it had had at least one observance, the parameters in which nothing had been observed, showed a zero (0). Also by category, the total amount of returned material, in kilograms, the total number of observations, as well as the total number of NC only, were calculated. In

the same way, if a category had not had any observance that month, the cell presented a hyphen (-), while if it had had some observance, a zero (0) was indicated. Owing to this, it was possible to have an idea, per month, of which categories were more susceptible and used to have more negative observances and which, on the other hand, were the least problematic.

In like manner, calculations were made by supplier. The number of O and NC separated by assessment parameter, their total number, as well as total number of NC only and returned amounts, were indicated.

Lastly, a complete valuation of the raw material, regarding categories, was performed, comprising the data of the 6 months, which consist in the first semester of the year 2021. For this purpose, it was necessary to define weighting criteria for each assessment parameter, by category. Therefore, for each category of raw material, temperature, package and/or transport conditions, labelling and authenticity, calibre, appearance, maturation or oxidation state, presence of mould and pests were each associated with a percentage, representing the partial weight of a final score, considering the significance of both the level of possibility/adequacy of occurrences and/or nonconformities in that parameter, and the severity of possible defaults regarding food safety. Thus, some parameters might have null meaningfulness for some categories (weighting of 0%) and different categories might have different percentages for the same parameter. In what concerns to parameter labelling/authenticity, it was understood that for every product the impact would be the same or it would have the same level of severity and, therefore, for all categories this was given a weighting of 10%. Owing to the fact that, by parameter, there was going to be considered the total number of observances (O and NC together), it was also important to consider some differentiation, within the weighting criteria, between the observations that comprised NC and the ones that covered simple occurrences, since NC usually are observances with more serious consequences and mean poorer quality of the raw material. For this reason, the existence (or not) of returned amount was taken into account, since this is an indicator of the manifestation (or not) of noncompliant material, and for all the categories its weight was defined as 20%. The sum of all the weightings for each category (total weighting) had to sum, at the end, 100%. Table 2 shows the weighting criteria defined for each of the 8 categories.

Table 2. Weighting criteria of each parameter of assessment, for each category.

Category	Assessment parameters								Returned amount (yes/no)	Total O/NC	Total weighting
	Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
					Appearance	Maturation/ oxidation state	Mould	Pests			
Dairy goods	20%	10%	10%	0%	0%	0%	20%	20%	20%		100%
Eggs and egg products	20%	10%	10%	0%	0%	0%	20%	20%	20%		100%
Fats and sauces	20%	10%	10%	0%	0%	0%	20%	20%	20%		100%
Fish and fish products	16%	5%	10%	5%	12%	0%	16%	16%	20%		100%
Fruits	5%	5%	10%	10%	10%	10%	15%	15%	20%		100%
Meat and meat products	16%	5%	10%	5%	12%	0%	16%	16%	20%		100%
Sugary products	20%	10%	10%	0%	0%	0%	20%	20%	20%		100%
Vegetables	5%	5%	10%	2%	10%	14%	17%	17%	20%		100%

Moreover, qualitative levels of assessment corresponding to values of final percentual valuations were defined, in order to more easily compare categories and reach conclusions. This association is shown in Table 3 and it was based on the assessment values and levels defined within the system for the evaluation of suppliers. With a half-year assessment of 0 to 19%, raw material categories would be evaluated as 'Excellent', from 20 to 59% they would be evaluated as 'Adequate', from 60 to 79% the level of assessment would be negative and 'Inadequate', and from 80 to 100% category would be classified as 'Critical'.

Table 3. Possible intervals of percentual values obtained for quantitative assessment and their corresponding level of assessment.

Half-year assessment	Assessment level
0-19%	Excellent
20-59%	Adequate
60-79%	Inadequate
80-100%	Critical

After the definition of the weighting criteria for each category, the final assessment was performed, compiling the data of each month for each category. The number of O/NC for each parameter during the semester was then compared to the total number of O/NC for that category throughout the same period, and partial percentages were obtained after calculating each relative weighting. Summing up all the partial percentages, it was possible to reach a final percentual value, which comprise the half-year assessment of that category.

4.2 Qualitative food waste analysis

In regard to the topic of food waste, and similarly to the tool for assessment of the raw material, for this part of the project it has only been considered the raw material received in the mentioned logistic operator facility and which is subject to QC. Moreover, from this group of products, only the categories with more observations/nonconformities and/or higher risk have been selected: fruits, meat and meat products, and vegetables, for being categories with higher rate of nonconformities, as well as fish and fish products, which, despite not having many occurrences, comprise a category of medium risk for being fresh or frozen materials that are prone to the development of pathogenic microorganisms, but will be subject to some kind of treatment prior to eating. As a result, categories dairy goods, eggs

and egg products, fats and sauces, and sugary products were not taken into account within this topic, given the minor number of observations. In order to consider the same period, as well as to have a significant amount of information, the numbers analysed comprised data from January to June.

The amount returned by the quality technician for each category, by month, was determined using the assessment tool, and then the total of the 6 months period was computed. In relation to the volume wasted/returned by all Eurest units, data was calculated using a compilation of all the nonconformity records filled in by the units, in which there were some type of food waste related to quality issues of one of the 4 mentioned categories of raw material. That is, in order to make a fair assessment of QC and its impact on qualitative food waste, raw material returned by the units due to some other type of issue not related to quality parameters, or, on the other hand, complaints made but in which food was still used for consumption, that is, where there was not waste, were not considered. This information was collected from the Unit Portal and analysed in the form of a Microsoft Excel datasheet. Lastly, both the total quantity returned by the quality technician and the volume wasted/returned by the units were then compared to the total amount of received raw material, in kilograms and always by category, which was provided by the Procurement department. Using a Microsoft Excel spreadsheet, all this data was registered, percentages were calculated and conclusions were made.

5 Results and Discussion

5.1 Assessment of received raw material

Regarding the need for a strict control of the food raw material, the quality technician and I were every day present at the storage facility of the logistic operator attending the reception of the products, inspecting their characteristics in terms of safety, authenticity and quality, deciding which course these should take and making daily recordings of the observations.

With regard to the specific quality parameters and product characteristics analysed, the temperature of the materials at reception, package and/or transport conditions, labelling information and authenticity of the raw material, calibre, as well as the organoleptic characteristics of the products, namely appearance, maturation or oxidation state, presence of mould or pests, were all controlled according to specific requirements, which depended on the categories and type of material.

Temperature

The temperature at which foods are preserved, distributed and stored is one of the most important factors regarding their safety and quality. Products may be kept at room, refrigerated or freezing temperature depending on the category and, thus, on the level of perishability. As stated before, room temperature is applied to shelf-stable products, like groceries and drinks. Conversely, cold temperatures must be applied in order to guarantee that eventual development of existing microorganisms is inhibited or slowed down, as well as for reducing chemical and physical processes and consequent organoleptic changes (44).

Firstly, and as mentioned in Regulation (EC) No 852/2004, it was important to inspect the temperature of the trucks which are making the delivery, in order to decide whether it was compliant with the temperature defined for those types of products (17). After that, both chilled and frozen material were received on an unloading dock whose temperature was between 6°C and 8°C, being, as quickly as possible, subject to QC and soon stored in defined racks within either a refrigerated room or a freezing chamber, respectively, with proper temperatures of storage. Frozen material should be kept at a negative cold temperature, between and -24°C to -18°C, values at which microbiological activity, as well as all degradation processes, are suppressed (18). For this reason, frozen raw materials such as fish and fish products, meat and meat products, sugary products, vegetables and dairy goods such as ice cream, may persist for a few years. At reception, both the truck containing the raw material and the material itself should present temperature values

between -24°C and -18°C as a guaranty that the cold chain had not been broken and that temperature variations did not occur, otherwise the food might be spoiled. However, due to the difficulty in maintaining these very low temperatures during transportation and distribution, and since the reception dock was usually at higher temperature, it was admissible to receive materials with temperature lower than -10°C, as long as the product was in good condition and the other parameters/characteristics were compliant (45). On the other hand, refrigerated material should be kept at a positive cold temperature, between 2°C and 5°C and, therefore, the same should be observed for the temperature of the material at reception (18). This applied to dairy goods, eggs and egg products, fats and sauces, chilled fish, chilled meat and meat products, and sugary products. Although this range of temperatures does not avoid all microorganisms multiplication, it allows to considerably minimise the processes and that products maintain their organoleptic and nutritional characteristics. In fact, refrigerated products present the best organoleptic and nutritional qualities, when compared to shelf-stable or frozen foods. However, shelf life is shorter, ranging from few days to several weeks (44).

The inspection of this parameter was made employing an infrared (IR) thermometer for food materials, a *Testo 104-IR* (Figure 4), which determined the temperature through an IR ray sensor for non-contact measurement. Moreover, it could be performed either with the material unwrapped, if possible, that is, without any plastic or wrapping material in between, or in indirect contact, when it was not possible to reach the material because the package or envelop could not be damaged, otherwise the raw material would be spoiled.

Fresh produce, that is, fruits and vegetables, was unloaded onto the next dock, whose temperatures were slightly higher, between 7°C and 10°C. Similarly to refrigerated products, this material was handled at these temperatures in order to have a balance between maintaining their organoleptic features and avoiding extreme natural development and degradation. Likewise, both the truck of transportation and the raw material should fulfil this range of temperatures. Afterwards, the material was maintained on the same place at the same temperature, although distributed through pallets, in order to be organised and ready to be transported again in trucks and shipped to units. Figure 5 shows this step. Only fourth range produce, that is, freshly-cut ready-to-eat vegetables, had a lower adequate temperature, such as refrigerated products, needing to be kept at 2°C to 5°C until they were ready to be shipped (46).



Figure 4. Infrared thermometer used for temperature control - *Testo 104-IR*.



Figure 5. Pallets loaded with containers of fresh raw material (fruits and vegetables), at one of the logistic operator warehouses.^{iv}

^{iv} These were later transported in trucks and distributed through Eurest units.

Packaging

Apart from analysing temperature, it was also important to check the conditions of the packaging. The packaging materials and objects are a significant deal within food safety because these protect foodstuff from its production until its consumption, not only being a great amount of time in contact with food material, but also sometimes helping extending their shelf-life (47). Both Regulation (EC) No 853/2004 and Regulation (EC) No 1831/2003 (22) mention the importance and requirements of the materials used for enfolding and packing foodstuff. The first one mentions, in a more general way, that these materials must not be a contamination source and need to be carefully handled until its intended use (17). The second regulation states the general principles for the inertness and safety of all packaging materials (22).

The quality technician inspected the consistency of the packaging, and checked whether it was intact, presenting no perforations or cuts that might have damaged the food material inside. Technician also saw the general hygiene of the package. This was valid mainly for refrigerated and frozen materials, as well as fourth category produce, since these materials are pre-packed/wrapped by the producer. Fruits and vegetables were received either within cardboard or IFCO plastic containers, which means that the QC of the packaging was less relevant or inexistent. Figure 6 illustrates a IFCO container used within Eurest food chain.



Figure 6. IFCO reusable plastic container.^v

^v This solution presents food-safe materials, apart from allowing to:

- optimise space within logistic platforms – since containers respect size standards;
- manage costs – as the containers are rented and not bought;
- reduce environmental impact – due to an approach of circular economy and a more sustainable supply chain, through continuing reusage (48).

Labelling

Following checking the temperature and the packaging conditions, the quality technician should analyse the label of the raw materials.

Labelling is one of the most important topics within the whole food sector, since it is a guaranty of safety, quality and authenticity of products. Until the seventies, meals were mostly prepared at home and pre-packed food was almost inexistent. With the progress of both situations, consumers started to require more information and labelling began to comprise an obligation (49). The first EU regulation on this was the Council Directive 79/112/EEC (50), which has suffered several amendments until the legislation in force today, Regulation (EU) No 1169/2011 (24). These regulations aim to protect, above all things, the health and safety of the consumer, promoting, at the same time, a complete access to information (51).

