The hierarchy of cereals by an ancient scientist in *De alimentorum Facultatibus* I: the properties of grain for bread making

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Abstract

When approaching the nature of things, Galen of Pergamon tends to use an analytic process based on the relation between different elements interacting in a particular system. With respect to ancient eating habits and health, this way of collecting information and formulating hypotheses has a kind of potential for generating hierarchies and is attested to in *De alimentorum facultatibus* I, in which foodstuffs are evaluated considering the particular result expected on a subject's metabolism. This paper aims to describe the manner by which a hierarchical construction is made in respect to the qualities of grains. In order to understand how such a method serves Galen's science, it offers a systematization of his commentaries and notes on the different kinds of grains and their nutritional properties in the equation: human body condition + (cereal + type of processing) = body reaction.

Keywords: ancient science, Galen, *De alimentorum facultatibus*, cereals, ancient medicine.

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The hierarchy of cereals by an ancient scientist in *De alimentorum Facultatibus I*: the properties of grain for bread making[1]

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2. ⌈Inana⌋, glossy mane, is a perfect beauty
3. Maiden, mane of the mountain goat [...] ⌈stag⌋, [...] stag
4. ⌈Inana⌋, mane of the mountain goat [...] [stag], [...] stag
5. The Maiden, multi-coloured as grain heap, is suitable for the Lord[2].
6. Inana, multi-coloured as grain heap, is suitable for Dumuzi
7. Maiden, you are a heap of hulled grain? (gu_2-nida), turned in luxurious,
8. Inana, you are a heap of hulled grain? (gu_2-nida), turned in luxurious.(...)[3]

De alimentarum facultatibus is far from being easy reading, whatever one's skill in ancient Greek. Depending on the objects under analysis in his text or the sources quoted by Galen, distinguishing Galen's own opinion on a subject from anecdotes[4] or from opinions of ancient physicians or philosophers known by Galen but not quoted in his speech can be puzzling[5]. Furthermore, there is great intertextuality between Galen's writings, for he tends not to fully restate information already given in previous works - information that would be helpful in clarifying the subject when looking at a single work. In the case of a later text, such as *de alim. fac.*, cross references are abundant, even in a text that resumes and updates previous dispersed considerations on the properties of cereals, both by Galen himself and other authors mentioned by him. For this reason, for those not engaged in philological debates or studies of the Second Sophistic and who would rather extract the maximum contextual and technical information from the text, it may be useful to have a kind of guide while reading it. This paper intends to summarize and offer insights into the technical information concerning the properties of bread, taking into account Galen's own teachings and following his own method of classification: the properties of the foodstuff as markers for defining value.

[1]The research for this paper was made supported by the fellowship SFRH/BD/93806/2013, granted by FCT – Fundação para a Ciência e Tecnologia.
[2] cf. Sefati 1998, 243.
[3] (…) 2. [d][inana] kun-sig$_3$ mul-mul-la sig$_7$ sag$_9$-ga-am$_3$ / 3. [lu2]ki-sikil] kun-sig$_3$ daraḫ X [lu?]-lim X lu-lim-ma / 4. [d][inanna] kun-sig$_3$ daraḫ X [lu]-lim X lu-lim-e / 5. [lu2]ki-sikil še-zar-maš-gin$_7$ gun$_3$-[a] lugal-ra tum$_2$-ma / 6. ^{d}inanna še-zar-maš-gin$_7$ gun$_3$-a ^{d}dumu-zid-ra tum$_2$-ma / 7. lu$_2$ki-sikil še-zar gu$_2$-nida?-a ḫi-li šu gi$_4$-a-ĝen / 8. ^{d}inana še-zar gu$_2$-nida?-a ḫi-li šu gi$_4$-a-ĝen. Sefati 1998, 242-3.
[4] Vide Mattern 2008, 40-47.
[5] Vide also Singer 1997.

Grain would have been considered the staple food par excellence and thus it was the focus of ancient authors who studied culture, the technicalities of flora (or agriculture), or healthcare[6]. For example, Cato the Elder specifies the amount of wheat and bread appropriate for good domestic management and, by comparison, relegates all other foodstuffs to a secondary role (Cato. *Agr*. 56-58). Vegetius, writing on the supply of the army during a military campaign, says that grain, along with wine and salt, are the provisions whose scarcity should be avoided at all cost (vide Vegetius 3.3)[7]. This importance is underlined by the variety of uses for different kinds of cereals, and follows the correlation: production / quantity / consumption / food quality. Accordingly, the products derived from cereal grains were valued according to the type of grain they contained.

It is obvious that grain was crucial for the Mediterranean diet[8], but the degree to which ancient people knew the benefits or drawbacks of such food is not known. Nutritional science based on a food's metabolic and organic compositions and functions is relatively new and so assumptions cannot be made as to the habits of Romans from today's knowledge of the properties of foodstuffs. However, knowledge about the food ancient people ate (or would have liked to eat) can give us clues about the empirical knowledge of Roman consumers and producers as well as revealing their cultural habits, which in turn may give us some insights into society, economic activity and even the political establishment[9].

Galen constructs a hierarchy of different types of bread, or rather the qualities that are attributed to each kind of bread, basing it on the quality of the cereals, and the methods of processing and cooking them[10]. It is important to note that Galen's understanding, and that of the wider population of the time respect both the quality and properties of a particular type of cereal would not necessarily concur with the different realities of the various regions of the empire - such knowledge came from assumptions based on tradition and empiricism resulting from observation and experience in specific contexts. In this regard and most importantly, we should note that the considerations made here are based solely on Galen's treaty *de alimentorum facultatibus I* and not on the production process and qualification in antiquity per se, compared to archaeological data or to other ancient authors' notes on diet. I aim to systematize the data provided by *de alim. fac*. in order to understand cereal consumption in antiquity from the eyes of Galen but not so much to study the efficiency of production or the technical accuracy of Galen and the previous authors that inspired him, as without Galen's own reference to his