There are mandatory indications, as well as voluntary. The quality technician checked if the labels information was correct and complete according to the requirements. Considering only the categories of raw material controlled, mandatory indications were the following (24):

- **Name of the raw material;**
 - Including mention of the physical state or specification of any special treatments when necessary.
- **List of ingredients;**
 - Elaborated by descending order of quantity;
 - This information was not necessary for the following: fresh produce (fruits and vegetables) that did not suffer any treatment or processing; dairy goods which did not contain any ingredient other than milk, enzymes, microorganisms and salt; raw material that comprised one single ingredient when both have the same name.
- **Ingredients that may cause allergies or intolerance;**
 - These should be, in addition, somehow highlighted within the list;
 - In EU, there are 14 allergens legally considered: cereals containing gluten; crustaceans and products thereof; eggs and products thereof; fish and products thereof; peanuts and products thereof; soybeans and products thereof; milk and products thereof; nuts; celery and products thereof; mustard and products thereof; sesame seeds and products thereof; sulphites; lupin and products thereof; molluscs and products thereof.
- **Net weight of the raw material;**
 - Specified either in mass or volume units, accordingly;

- Values should be the drained net weight, that is, the weight of solids that remains after the conservation/preparation liquids are removed.
- **Expiration date;**
 - This information was not necessary for the following: fresh produce (fruits and vegetables) that did not suffer any treatment or processing.
- **Conservation conditions;**
 - If applicable.
- **Name of the producer;**
 - Name of the company (producer, packager, national intermediary, etc.) responsible for the labelling.
- **Country of origin;**
- **Nutritional declaration;**
 - This information was not mandatory for the following: unprocessed products that comprised a single ingredient or category of ingredients (such as fresh produce); processed products which the only processing they had been subjected to is maturing and that comprised a single ingredient or category of ingredients; gelatines;
 - Moreover, this information was not mandatory for foods that were offered for sale to mass caterers without pre-packaging (29).

Furthermore, the quality technician should be aware of other information within the label, either because of other legal requirements dependent on the specific category of the product, or demands of Eurest for reasons related to its activities.

According to the Annex X of the Regulation (EU) No 1169/2011, the **date of freezing** is an extra label mention mandatory for frozen meat, meat products and non-processed fishery products (24). Also, for fishery raw material, the Regulation (EU) No 1379/2013 (26) states that the label must contain, additionally:

- Apart from the common name of the species, its **scientific nomenclature**;
- **Production/capture method**;
- **Production/capture zone**, as well as **fishing gear**.

In relation to meat and specific meat products, Regulation (EC) No 1760/2000 (21) and Implementing Regulation (EU) No 1337/2013 (27), declare that it is necessary to indicate, apart from the country of origin, the **country of rearing**, **slaughter** and **cutting**. Finally, for every animal product, it is also mandatory to have the **health mark**, showed in Figure 7, according to Regulation (EU) No 2017/625 (30).



Figure 7. Example of a health mark of a Portuguese meat producer.^{vi}

Meanwhile, for fresh produce, fruits and vegetables, there are also specific rules and legislation that defines which mentions are mandatory within the label. The Commission Implementing Regulation (EU) No 543/2011 (23) [related to Regulation (EU) No 1308/2013 (28)] stipulates specific commercialisation standards for several products, which are: apples, citrus, kiwis, lettuce, peaches, pears, strawberries, peppers, grapes and tomatoes. In general, for these specific products, mandatory mentions were the following:

- **Variety** when applicable;
- Commercial characteristics such as **category** – which might be *extra*, *I* or *II* – and **calibre**, when applicable.

However, all the other produce which are not comprised under these legal specifications, were as well obliged by Eurest to include the mentioned label indications.

The **lot** is a mandatory mention of every food product and raw material (though there are some exceptions). It allows to maintain the chain of traceability, meaning that it is possible to know every step of foodstuff from its production, to distribution, until consumption by the end user, and, therefore, to identify any problems within the production-distribution-commercialisation circuit. For this reason, traceability, the ‘ability to trace the history, application or location of an object’ according to ISO 9000:2015, is of extreme importance within the food area and safety (15). The lot is a code comprised by a series of numbers and letters, and every product made (fabricated, packed, etc) under the same or almost the same circumstances share the same lot, according to Directive 2011/91/EU (25) (and Decree Law No 26/2016 (29) in Portugal). For Eurest, the lot should be comprised within the label, although for several types of products this reference might be only stated on the package.

Finally, Eurest works with suppliers who may buy the raw material to other suppliers or producers. Therefore, it was important that the material presented additionally the **identification of the supplier** from which the company purchased the raw material, either on the main label or by means of a second label.

^{vi} The health mark is comprised by 3 acronyms: the international code of the country (*P* or *PT*), the national approval number of the producer (*PTR 31X*) and the European Union initials (*CE* or *EU/EC/EEC*).

In Portugal, according to national legislation under Decree Law No 238/86 (20), all this information must be presented in Portuguese. For this reason, the quality technician checked the language of the inscriptions to confirm if these were written in Portuguese, even if there was information written also in other languages, or if there was a second label with mentions translated into Portuguese.

Figure 8 shows an example of a complete label.

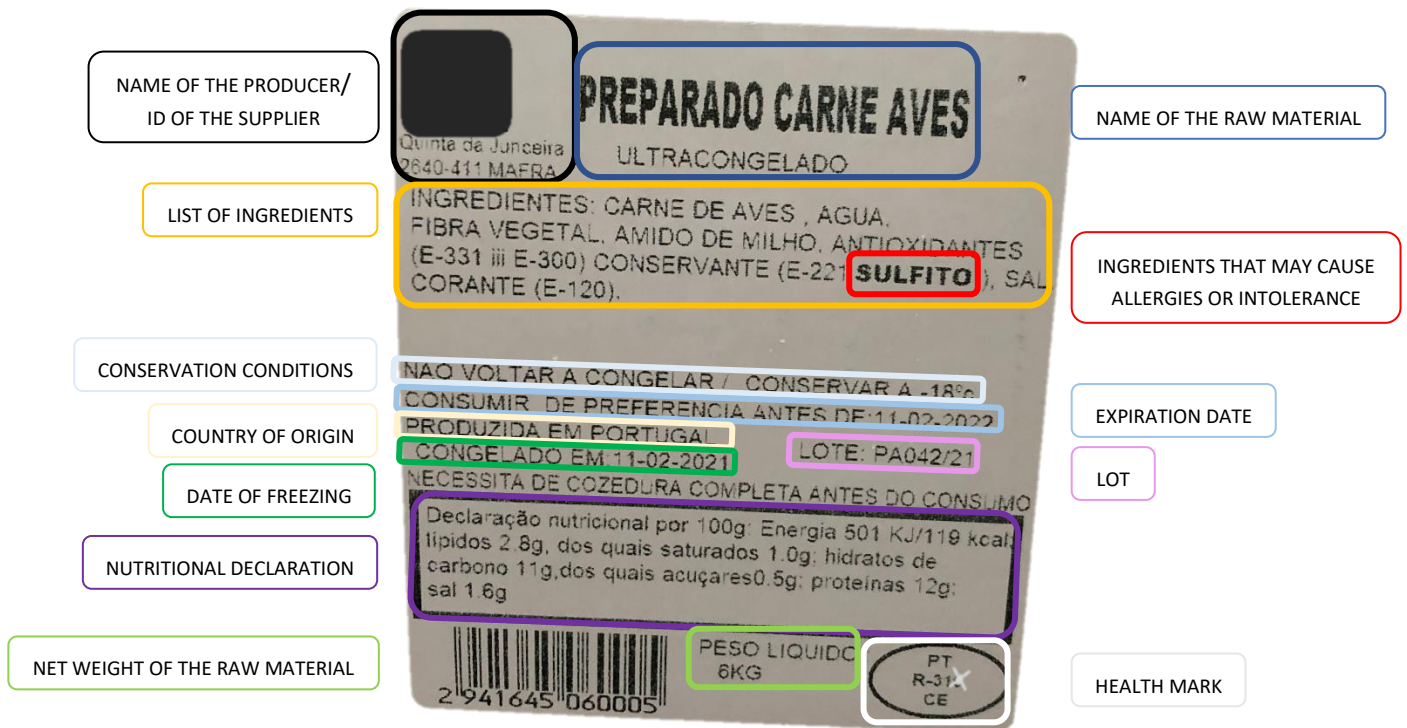


Figure 8. Example of a complete label.

Calibre

For fresh produce, as previously stated, it was mandatory to indicate the defined calibre on the label. This was an important characteristic because, according to the guidelines and standards of food quality and safety, it was necessary that raw material within the same container or package presented some homogeneity, instead of each unit being completely different from another. Moreover, depending on the calibre, the price of the product might vary and, therefore, it became crucial to control this. Furthermore, the chosen calibre might be related to the portion intended for specific diets, which raised another issue to take into account within the QC field.

The calibre is determined by diameter or weight of each piece. Usually this is a range and, for each produce, per calibre value there is a corresponding interval of diameters and

one of weights. The instrument used for monitoring this characteristic was a calliper. There were different callipers for different products, depending on the established calibres. Figure 9 shows the 3 callipers used by the quality technician of Eurest.

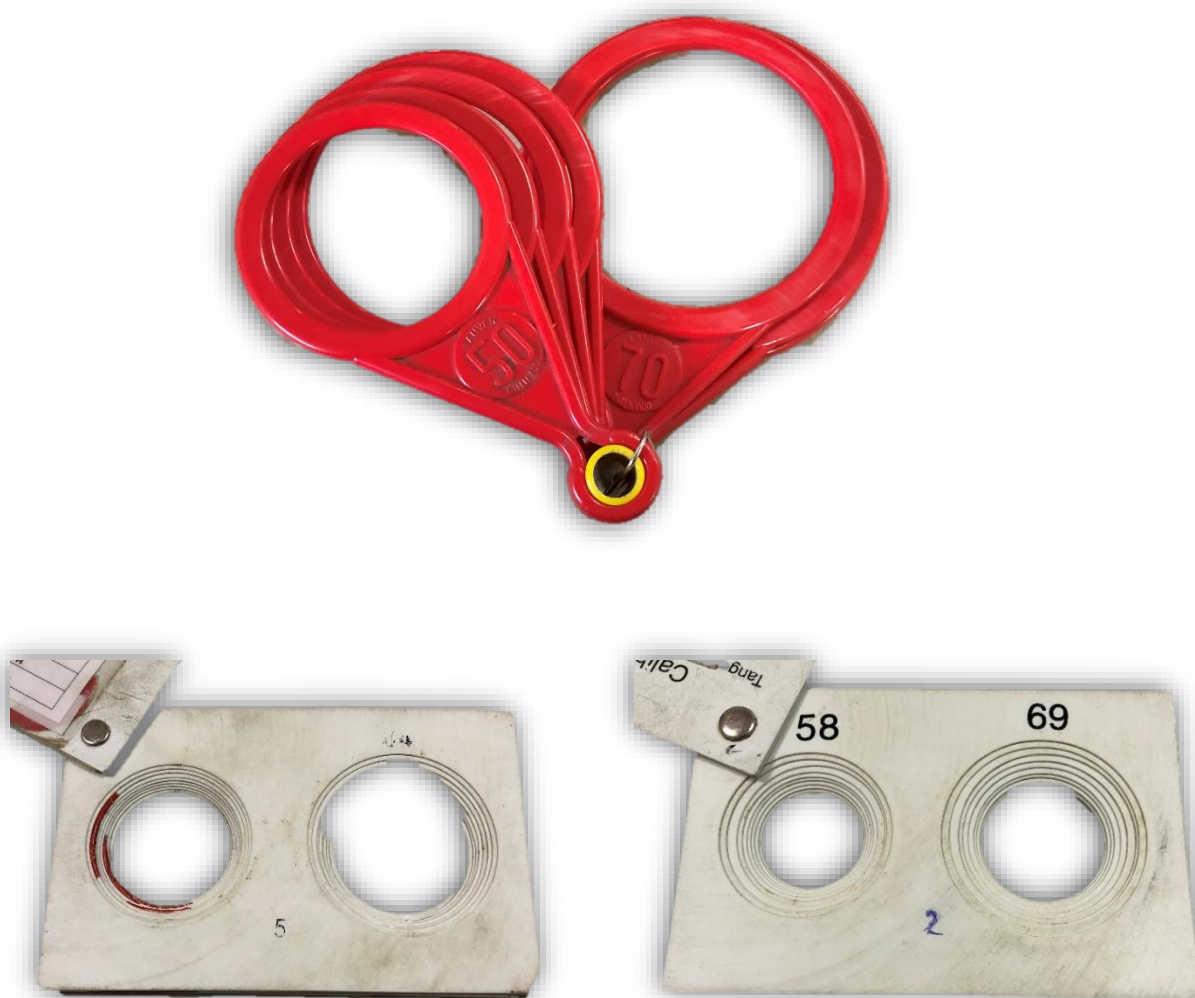


Figure 9. Fruits callipers: apples and pears calliper (top); oranges calliper (bottom left); mandarins calliper (bottom right).

Other products like, for instance, fish or meat pieces, had sometimes a defined calibre, which was determined, mainly, according to the weight of each unit/piece. This monitoring was performed using a weighing balance, which is shown in Figure 10.



Figure 10. Weighing balance.

Organoleptic Characteristics

Something termed 'organoleptic' is something related to the senses, that is, an organoleptic characteristic is an attribute of a product which is perceived by our senses (52). Therefore, for this evaluation, control technician used his sight, smell, touch and even hearing to identify some aspects and decide whether these were compliant or not compliant with quality requirements.

There were minimum requirements in what concerns to organoleptic characteristics, since the raw material could not obviously be absolutely defectless, but needed to present itself in good condition. Regarding the quality of fresh produce, these minimum requirements were independent from the category of the product (*extra*, *I* or *II*), since all should meet (at least) these criteria – although categories *extra* and *I* had to satisfy more strict rules. General standard requirements state that a tolerance of 10% in number or total weight is accepted for products that do not fulfil the minimum requisites: units should be intact, sane, without any rottenness – these must be excluded –, clean and without strange substances, with almost no parasites, free from pests, free from strange external humidity, free from strange odours (23).

For refrigerated and frozen products, organoleptic evaluation was harder to perform, as the raw material presented itself packed most of the times and, therefore, the sensory

analysis was reduced to a visual inspection. Moreover, even some visual aspects were sometimes difficult to perceive if the food was frozen, and some irregularities were noticed only after defrosting or preparation.

Appearance

Appearance is related to the visible attributes of the product (52). Concerning fresh fruits and vegetables, products might have some defects in shape, development, colouring, some bruises, skin defects or slight russetting (23). Figure 11 shows an example of two identical products, where one had the desirable appearance and the other presented some skin defects.

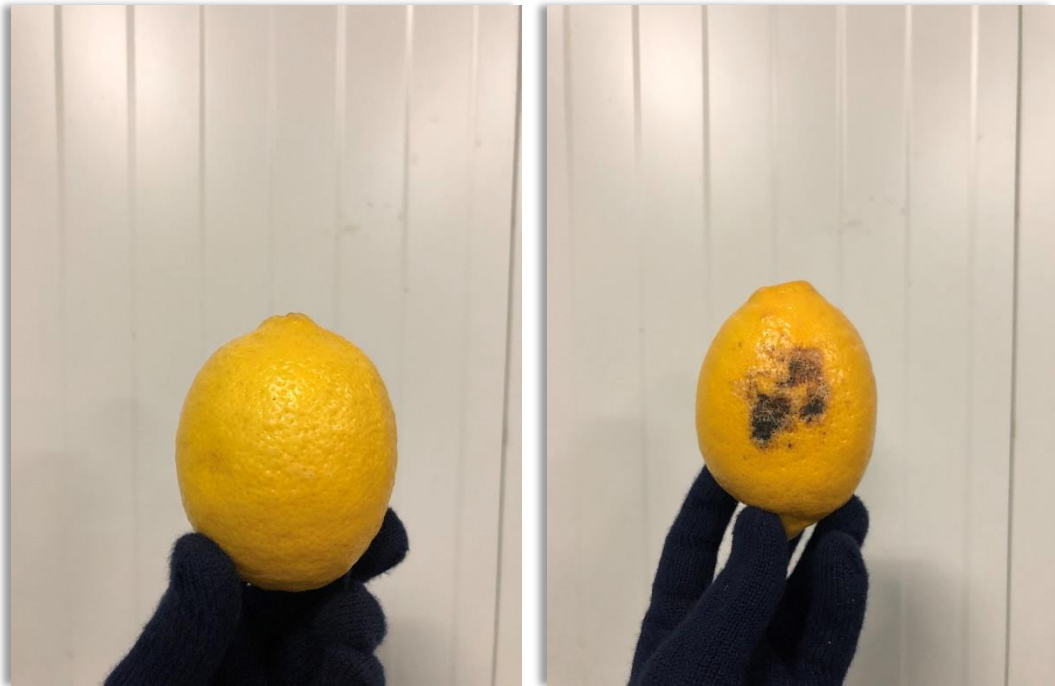


Figure 11. Lemon with desirable appearance (left) and lemon with some skin defects (right).

In what concerned to frozen products, raw material should present, on the surface, minimum amount of ice crystals or frost, which are a signal of moisture loss, consequence, in turn, of temperature fluctuation or deficient packaging. On a more advanced stage, this might cause a freezer burn, which is characterised by dehydration/dryness of a portion of the product, which turns grainy and light brown, and therefore, this should be controlled and avoided (53).

Maturation/oxidation state

The level of maturation of the raw material, namely fresh produce, was also an important factor to take into account, as this would influence the whole validity and conformity of the products. The maturation and development state should be sufficient but not excessive, that is, should be enough to keep developing and to reach a satisfactory degree right prior to the consumption, but should not be such that the raw material could not undergo transportation (23). Maturation and oxidation of fruits and vegetables was perceivable, most of the times, by colour and texture. The colours varied a lot depending on the specific product but, for vegetables, usually these should not be too yellow or dark green, nor with yellow or dark green (with soaked aspect) leaves, regarding leaf vegetables. In Figure 12 it is possible to see this difference. Texture of the produce should not be too soft or delicate when touched.



Figure 12. Sugarloaf cabbage with desirable maturation/oxidation state (left) and sugarloaf cabbage in advanced oxidation state (right).

Mould

Moulds are micro fungi which can develop under harsh conditions and live on vegetal or animal matter. Some moulds may cause allergies and produce toxins, which can provoke sickness (54, 55). Presence of mould was rare and, when it happened, it was usually either

in isolated units that had already great degree of maturation, in the case of fresh produce, or units whose package was previously deficient or lost the vacuum, for refrigerated raw material. For fruits and vegetables, according to what was previously said, if there was one single isolated unit, and at least 90% of the lot was in good condition, that specific unit should be discarded, in order to avoid contamination of the products close by. For refrigerated raw material, practically the same was applicable and, if approximately 90% of the total amount of products was not spoiled, the lot could be accepted. Figure 13 shows products with and without mould.



Figure 13. Beetroot with satisfactory organoleptic characteristics (left) and beetroot with presence of mould (right).

Pests

Pests are organisms, usually insects, that grow in number within an agricultural culture, causing destruction and, sometimes, spreading diseases, to the growing plants (56). It was rare to encounter this situation at the raw material reception, as all the producers/suppliers are aware of the problems and take care of the cultivations to avoid development of pests. However, sometimes, vegetables had a greater number of organisms than what should be accepted and, therefore, the products should be rejected and returned. Figure 14 illustrates one of these cases.

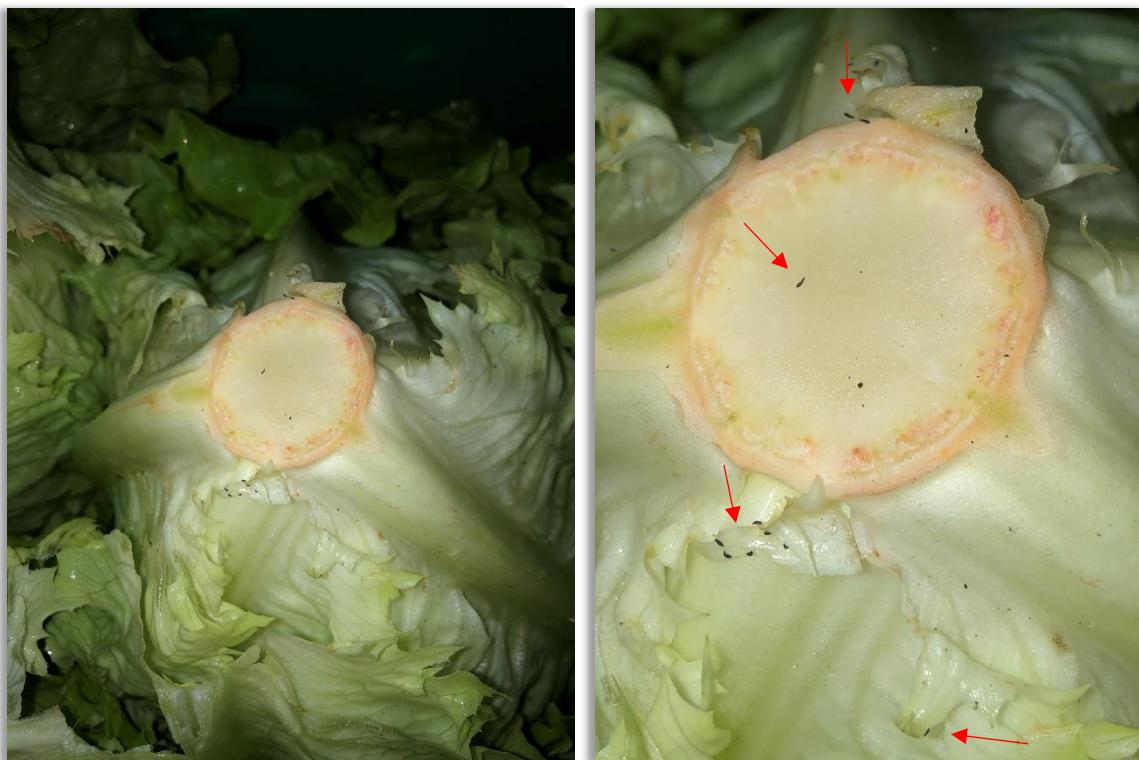


Figure 14. Green leaf lettuce with pest. Organisms identified by the red arrows (right).

The raw material was checked by sampling, as it was impractical to perform this control with all the parameters for every single product. However, this way it was still possible to draw an opinion on the quality and safety of the products, and to come to a decision (C/O/NC). After that, the tool of assessment was developed and it can be referred to in Annex I.

Although being important to specify products, final assessment was made by category, as it was not possible or relevant to consider each different product received during the semester. Conclusions about the 8 categories were considered to be meaningful and more useful for future work.

The final assessment obtained for each category is shown in Table 4.

Table 4. Half-year assessment for each category of raw material.

Category	Half-year assessment	Assessment level
Dairy goods	0%	Excellent
Eggs and egg products	0%	Excellent
Fats and sauces	13%	Excellent
Fish and fish products	18%	Excellent
Fruits	30%	Adequate
Meat and meat products	34%	Adequate
Sugary products	0%	Excellent
Vegetables	33%	Adequate

The results show that from the 8 assessed categories of raw material, only 3 were evaluated as 'Adequate', the second-best level of assessment, while the remaining 5 were considered 'Excellent'. 3 categories had the maximum valuation (0%), since during the semester did not present any O and NC and, therefore, their raw material was never returned to the supplier. These are dairy goods, eggs and egg products, and sugary products. Categories fish and fish products, and fats and sauces, had few observances and returns and, therefore, had an excellent half-year assessment. Nevertheless, both categories presented a disadvantage due to the fact that great amount of the same lot is usually received at once, since this resulted in great amounts of returned material each time there was one NC. Category with the weakest valuation was meat and meat products, followed by vegetables, and then fruits. This was expected as these are the categories of more susceptible raw material, that is, whose level of perishability is higher. Regarding fresh produce, as previously said, the internal processes development is harder to slow down as, in order for these to keep their organoleptic characteristics, the temperature of storage cannot be too low. In fact, the parameter which had more observances in the whole period was maturation/oxidation state (94 in 235 for fruits; 92 in 159 for vegetables). With regard to fruits, also questions of calibre were numerous (88 in 235). In what concerns to meat and meat products, although the majority of raw material of this category controlled was frozen products, these are truly prone to spoilage, as chemical, physical and biological processes occur easily. As a matter of fact, the greater number of observances in this category during the semester was caused by temperature issues (125 in 207), which make this raw material

even more susceptible. This problem may be usually caused by fluctuations of temperature through the whole food chain, like, for instance, difficulty in maintaining a constant temperature during transportation, which may indicate, in turn, that quality parameters of the suppliers are not being fulfilled or efficiently monitored. Having this said, it is clear, though, that all the other frozen products observed during the semester (such as fish and fish products, sugary products, vegetables and ice creams) present none or few occurrences or nonconformities, which may emphasise that, although presenting freezing temperatures, these are not as perishable. Fish and fish products category presented a total of 10 observances during the 6-month period, with only 2 NC, corresponding to the months February and May, the only 2 in which there were returns. Both of these were due to labelling/authenticity matters.

In the case of suppliers, conclusions were not performed for the whole period, only an analysis for each month was made. This was basically due to the fact that the same supplier may provide different categories of raw material to Eurest, which makes impossible to evaluate them with the defined weighting criteria. As a matter of fact, throughout the period of on-the-spot activities, it was recorded, for instance, the delivery of fruits by usual vegetables suppliers. Moreover, a meaningful conclusion was difficult to reach, as we had the returned amount value for each supplier, but a comparison required also the total received amount by supplier, which we did not know.

The main aim of this tool of assessment, after being developed, was to be put into operation within the regular activities of Eurest DQ. The proposal for the future is to keep doing this analysis with consistent frequency and to accomplish a periodical assessment of the raw material. For the present work the evaluation was made for the first semester of the year, based on the data collected during 6 months, which is also useful for Eurest, since the suppliers assessment is, likewise, performed every 6 months.

One drawback of this work was the weak automation. Data had to be manually collected at a daily basis, since QC procedures still require handwork by the technician and there is little digital recording. Furthermore, afterwards, during the development of the Excel tool, automation was easier to obtain, as the software allows the introduction of formulas, and several calculations, sum ups, percentages and compilations could be programmed, although some values yet needed to be obtained less automatically, using the filtering tool of the software. Hence, this is a topic Eurest might aim to develop in order to improve the process and obtain an easier-to-use tool for the assessment of the received raw material.

5.2 Qualitative food waste analysis

Concerning food waste, the analysis performed may be referred to in Annex II, and final results are presented below, in Table 5.

Table 5. Comparison between percentages of returned amounts of raw material by the quality technician and wasted amounts of raw material by units.

Category	<u>Returned</u> Received	<u>Wasted</u> Received
Fish and fish products	0.63%	0.13%
Fruits	0.99%	0.84%
Meat and meat products	0.80%	0.16%
Vegetables	1.31%	0.10%
TOTAL	0.93%	0.31%

With these results we may conclude that the returned amount of raw material, done upstream by the quality technician of Eurest, is much higher than the amount of raw material Eurest units need to waste due to some nonconformity. In general, and considering the total of the 6 months and 4 categories, the percentage of returned material in relation to the total received is around 0.9%, whereas the value for the wasted amount over the same total received is around 0.3%. That is, this number is about 3 times less, which may be indicative of the effectiveness of the QC procedure in the reduction of the number of nonconformities within raw material received by the units and, consequently, in decreasing qualitative food waste. Since non-compliant products are returned to the suppliers, the remaining raw material, accepted by the quality technician, is shipped without evident nonconformities and in good general condition, avoiding posterior waste by the units. However, it is impossible to reach 100% of effectiveness, and there is always some waste of raw material, although to a small extension. On the one hand, as previously said, the technician work is made by sampling and, therefore, there are always some products which are not controlled, leaving a gap for the existence of nonconformities. Moreover, sometimes the amount of received raw material is too much, and for that reason pallets are too loaded, which makes it impossible for the technician to see what is in the bottom containers. On the other hand, there is the problem of the time window since the control at reception until the raw material arrives to the units. During this period, and due to more transport and logistic operations,

fluctuations of temperature and natural course of time, materials are expected to deteriorate and worsen their quality. This may explain why the highest percentage of food waste was seen with category fruits, as these are more perishable materials. Furthermore, depending on the type of raw material that is being analysed, it can be more difficult to see some nonconformities at that stage of the process, that is, if the raw material is frozen, for example, and the temperature has been checked and is compliant, it may be difficult to see some organoleptic characteristics before defrosting or cook, such as appearance, texture, colour issues. Thus, there may be some products whose quality is controlled and accepted, but will present some nonconformity afterwards. This situation can explain why the category fish and fish products had few returns and observances during the semester, achieving an assessment level of 'Excellent' but, conversely, there were wasted amounts every month (see Table 6).

Table 6. Returned amounts of raw material by the quality technician and wasted amount of raw material by units, for the category fish and fish products.^{vii}

Month	Category	Returned amount (kg)	Wasted amount (kg)
January	Fish and fish products	0	134
February		220	32.5
March		0	486.52
April		0	48
May		3500	11.5
June		0	65
TOTAL		3720	777.52

Table 6 also shows that the 2 months in which there were returns directly to the supplier were the ones in which the amount wasted by the units was the smallest (February and May, 32.5 kg and 11.5 kg, respectively). This supports the idea, stated before, of the effectiveness of the QC procedure in the reduction of nonconformities within the raw material received by the units and consequent food waste.

^{vii} Table adapted from Annex II.

To perform this analysis, it was necessary to compare both the returned and the wasted material with the total material received, in order to obtain percentages, possible to compare and reach conclusions. The amount received within the logistic operator was provided by the Procurement department, responsible for that part of the process. In regard to the amount received by the units, it is understandable to think that this number equals to the total amount received without the amount returned by the quality technician. However, although the material is returned due to quality reasons, units still require the quantities of food they ordered for their operations and, therefore, this inexistent amount is restored by the Procurement department, which makes a new order, either to other suppliers or the same. It follows that the amount received by the units is thus the same as the amount received at the logistic operator. This raw material is generally delivered in better condition, either because it is delivered by a more expensive supplier which fulfils thoroughly all quality parameters, or due to a more careful approach of the supplier. However, as this is not controlled by the technician, some nonconformities may yet appear, which can also justify some of the wasted amounts by the units.

Another set of data used for this analysis was the nonconformity records from the units from the whole semester. According to what was said before, these records were assembled, filtered and selected, in order to obtain the volumes of raw material wasted by units. This assortment, nonetheless, was manually carried out by analysing each complaint in terms of category of raw material, causes of complaint and occurrence of food waste, and selecting, afterwards, the appropriate ones. Moreover, several records did not comprise the amount of raw material wasted, and thus, this parameter had to be estimated after a careful examination of the complaint, although some did not even present enough information for achieving an estimate and, therefore, were excluded. For that reason, these values of wasted amount are only an approximation and cannot be seen as absolutely accurate, but only slightly representative. Being a laborious task with little automation is a great limitation of this part of the work, not only because the results obtained cannot be considered fully truthful, but also because it may hinder the maintenance of this type of study by Eurest.

In relation to both the food that is to be wasted and the food that, due to other reasons and specific situations impossible to control, has spared and needs to take a different course, Eurest intention is to make agreements to deliver this excess to contract suppliers who are also livestock producers, in order to promote a circular economy. However, food excess is a reality within these situations and, therefore, this is not always easy.

5.3 General overview

The importance of the QC of the raw material has been extensively demonstrated, namely regarding contract catering operations. As we could see, the best approach is for material to be returned immediately to the supplier, which usually means having some defined destination, like for instance, fresh produce being used for animal feeding, averting food waste. Moreover, this system avoids gaps in the raw material flow and consequent shortages in the units, since suppliers can try to restore the products right afterwards, if these are not compliant, specially if the fault is due to more procedural questions instead of food safety issues. Lastly, this also means economic advantages, as it may prevent the need for ordering raw material to more expensive suppliers as a last-minute resource if units turn out to be with lack of stock without prior notice. A consistent QC analysis and periodical assessment of the raw material also has importance for the needed improvement of the general quality and safety of the food served to the contract catering clients and final consumers.

However, questions may be raised on the necessity of strictness of some procedures, in what concerns to sustainability and even waste. Not mentioning food safety issues which are obviously of extreme importance for people's health, or authenticity topics which are seriously relevant for fair trading and market questions, in what concerns to calibre and packaging requirements, for instance, the current food system policies and food regulations may have some extreme approaches which, at the end, are not paired with the need for sustainable approaches, reduction of food waste and improved use of food. In fact, Europe has set targets for 2050 regarding a change in food systems, in view of the use of digital technology, the need for environmental sustainability and a shift of the actual climatic crisis, taking into account its impact in society and biodiversity (57). This is therefore, related to the development of new policies, more consistent but helpful, strict but balanced.

The current COVID-19 pandemic has been a true challenge for the food industry, contract catering companies and the worldwide food market and, together with climate setbacks, has showed us the importance of a change into a more local production with the involvement of the whole food chain, in order to achieve an easier and more accessible distribution of food, the reduction of ecological footprint, but also to promote an efficient circular economy (58, 59). This pandemic may be the motto for a shift in our way of thinking and also for the creation of a useful and efficient change in the actual food system.

6 Conclusion

Eurest is a certified company which means it has high quality standards and fundamental excellence values. For this reason, it is essential to have a strict food control in order to comply with food safety measures and, in the end, to present healthy foodstuff to the consumers. The quality technician carrying out daily QC procedures analyses specific categories of food raw material, comprised within the scope of refrigerated and frozen foods, checking compliance with several defined parameters, at reception. He takes on-the-spot decisions about the destination of the product, and whether this is compliant, non-compliant or if there is an observed occurrence.

These 5 months of internship enabled to develop and put into practice some QC knowledge and concepts previously apprehended. I started by understanding the processes and the QC procedure, going then to the development of the project objectives and activities, and finally culminating with my whole involvement in the process and tasks, supporting and learning with the quality technician. As far as the objectives are concerned, this work allowed to develop a tool for the assessment of the received food raw material, following the procedure of QC at reception. For the analysed period, that is, the first semester of 2021, the worst received categories were meat and meat products, as well as vegetables, followed by fruits. Categories with the maximum final valuation were the least perishable goods like sugary products, but also dairy goods, and eggs and egg products, for which none observation was made during the whole semester. The concept of this tool, from this point on, is to consistently assess the quality of the products, so Eurest is able to present reliable results and conclusions to the suppliers, and therefore demand higher quality and safety patterns of the food raw material, which, at the end of the day, guarantees that meals served to all Eurest clients and final consumers are even safer and of higher quality. Moreover, it was possible to perform an analysis on the misapplication of raw material and consequently to realise what the extension of qualitative food waste is within Eurest, more specifically, in units. Calculated waste of fish, fruits, meat and vegetables was around 0.3% of the total received raw material for the first 6 months of the year, which comprises a small figure. However, the aim is to always try to further reduce this value and, therefore, Eurest policies and projects on this matter are rising in importance. This was also associated with QC procedures and the returned amount of raw material at a prior stage of the chain, and it could be presumed that this process helps greatly reducing the number of nonconformities arriving to units, which, in turn, has impact on decreasing the dimension of qualitative food waste. The main drawback of the two instruments of analysis was the fact that little automation was possible, which created a limitation on the studies. Nevertheless,

it also holds the possibility for future work and for the company to develop these subjects and improve approaches.

During the time of the internship, COVID-19 pandemic was taking place with one of the worst periods of infection, having impact on the normal flow of the company's operations and, in fact, on the whole food sector. This pandemic has been challenging in many ways, but it may be used as a trigger to a change in food policies and current food systems which are sometimes too strict, but ineffective. This can be done by taking into account more significantly sustainable practices, an improved promotion of a good and complete use of food, a more local economy and production, higher involvement of the whole food chain, as well as stronger governmental support to all parties, while keeping investing in a circular economy.

Overall, throughout this work it has been understood how QC and QC activities are important, namely within a contract catering company. A quality technician tasks and know-how allow not only to assure that the received raw material, subsequently used for the preparation of meals, is the best possible, promoting food safety and health, but also allow to maintain the normal flow of the company's operations and, moreover, to prevent excessive food waste.

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Annex I a. Assessment of received raw material – Control at reception – January

Assessment of received raw material													
2021	JANUARY	Control at reception										03/2021	V.01
Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S7	Turnip greens	Vegetables						NC			8		
S7	Tomato	Vegetables			O						-		
S7	Tomato	Vegetables			O						-		
S10	Banana	Fruits						O			-		
S4	Orange	Fruits				O					-		
S13	Green leaf lettuce	Vegetables						O			-		
S9	Starking apple	Fruits				O					-		
S7	Tomato	Vegetables			O						-		
S11	Piglet rissole	Meat and meat products	O				O				-		
S26	Pork chop	Meat and meat products	O								-		
S10	Banana	Fruits						O			-		
S18	Red pepper	Vegetables						NC			20		
S15	Mango	Fruits						NC			4		
S10	Banana	Fruits						NC			370		
S10	Banana	Fruits						O			-		
S26	Beef minced meat	Meat and meat products	O				O				-		
S7	Tomato	Vegetables						O			-		
S15	Kiwi	Fruits						NC			260		
S23	oultry minced mea	Meat and meat products	NC				NC				150		
S7	Tomato	Vegetables						O			-		
S13	Green leaf lettuce	Vegetables						NC			48		
S1	Plaice	Fish and fish products				O					-		
S5	Ovine palette	Meat and meat products	O								-		
S7	Tomato	Vegetables						O			-		
S9	Starking apple	Fruits				O					-		
S10	Banana	Fruits						NC			1387		
S4	Clementine	Fruits				O					-		
S23	Chopped pork meat	Meat and meat products					O				-		
S23	Pork steak	Meat and meat products	O				O				-		

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Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S18	Red pepper	Vegetables						O			-		
S18	Zucchini	Vegetables						O			-		
S22	Pork ham	Meat and meat products	O								-		
S23	Chopped pork meat	Meat and meat products	O				O				-		
S21	Beef tripe	Meat and meat products					O				-		
S10	Banana	Fruits						O			-		
S15	Green melon	Fruits						O			-		
S4	Clementine	Fruits				O					-		
S21	Beef brisket	Meat and meat products	O								-		
S21	Beef brisket	Meat and meat products	O								-		
S13	Green leaf lettuce	Vegetables						NC			112		
S4	Orange	Fruits			O						-		
S4	Orange	Fruits			O						-		
S21	Pork leg	Meat and meat products	O								-		
S15	Kiwi	Fruits						O			-		
S9	Gala apple	Fruits			NC						12		
S21	Beef brisket	Meat and meat products	O								-		
S15	Papaya	Fruits						O			-		
S15	Green melon	Fruits						O			-		
S9	Starking apple	Fruits				NC					12		
S23	Pork hand	Meat and meat products	O								-		
S25	Salmon steak	Fish and fish products	O								-		
S3	Nile perch	Fish and fish products	O								-		
S23	Pork medallions	Meat and meat products	O								-		
S10	Banana	Fruits						O			-		
S15	Green melon	Fruits						O			-		
S13	Green leaf lettuce	Vegetables			O						-		
S13	Sugarloaf cabbage	Vegetables			O						-		
S13	Red cabbage	Vegetables			O						-		
S13	Beetroot	Vegetables			O						-		
S4	Clementine	Fruits				O					-		
S18	Cucumber	Vegetables						O			-		
S15	Green melon	Fruits						O			-		
S15	Papaya	Fruits						O	O		-		
S13	Beetroot	Vegetables									-		

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
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Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S19	Turkey skewers	Meat and meat products	O				O				-		
S21	Chicken	Meat and meat products	O								-		
S9	White grapes	Fruits							O		-		
S13	Beetroot	Vegetables							O		-		
		Dairy goods	-	-	-	-	-	-	-	-	-	-	-
		Eggs and egg products	-	-	-	-	-	-	-	-	-	-	-
		Fats and sauces	-	-	-	-	-	-	-	-	-	-	-
		Fish and fish products	2	0	0	1	0	0	0	0	0	3	0
		Fruits	0	0	3	7	0	16	2	0	2045	28	6
		Meat and meat products	16	0	0	0	8	0	0	0	150	24	2
		Sugary products	-	-	-	-	-	-	-	-	-	-	-
		Vegetables	0	0	7	0	0	11	1	0	188	19	4
			18	0	10	8	8	27	3	0	2383	74	12
S1			0	0	0	1	0	0	0	0	0	1	0
S3			1	0	0	0	0	0	0	0	0	1	0
S4			0	0	2	4	0	0	0	0	0	6	0
S5			1	0	0	0	0	0	0	0	0	1	0
S7			0	0	3	0	0	4	0	0	8	7	1
S9			0	0	1	3	0	0	1	0	24	5	2
S10			0	0	0	0	0	7	0	0	1757	7	2
S11			1	0	0	0	0	0	0	0	0	1	0
S13			0	0	4	0	0	3	1	0	160	8	2
S15			0	0	0	0	0	9	1	0	264	10	2
S18			0	0	0	0	0	4	0	0	20	4	1
S19			1	0	0	0	1	0	0	0	0	2	0
S21			5	0	0	0	1	0	0	0	0	6	0
S22			1	0	0	0	0	0	0	0	0	1	0
S23			5	0	0	0	4	0	0	0	150	9	2
S25			1	0	0	0	0	0	0	0	0	1	0
S26			2	0	0	0	0	1	0	0	0	3	0

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
in a Contract Catering Company*

Annex I b. Assessment of received raw material – Control at reception – February

Assessment of received raw material													
2021	FEBRUARY	Control at reception										03/2021	V.01
Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S14	deep-frozen broccol	Vegetables					O				-		
S21	Pork steak	Meat and meat products				O					-		
S26	Beef burger	Meat and meat products	O								-		
S10	Banana	Fruits						O			-		
S4	Orange	Fruits				O					-		
S13	Beetroot	Vegetables							O		-		
S3	Hake	Fish and fish products				O					-		
S10	Banana	Fruits						O			-		
S9	Rocha pear	Fruits				O					-		
S15	Gala apple	Fruits				O					-		
S4	Orange	Fruits				O					-		
S21	Pork leg	Meat and meat products	O								-		
S13	Green leaf lettuce	Vegetables								NC	200		
S15	Gala apple	Fruits				O					-		
S7	Tomato	Vegetables						O			-		
S15	Starking apple	Fruits							NC		226		
S10	Banana	Fruits						O			-		
S10	Banana	Fruits						O			-		
S23	Pork chops	Meat and meat products			NC						52.04		
S23	Chorizo	Meat and meat products							NC		50		
S15	Papaya	Fruits						NC			3.67		
S7	Green leaf lettuce	Vegetables						O			-		
S10	Banana	Fruits					O				-		
S9	Green melon	Fruits		NC							32		
S9	Yellow melon	Fruits		NC							273		
S4	Orange	Fruits				O					-		
S21	Chicken	Meat and meat products	O								-		
S23	Chorizo	Meat and meat products							O		-		
S15	Papaya	Fruits						NC			3.48		

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in a Contract Catering Company*

Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S23	Alheira	Meat and meat products			O						-		
S21	Chicken steak	Meat and meat products	O								-		
S21	Beef sparerib	Meat and meat products	O								-		
S4	Orange	Fruits						NC			330		
S4	Orange	Fruits						NC			210		
S19	Beef steak	Meat and meat products					O				-		
S26	Turkey burger	Meat and meat products			O						-		
S26	Beef minced meat	Meat and meat products			O						-		
S15	Starking apple	Fruits				O					-		
S18	Red pepper	Vegetables						O			-		
S25	Nile perch	Fish and fish products	O								-		
S26	Pork minced meat	Meat and meat products			O						-		
S26	Beef minced meat	Meat and meat products			O						-		
S26	Beef burger	Meat and meat products			O						-		
S15	Golden apple	Fruits					O				-		
S15	Gala apple	Fruits				O					-		
S9	Rocha pear	Fruits				O					-		
S14	ep-frozen cauliflow	Vegetables					O				-		
S9	Green melon	Fruits						O			-		
S9	Rocha pear	Fruits				O					-		
S18	Red pepper	Vegetables						O	O		-		
S4	Orange	Fruits				O					-		
S23	Pork chop	Meat and meat products	O								-		
S26	Beef minced meat	Meat and meat products	O		O						-		
S26	Beef burger	Meat and meat products	O		O	O					-		
S21	Beef brisket	Meat and meat products	O				O				-		
S7	Tomato	Vegetables						O			-		
S21	Beef neck	Meat and meat products	NC				NC				128.78		
S21	Beef shank	Meat and meat products	O								-		
S21	Beef rib	Meat and meat products	O								-		
S15	White grapes	Fruits		NC							8.4		
S15	Red grapes	Fruits							NC		25		
S13	Green leaf lettuce	Vegetables		NC			NC	NC			60		
S18	Red pepper	Vegetables					NC	NC			12		
S18	Red pepper	Vegetables					O				-		

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
in a Contract Catering Company*

Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S9	Papaya	Fruits						NC			4.5		
S23	Pork chops	Meat and meat products	O								-		
S21	Beef feet	Meat and meat products	NC				NC				147.76		
S17	Shortfin squid	Fish and fish products			NC						220		
S16	Chicken leg	Meat and meat products				O					-		
S16	Chicken leg	Meat and meat products				O					-		
S21	Pork steak	Meat and meat products				O					-		
S21	Chicken	Meat and meat products	O								-		
S21	Chicken breast	Meat and meat products	O								-		
S15	Golden apple	Fruits		NC							75.6		
		Dairy goods	-	-	-	-	-	-	-	-	-	-	-
		Eggs and egg products	-	-	-	-	-	-	-	-	-	-	-
		Fats and sauces	-	-	-	-	-	-	-	-	-	-	-
		Fish and fish products	1	0	1	1	0	0	0	0	220	3	1
		Fruits	0	4	0	11	2	10	2	0	1191.65	29	11
		Meat and meat products	16	0	9	5	4	0	2	0	378.58	36	6
		Sugary products	-	-	-	-	-	-	-	-	-	-	-
		Vegetables	0	1	0	0	5	7	2	1	272	16	6
			17	5	10	17	11	17	6	1	2062.23	84	24

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
in a Contract Catering Company*

Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S3			0	0	0	1	0	0	0	0	0	1	0
S4			0	0	0	4	0	2	0	0	540	6	2
S7			0	0	0	0	0	3	0	0	0	3	0
S9			0	2	0	3	0	2	0	0	309.5	7	3
S10			0	0	0	0	1	4	0	0	0	5	0
S13			0	1	0	0	1	1	1	1	260	5	4
S14			0	0	0	0	2	0	0	0	0	2	0
S15			0	2	0	4	1	2	2	0	342.15	11	6
S16			0	0	0	2	0	0	0	0	0	2	0
S17			0	0	1	0	0	0	0	0	220	1	1
S18			0	0	0	0	2	3	1	0	12	18	2
S19			0	0	0	0	1	0	0	0	0	1	0
S21			11	0	0	2	3	0	0	0	276.54	16	4
S23			2	0	2	0	0	0	2	0	102.04	6	2
S25			1	0	0	0	0	0	0	0	0	1	0
S26			3	0	7	1	0	0	0	0	0	11	0

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
in a Contract Catering Company*

Annex I c. Assessment of received raw material – Control at reception – March

Assessment of received raw material													
2021	MARCH	Control at reception										03/2021	V.01
Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S7	Coriander	Vegetables						O			-		
S13	Green leaf lettuce	Vegetables						O			-		
S23	Pork medallions	Meat and meat products	O								-		
S23	Pork chops	Meat and meat products	O								-		
S7	Watercress	Vegetables						NC			16		
S7	Tomato	Vegetables						O			-		
S7	Red pepper	Vegetables						O			-		
S9	Starking apple	Fruits			NC						24		
S9	Starking apple	Fruits					NC				108		
S7	Tomato	Vegetables						O			-		
S7	Turnip	Vegetables			O						-		
S15	Gala apple	Fruits				O					-		
S22	Pork loin	Meat and meat products	O								-		
S22	Pork ear	Meat and meat products	O								-		
S22	Pork liver	Meat and meat products	O								-		
S22	Pork ham	Meat and meat products	O								-		
S7	Tomato	Vegetables						NC			224		
S7	Celery	Vegetables						NC			5		
S15	Gala apple	Fruits				O					-		
S4	Orange	Fruits				O					-		
S9	Starking apple	Fruits					O				-		
S21	Chicken steak	Meat and meat products		NC							5		
S21	Pork steak	Meat and meat products				O					-		
S21	Pork steak	Meat and meat products				O					-		
S21	Pork stroganoff	Meat and meat products					O				-		
S21	Chicken leg	Meat and meat products	O								-		
S21	Chicken breast	Meat and meat products	O				O				-		
S7	Red pepper	Vegetables						NC	NC		4		
S15	Gala apple	Fruits						O			-		

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in a Contract Catering Company*

Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S10	Banana	Fruits						O			-		
S21	Pork steak	Meat and meat products				O					-		
S23	Rabbit	Meat and meat products	O								-		
S23	Mixed chops	Meat and meat products	O								-		
S23	Mixed chops	Meat and meat products	O								-		
S7	Coriander	Vegetables						O			-		
S10	Banana	Fruits						NC			399		
S10	Banana	Fruits						NC			9.25		
S10	Banana	Fruits						NC			194.25		
S4	Orange	Fruits				O					-		
S15	Golden apple	Fruits				O					-		
S9	Rocha pear	Fruits				NC					156		
S21	Beef tripe	Meat and meat products					O				-		
S15	Papaya	Fruits						NC			3.67		
S23	Pork chops	Meat and meat products	O			O					-		
S6	Nile perch	Fish and fish products				O					-		
S21	Pork hock	Meat and meat products	O								-		
S7	Celery	Vegetables						NC			5		
S18	Tomato	Vegetables						O			-		
S9	Rocha pear	Fruits				O					-		
S7	Red pepper	Vegetables						NC			4		
S7	Tomato	Vegetables						NC			?		
S10	Banana	Fruits				O					-		
S13	Green leaf lettuce	Vegetables					NC				36		
S26	Beef minced meat	Meat and meat products			O						-		
S26	Beef minced meat	Meat and meat products			O						-		
S13	Green leaf lettuce	Vegetables					NC				8		
S23	Pork ribs	Meat and meat products	O								-		
S21	Beef neck	Meat and meat products	NC				NC				303.5		
S21	Chicken drumstick	Meat and meat products	O								-		
S15	Gala apple	Fruits				O					-		
S9	Papaya	Fruits					NC				4.5		
S15	Mango	Fruits						NC			4		
S7	Tomato	Vegetables						O			-		
S7	Red pepper	Vegetables						NC	NC		24		

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
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Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S10	Banana	Fruits						NC			555		
S10	Banana	Fruits						NC			397.75		
S9	Starking apple	Fruits					NC				132		
S9	Starking apple	Fruits				O					-		
S13	Watercress	Vegetables			NC						4		
S7	Tomato	Vegetables						O			-		
S7	Tomato	Vegetables				O		O			-		
S9	Gala apple	Fruits				NC					36		
S4	Clementine	Fruits						O			-		
S10	Banana	Fruits						O			-		
S21	Pork strogonoff	Meat and meat products	O				O				-		
S13	Green leaf lettuce	Vegetables					O				-		
S26	Beef minced meat	Meat and meat products			O						-		
S26	Pork minced meat	Meat and meat products			O						-		
S15	Gala apple	Fruits				NC					75		
S15	Gala apple	Fruits				O					-		
S13	Watercress	Vegetables			NC						4		
S5	Turkey roti	Meat and meat products	NC				NC				514.6		
S5	Lamb palette	Meat and meat products	O								-		
S5	Lamb palette	Meat and meat products	O				O				-		
S21	Pork chops	Meat and meat products				O					-		
S10	Banana	Fruits						O			-		
S10	Banana	Fruits						O			-		
S18	Cucumber	Vegetables						O	O		-		
S13	Green leaf lettuce	Vegetables			O						-		
S4	Orange	Fruits						O			-		
S5	Turkey roti	Meat and meat products	NC				NC				514.6		
S21	Chicken	Meat and meat products	O								-		
S4	Clementine	Fruits						NC			240		
S7	Portuguese cabbage	Vegetables						O			-		
S4	Clementine	Fruits						NC			162		
S5	Lamb palette	Meat and meat products			NC						100.8		
S5	Lamb palette	Meat and meat products			NC						11.2		
S5	Lamb palette	Meat and meat products			NC						71.4		
S23	Rabbit	Meat and meat products	O								-		
S21	Pork strogonoff	Meat and meat products					O				-		

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
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Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
		Dairy goods	-	-	-	-	-	-	-	-	-	-	-
		Eggs and egg products	-	-	-	-	-	-	-	-	-	-	-
		Fats and sauces	-	-	-	-	-	-	-	-	-	-	-
		Fish and fish products	0	0	0	1	0	0	0	0	0	1	0
		Fruits	0	0	1	13	4	16	0	0	2500.42	34	16
		Meat and meat products	23	1	7	5	9	0	0	0	1521.1	45	10
		Sugary products	-	-	-	-	-	-	-	-	-	-	-
		Vegetables	0	0	4	1	3	20	3	0	334	31	14
			23	1	12	20	16	36	3	0	4355.52	111	40
S4			0	0	0	2	0	4	0	0	402	6	2
S5			4	0	3	0	3	0	0	0	1212.6	10	7
S6			0	0	0	1	0	0	0	0	0	1	0
S7			0	0	1	1	0	17	2	0	282	21	10
S9			0	0	1	4	4	0	0	0	460.5	9	6
S10			0	0	0	1	0	9	0	0	1555.25	10	5
S13			0	0	3	0	3	1	0	0	52	7	4
S15			0	0	0	6	0	3	0	0	82.67	9	3
S18			0	0	0	0	0	2	1	0	0	3	0
S21			7	1	0	4	6	0	0	0	308.5	18	3
S22		4	0	0	0	0	0	0	0	0	4	0	
S23		8	0	0	1	0	0	0	0	0	9	0	
S26		0	0	4	0	0	0	0	0	0	4	0	

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
in a Contract Catering Company*

Annex I d. Assessment of received raw material – Control at reception – April

Assessment of received raw material													
2021	APRIL	Control at reception										03/2021	V.01
Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S23	Beef steak	Meat and meat products	O								-		
S21	Pork steak	Meat and meat products	NC								-		
S21	Pork steak	Meat and meat products	NC								-		
S21	Beef sirloin	Meat and meat products	NC								-		
S21	Pork leg	Meat and meat products	NC								-		
S21	Beef brisket	Meat and meat products	NC								-		
S21	Turkey leg	Meat and meat products	NC								-		
S18	Red pepper	Vegetables						NC			8		
S7	Zucchini	Vegetables							NC		30		
S13	Beetroot	Vegetables							O		-		
S13	Green leaf lettuce	Vegetables						O			-		
S21	Chicken breast	Meat and meat products	O				O				-		
S4	Clementine	Fruits				O					-		
S7	Zucchini	Vegetables						NC	NC		156		
S7	Cucumber	Vegetables						NC	NC		185		
S4	Clementine	Fruits						O			-		
S10	Banana	Vegetables						O			-		
S13	Green leaf lettuce	Vegetables			O						-		
S5	Turkey roti	Meat and meat products	NC								505.7		
S4	Clementine	Fruits						O			-		
S7	Zucchini	Vegetables		NC							516		
S9	Packham's pear	Fruits				NC					13		
S9	Golden apple	Fruits				O					-		
S7	Turnip greens	Vegetables					O			O	-		
S4	Clementine	Fruits						NC			588		
S13	Green leaf lettuce	Vegetables					NC				10		
S23	Pork chops	Meat and meat products	O								-		
S21	Pork steak	Meat and meat products	O								-		
S4	Lemon	Fruits						O			-		

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
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Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S4	Clementine	Fruits						O			-		
S4	Orange	Fruits						O			-		
S7	Turnip rapini	Vegetables						NC			16		
S7	Watercress	Vegetables						NC			20		
S18	Tomato Cherry	Vegetables						NC			2		
S18	Red pepper	Vegetables			NC						4		
S18	Cucumber	Vegetables						O			-		
S4	Orange	Fruits						O			-		
S4	Clementine	Fruits						O			-		
S4	Orange	Fruits						O			-		
S7	Green beans	Vegetables		NC							10		
S7	Watercress	Vegetables						NC			4		
S18	Savoy cabbage	Vegetables			NC						340		
S18	Leak	Vegetables			O						-		
S9	Golden apple	Fruits					O				-		
S10	Banana	Fruits					O				-		
S18	Strawberries	Fruits						NC	NC		270		
S18	Strawberries	Fruits						NC	NC		210		
S9	Red grapes	Fruits							NC		32		
S10	Banana	Fruits						O			-		
S18	Strawberries	Fruits						NC			384		
S18	Cauliflower	Vegetables						NC			16		
S18	Savoy cabbage	Vegetables			NC						380		
S18	Watercress	Vegetables						NC			12		
S7	Sugarloaf cabbage	Vegetables						NC			100		
S7	Cherry tomato	Vegetables						O			-		
S23	Beef steak	Meat and meat products	O				O				-		
S21	Pork steak	Meat and meat products	O								-		
S21	Beef brisket	Meat and meat products	NC				NC				624		
S21	Pork hand	Meat and meat products	O								-		
S18	Cucumber	Vegetables						O			-		
S9	Golden apple	Fruits				O					-		
S22	Pork ham	Meat and meat products	O								-		
S22	Pork loin	Meat and meat products	O								-		
S22	Pork ear	Meat and meat products	O								-		

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
in a Contract Catering Company*

Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S22	Pork liver	Meat and meat products	O								-		
S21	Beef tripe	Meat and meat products			NC						66		
S23	Pork sausage	Meat and meat products	O	O			O				-		
S10	Banana	Fruits						O			-		
S10	Banana	Fruits						O			-		
S4	Clementine	Fruits						O			-		
S18	Tomato	Vegetables		NC							18		
S18	Zucchini	Vegetables						NC			678		
S15	Pineapple	Fruits						O			-		
S7	Turnip greens	Vegetables			O						-		
S7	Savoy cabbage	Vegetables			O						-		
S9	Rocha pear	Fruits			O						-		
S9	Golden apple	Fruits				O					-		
S9	Starking apple	Fruits					NC				84		
S10	Banana	Fruits						O			-		
S10	Banana	Fruits						O			-		
S7	Turnip greens	Vegetables			O						-		
S7	Savoy cabbage	Vegetables			O						-		
S9	Banana	Fruits						O			-		
S9	Banana	Fruits						O			-		
S21	Beef rib	Meat and meat products				O					-		
S23	Rabbit	Meat and meat products	O								-		
S23	Pork chops	Meat and meat products	O								-		
S23	Pork leg	Meat and meat products	O				O				-		
S4	Orange	Fruits				O		O			-		
S4	Clementine	Fruits				O		O			-		
S4	Orange	Fruits				O					-		
S7	Watercress	Vegetables						NC			5		
S9	Rocha pear	Fruits				O					-		
S9	Rocha pear	Fruits				O		O			-		
S9	Rocha pear	Fruits				O		O			-		
S26	Beef minced meat	Meat and meat products	O		O						-		
S26	Beef burger	Meat and meat products	O								-		
S21	Pork hand	Meat and meat products	O								-		
S21	Pork strogonoff	Meat and meat products	O				O				-		

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Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S4	Orange	Fruits						O			-		
S9	Rocha pear	Fruits				O					-		
S9	Rocha pear	Fruits				O					-		
S9	Golden apple	Fruits				O	NC				792		
S18	Tomato	Vegetables						NC			172		
S18	Tomato	Vegetables						NC			1344		
S18	Tomato	Vegetables						O			-		
S7	Zucchini	Vegetables						NC			240		
S15	Mango	Fruits						NC			12		
S9	Golden apple	Fruits					O				-		
S9	Starking apple	Fruits				O					-		
S21	Chicken	Meat and meat products	NC								1430.096		
S4	Orange	Fruits				O	O	O			-		
S4	Orange	Fruits					O				-		
S7	Leak	Vegetables			NC						10		
S18	Tomato	Vegetables						O			-		
S18	Tomato	Vegetables						O			-		
S18	Tomato	Vegetables						NC			96		
S18	Yellow pepper	Vegetables		NC							4		
S20	Rocha pear	Fruits			O	O					-		
S20	Strawberries	Fruits			O						-		
S9	Rocha pear	Fruits				O					-		
S9	Papaya	Fruits			NC						9		
S12	Butter	Fats and sauces			NC						480		
S4	Orange	Fruits					O	O			-		
S4	Orange	Fruits					O	O			-		
S18	Tomato	Vegetables			NC			NC			1179		
S18	Tomato	Vegetables			NC			NC			274		
S18	Red pepper	Vegetables						O			-		
S18	Sugarloaf cabbage	Vegetables						NC			140		
S7	Red cabbage	Vegetables			NC						-		
S15	Mango	Fruits						NC			8.2		
S9	Packham's pear	Fruits				O					-		
S9	Rocha pear	Fruits				O					-		

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
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Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
		Dairy goods	-	-	-	-	-	-	-	-	-	-	-
		Eggs and egg products	-	-	-	-	-	-	-	-	-	-	-
		Fats and sauces	0	0	1	0	0	0	0	0	480	1	1
		Fish and fish products	-	-	-	-	-	-	-	-	-	-	-
		Fruits	0	0	4	20	9	31	3	0	2402.2	67	13
		Meat and meat products	28	1	2	1	6	0	0	0	2625.796	38	11
		Sugary products	-	-	-	-	-	-	-	-	-	-	-
		Vegetables	0	4	13	0	2	28	4	1	5969	52	34
			28	5	20	21	17	59	7	1	11476.996	158	59
S4			0	0	0	5	4	16	0	0	588	25	1
S5			1	0	0	0	0	0	0	0	505.7	1	1
S7			0	2	6	0	1	9	3	1	1292	22	15
S9			0	0	2	14	4	4	1	0	930	25	5
S10			0	0	0	0	1	6	0	0	0	7	0
S12			0	0	1	0	0	0	0	0	480	1	1
S13			0	0	1	0	1	1	1	0	10	4	1
S15			0	0	0	0	0	3	0	0	20.2	3	2
S18			0	2	6	0	0	20	2	0	5531	30	23
S20			0	0	2	1	0	0	0	0	0	3	0
S21			14	0	1	1	3	0	0	0	2120.096	19	10
S22			4	0	0	0	0	0	0	0	0	4	0
S23			7	1	0	0	3	0	0	0	0	11	0
S26		2	0	1	0	0	0	0	0	0	3	0	

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
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Annex I e. Assessment of received raw material – Control at reception –May

Assessment of received raw material													
2021	MAY	Control at reception										03/2021	V.01
Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S15	Mango	Fruits						NC			8		
S18	Tomato	Vegetables						NC			14		
S13	Green leaf lettuce	Vegetables						O			-		
S9	Starking apple	Fruits				O					-		
S9	Fuji apple	Fruits				O					-		
S9	Golden apple	Fruits					NC				84		
S9	Golden apple	Fruits					O				-		
S18	Cucumber	Vegetables						O			-		
S9	Golden apple	Fruits					O				-		
S9	Golden apple	Fruits					O				-		
S9	Gala apple	Fruits				O					-		
S7	Tomato	Vegetables						NC			406		
S7	Tomato	Vegetables						O			-		
S18	Tomato	Vegetables						O			-		
S9	Starking apple	Fruits				O					-		
S9	Gala apple	Fruits				O					-		
S9	Gala apple	Fruits				O					-		
S2	Salmon filets	Fish and fish products			NC						3500		
S23	Pork steak	Meat and meat products	NC				NC				80		
S18	Broccoli	Vegetables			NC						18		
S4	Orange	Fruits					O				-		
S4	Orange	Fruits					O				-		
S9	Banana	Fruits						O			-		
S25	See bass	Fish and fish products	O								-		
S23	Chicken	Meat and meat products		NC							10.4		
S21	Beef tripe	Meat and meat products					O				-		
S21	Chicken breast	Meat and meat products					O				-		
S15	Pineapple	Fruits						O			-		
S7	Tomato	Vegetables						O			-		

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
in a Contract Catering Company*

Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S23	Pork chops	Meat and meat products	NC				NC				245		
S23	Mixed chops	Meat and meat products	NC				NC				255		
S23	Pork steak	Meat and meat products	O								-		
S23	Pork chops	Meat and meat products	O								-		
S8	Headed chicken breast	Meat and meat products			O						-		
S8	Fish fingers	Meat and meat products			O						-		
S21	Chicken breast	Meat and meat products	O				O				-		
S21	Pork chops	Meat and meat products	O								-		
S4	Orange	Fruits					O	O			-		
S4	Orange	Fruits				O	O	O			-		
S4	Orange	Fruits					O	O			-		
S21	Pork chops	Meat and meat products	O								-		
S21	Pork stroganoff	Meat and meat products	O				O				-		
S18	Red pepper	Vegetables							O		-		
S9	Gala apple	Fruits				O					-		
S9	Gala apple	Fruits				O					-		
S16	Chicken leg	Meat and meat products				O					-		
S21	Pork steak	Meat and meat products	O								-		
S21	Pork ribs	Meat and meat products	O				O				-		
S21	Pork hand	Meat and meat products	O								-		
S21	Chicken leg	Meat and meat products	O								-		
S9	Gala apple	Fruits				O					-		
S9	Gala apple	Fruits			NC	O					18		
S7	Turnip greens	Vegetables			O						-		
S21	Chicken steak	Meat and meat products	NC				NC				440		
S21	Pork steak	Meat and meat products	O								-		
S18	Savoy cabbage	Vegetables			NC						320		
S18	Tomato	Vegetables						O			-		
S9	Gala apple	Fruits				O					-		
S21	Chicken steak	Meat and meat products	NC				NC				440		
S15	Packham's pear	Fruits			NC						25.6		
S10	Banana	Fruits						O			-		
S10	Banana	Fruits						NC			111		
S7	Watercress	Vegetables						NC			4		
S18	Tomato	Vegetables				O					-		
S4	Orange	Fruits				NC	NC				600		
S9	Gala apple	Fruits				O					-		

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Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
		Dairy goods	-	-	-	-	-	-	-	-	-	-	-
		Eggs and egg products	-	-	-	-	-	-	-	-	-	-	-
		Fats and sauces	-	-	-	-	-	-	-	-	-	-	-
		Fish and fish products	1	0	1	0	0	0	0	0	3500	2	1
		Fruits	0	0	2	14	10	8	0	0	846.6	34	7
		Meat and meat products	16	1	2	1	10	0	0	0	1470.4	30	11
		Sugary products	-	-	-	-	-	-	-	-	-	-	-
		Vegetables	0	0	3	1	2	9	1	0	762	16	5
			17	1	8	16	22	17	1	0	6579	82	24
S2			0	0	1	0	0	0	0	0	3500	1	1
S4			0	0	0	2	6	3	0	0	600	11	2
S7			0	0	1	0	0	4	0	0	410	5	2
S8			0	0	2	0	0	0	0	0	0	2	0
S9			0	0	1	12	4	1	0	0	102	18	2
S10			0	0	0	0	0	2	0	0	111	2	1
S13			0	0	0	0	0	1	0	0	0	1	0
S15			0	0	1	0	0	2	0	0	33.6	3	2
S16			0	0	0	1	0	0	0	0	0	1	0
S18			0	0	2	1	0	4	1	0	352	8	3
S21			11	0	0	0	7	0	0	0	880	18	4
S23			5	1	0	0	3	0	0	0	590.4	9	7
S25		1	0	0	0	0	0	0	0	0	1	0	

*Development of a Tool for the Assessment of the Quality of Food Raw Material,
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Annex I f. Assessment of received raw material – Control at reception –June

Assessment of received raw material													
2021	JUNE	Control at reception										03/2021	V.01
Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S21	Pork steak	Meat and meat products	O								-		
S21	Beef tri-tip	Meat and meat products	O								-		
S12	Butter	Fats and sauces			O						-		
S4	Orange	Fruits				O	NC				1005		
S9	Gala apple	Fruits				O					-		
S9	Golden apple	Fruits				O					-		
S13	Green leaf lettuce	Vegetables						NC			455		
S23	Pork chops	Meat and meat products	O								-		
S23	Pork hand	Meat and meat products	O								-		
S15	Mango	Fruits						NC			4		
S9	Ginger	Vegetables			NC						0.13		
S15	Mago	Fruits						NC			3.88		
S7	Watercress	Vegetables						NC			4		
S13	Green leaf lettuce	Vegetables			NC						110		
S21	Beef strogonoff	Meat and meat products	NC				NC				336		
S13	Green leaf lettuce	Vegetables						NC			15		
S15	Kiwi	Fruits			NC						10.33		
S18	Cucumber	Vegetables						O			-		
S9	Gala apple	Fruits				O					-		
S9	Starking apple	Fruits				O					-		
S24	Codfish	Fish and fish products	O								-		
S21	Chicken breast	Meat and meat products	O								-		
S21	Pork hock	Meat and meat products	O								-		
S21	Pork strogonoff	Meat and meat products	O				O				-		
S10	Banana	Fruits						NC			203.5		
S15	Mango	Fruits						NC			4		
S9	Packham's pear	Fruits				O					-		
S9	Staking apple	Fruits				O					-		
S21	Beef neck	Meat and meat products	O								-		

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Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S21	Pork leg	Meat and meat products	O				O				-		
S21	Pork steak	Meat and meat products	O				O				-		
S18	Cucumber	Vegetables						O			-		
S9	Gala apple	Fruits				NC					18		
S9	Rocha pear	Fruits				O					-		
S21	Pork steak	Meat and meat products	O								-		
S7	Green leaf lettuce	Vegetables						O			-		
S7	Watercress	Vegetables						O			-		
S7	Tomato	Vegetables						O			-		
S9	Packham's pear	Fruits			NC						13		
S9	Ginger	Vegetables			NC						0.5		
S9	Gala apple	Fruits				NC					324		
S9	Starking apple	Fruits				O					-		
S23	Rabbit	Meat and meat products	O								-		
S9	Gala apple	Fruits				O					-		
S15	Granny Smith apple	Fruits				NC					91		
S15	Golden apple	Fruits				NC					16		
S9	Watermelon	Fruits		NC							20		
S26	Pork minced meat	Meat and meat products	O		O						-		
S26	Pork leg	Meat and meat products			NC						2600		
S21	Pork chops	Meat and meat products	O								-		
S21	Pork steak	Meat and meat products	O								-		
S21	Pork hand	Meat and meat products	O								-		
S9	Strawberries	Fruits						NC			16		
S9	Packham's pear	Fruits				NC					208		
S9	Packham's pear	Fruits				O					-		
S10	Banana	Fruits						NC			185		
S10	Banana	Fruits						NC			83.25		
S9	Gala apple	Fruits				O					-		
S13	Coriander	Vegetables						NC			3.2		
S13	Parsley	Vegetables						NC			0.2		
S21	Pork steak	Meat and meat products	O								-		
S21	Turkey skewers	Meat and meat products	O				O				-		
S21	Beef sirloin	Meat and meat products	O								-		
S21	Pork leg	Meat and meat products	O								-		

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Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
S21	Beef sparerib chops	Meat and meat products	O				O				-		
S4	Orange	Fruits						O			-		
S9	Gala apple	Fruits				O					-		
S7	Aubergine	Vegetables			O						-		
S7	Zucchini	Vegetables							O		-		
S9	Gala apple	Fruits				O					-		
S9	Green melon	Fruits						O			-		
S13	Sugarloaf cabbage	Vegetables						NC			10		
S7	Aubergine	Vegetables			O						-		
S21	Chicken leg	Meat and meat products	O								-		
S21	Chicken giblets	Meat and meat products	O								-		
S21	Beef brisket	Meat and meat products	O								-		
S21	Pork steak	Meat and meat products	O								-		
S7	Celery	Vegetables					NC				5		
S13	Coriander	Vegetables						NC			13		
S4	Orange	Fruits					O				-		
S4	Orange	Fruits					O				-		
S9	Green melon	Fruits						O			-		
S9	Jonagored apple	Fruits				O					-		
S9	Jonagored apple	Fruits				O					-		
S15	Nectarine	Fruits						NC			6.3		
S7	Zucchini	Vegetables						NC	NC		38		
S7	Tomato	Vegetables						O			-		
S13	Coriander	Vegetables						NC			0.6		
S9	Packham's pear	Fruits			NC						13		
S9	Gala apple	Fruits				O					-		
S9	Watermelon	Fruits						O			-		
S9	Gala apple	Fruits				O					-		
S9	Green melon	Fruits						O			-		
S13	Coriander	Vegetables						NC			0.4		
S13	Cabbage rapini	Vegetables						NC			4		

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Supplier	Raw material	Category	Assessment parameters								Returned amount (kg)	Total O/NC	Total NC
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
		Dairy goods	-	-	-	-	-	-	-	-	-	-	-
		Eggs and egg products	-	-	-	-	-	-	-	-	-	-	-
		Fats and sauces	0	0	1	0	0	0	0	0	0	1	0
		Fish and fish products	1	0	0	0	0	0	0	0	0	1	0
		Fruits	0	1	3	23	3	13	0	0	2224.26	43	18
		Meat and meat products	26	0	2	0	6	0	0	0	2936	34	3
		Sugary products	-	-	-	-	-	-	-	-	-	0	-
		Vegetables	0	0	5	0	1	17	2	0	659.03	25	16
			27	1	11	23	10	30	2	0	5819.29	104	37
S4			0	0	0	1	3	1	0	0	1005	5	1
S7			0	0	2	0	1	6	2	0	47	11	4
S9			0	1	4	20	4	5	0	0	612.63	34	9
S10			0	0	0	0	0	3	0	0	471.75	3	3
S12			0	0	1	0	0	0	0	0	0	1	0
S13			0	0	1	0	0	9	0	0	611.4	10	10
S15			0	0	1	2	0	4	0	0	135.51	7	7
S18			0	0	0	0	0	2	0	0	0	2	0
S21			22	0	0	0	6	0	0	0	336	28	2
S23			3	0	0	0	0	0	0	0	0	3	0
S24			1	0	0	0	0	0	0	0	0	1	0
S26		1	0	2	0	0	0	0	0	2600	3	1	

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Annex I g. Assessment of received raw material – Half-year assessment

Assessment of received raw material														
2021	SEMESTER 1	Half-year assessment											03/2021	V.01
Supplier	Month	Category	Assessment parameters								Returned amount (yes=1/no=0)	Total O/NC	Weighting/ assessment	
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics							
							Appearance	Maturation/ oxidation state	Mould	Pests				
			20%	10%	10%	0%	0%	0%	20%	20%	20%		100%	
	January	Dairy goods	0	0	0	-	-	-	0	0	0	0		
	February		0	0	0	-	-	-	0	0	0	0		
	March		0	0	0	-	-	-	0	0	0	0		
	April		0	0	0	-	-	-	0	0	0	0		
	May		0	0	0	-	-	-	0	0	0	0		
	June		0	0	0	-	-	-	0	0	0	0		
	TOTAL		0	0	0	-	-	-	0	0	0	0		
			0%	0%	0%	-	-	-	0%	0%	0%		0%	
			20%	10%	10%	0%	0%	0%	20%	20%	20%		100%	
	January	Eggs and egg products	0	0	0	-	-	-	0	0	0	0		
	February		0	0	0	-	-	-	0	0	0	0		
	March		0	0	0	-	-	-	0	0	0	0		
	April		0	0	0	-	-	-	0	0	0	0		
	May		0	0	0	-	-	-	0	0	0	0		
	June		0	0	0	-	-	-	0	0	0	0		
	TOTAL		0	0	0	-	-	-	0	0	0	0		
			0%	0%	0%	-	-	-	0%	0%	0%		0%	

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Supplier	Month	Category	Assessment parameters								Returned amount (yes=1/no=0)	Total O/NC	Weighting/ assessment
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
		Fats and sauces	20%	10%	10%	0%	0%	0%	20%	20%	20%		100%
	January		0	0	0	-	-	-	0	0	0	0	
	February		0	0	0	-	-	-	0	0	0	0	
	March		0	0	0	-	-	-	0	0	0	0	
	April		0	0	1	-	-	-	0	0	1	1	
	May		0	0	0	-	-	-	0	0	0	0	
	June		0	0	1	-	-	-	0	0	0	1	
	TOTAL		0	0	2	-	-	-	0	0	1	2	
		0%	0%	10%	-	-	-	0%	0%	3.3%			
		Fish and fish products	16%	5%	10%	5%	12%	0%	16%	16%	20%		100%
	January		2	0	0	1	0	-	0	0	0	3	
	February		1	0	1	1	0	-	0	0	1	3	
	March		0	0	0	1	0	-	0	0	0	1	
	April		0	0	0	0	0	-	0	0	0	0	
	May		1	0	1	0	0	-	0	0	1	2	
	June		1	0	0	0	0	-	0	0	0	1	
	TOTAL		5	0	2	3	0	-	0	0	2	10	
		8.0%	0%	2.0%	1.5%	0%	-	0%	0%	7%			
		Fruits	5%	5%	10%	10%	10%	10%	15%	15%	20%		100%
	January		0	0	3	7	0	16	2	0	1	28	
	February		0	4	0	11	2	10	2	0	1	29	
	March		0	0	1	13	4	16	0	0	1	34	
	April		0	0	4	20	9	31	3	0	1	67	
	May		0	0	2	14	10	8	0	0	1	34	
	June		0	1	3	23	3	13	0	0	1	43	
	TOTAL		0	5	13	88	28	94	7	0	6	235	
		0%	0.1%	0.6%	3.7%	1.2%	4.0%	0.4%	0%	20%			

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Supplier	Month	Category	Assessment parameters								Returned amount (yes=1/no=0)	Total O/NC	Weighting/ assessment
			Temperature	Packaging/ Transportation	Labelling/ Authenticity	Calibre	Organoleptic characteristics						
							Appearance	Maturation/ oxidation state	Mould	Pests			
		Meat and meat products	16%	5%	10%	5%	12%	0%	16%	16%	20%		100%
	January		16	0	0	0	8	-	0	0	1	24	
	February		16	0	9	5	4	-	2	0	1	36	
	March		23	1	7	5	9	-	0	0	1	45	
	April		28	1	2	1	6	-	0	0	1	38	
	May		16	1	2	1	10	-	0	0	1	30	
	June		26	0	2	0	6	-	0	0	1	34	
	TOTAL		125	3	22	12	43	-	2	0	6	207	
			9.7%	0.1%	1.1%	0.3%	2.5%	-	0.2%	0.0%	20%		34%
		Sugary products	20%	10%	10%	0%	0%	0%	20%	20%	20%		100%
	January		0	0	0	-	-	-	0	0	0	0	
	February		0	0	0	-	-	-	0	0	0	0	
	March		0	0	0	-	-	-	0	0	0	0	
	April		0	0	0	-	-	-	0	0	0	0	
	May		0	0	0	-	-	-	0	0	0	0	
	June		0	0	0	-	-	-	0	0	0	0	
	TOTAL		0	0	0	0	0	0	0	0	0	0	
			0%	0%	0%	0%	0%	0%	0%	0%	0%		0%
		Vegetables	5%	5%	10%	2%	10%	14%	17%	17%	20%		100%
	January		0	0	7	0	0	11	1	0	1	19	
	February		0	1	0	0	5	7	2	1	1	16	
	March		0	0	4	1	3	20	3	0	1	31	
	April		0	4	13	0	2	28	4	1	1	52	
	May		0	0	3	1	2	9	1	0	1	16	
	June		0	0	5	0	1	17	2	0	1	25	
	TOTAL		0	5	32	2	13	92	13	2	6	159	
			0%	0.2%	2.0%	0.03%	0.8%	8.1%	1.4%	0.2%	20%		33%

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Annex II. Qualitative food waste analysis – Half-year valuation

Qualitative food waste analysis							
2021	SEMESTER 1	Half-year valuation				04/2021	V.01
Month	Category	Returned amount (kg)	Received amount (kg)	<u>Returned</u> <u>Received</u>	Wasted amount (kg)	Received amount (kg)	<u>Wasted</u> <u>Received</u>
January	Fish and fish products	0	91274.73	0.00%	134	91274.73	0.15%
February		220	58650.8	0.38%	32.5	58650.8	0.06%
March		0	101376.49	0.00%	486.52	101376.49	0.48%
April		0	105814.35	0.00%	48	105814.35	0.05%
May		3500	140057.77	2.50%	11.5	140057.77	0.01%
June		0	91449.15	0.00%	65	91449.15	0.07%
TOTAL		3720	588623.29	0.63%	777.52	588623.29	0.13%
January	Fruits	2045	160472.695	1.27%	742.7	160472.695	0.46%
February		1191.65	89347.78	1.33%	296.36	89347.78	0.33%
March		2500.42	175410.45	1.43%	1257	175410.45	0.72%
April		2402.2	226289.85	1.06%	4479.37	226289.85	1.98%
May		846.6	250062.3	0.34%	2347.1	250062.3	0.94%
June		2224.76	231116.44	0.96%	359.01	231116.44	0.16%
TOTAL		11210.63	1132699.515	0.99%	9481.54	1132699.515	0.84%
January	Meat and meat products	150	173170.33	0.09%	28.83	173170.33	0.02%
February		378.58	116276.22	0.33%	18	116276.22	0.02%
March		1521.1	190608.16	0.80%	192.018	190608.16	0.10%
April		2625.796	206128.88	1.27%	460.91	206128.88	0.22%
May		1470.4	222261.94	0.66%	1068.454	222261.94	0.48%
June		2936	232635.48	1.26%	22.326	232635.48	0.01%
TOTAL		9081.876	1141081.01	0.80%	1790.538	1141081.01	0.16%
January	Vegetables	188	91344	0.21%	88.65	91344	0.10%
February		272	63838.78	0.43%	28	63838.78	0.04%
March		334	96492.96	0.35%	90	96492.96	0.09%
April		5969	119276.08	5.00%	265.23	119276.08	0.22%
May		762	129156.7	0.59%	41.5	129156.7	0.03%
June		658.53	124059.4	0.53%	94.2	124059.4	0.08%
TOTAL		8183.53	624167.92	1.31%	607.58	624167.92	0.10%

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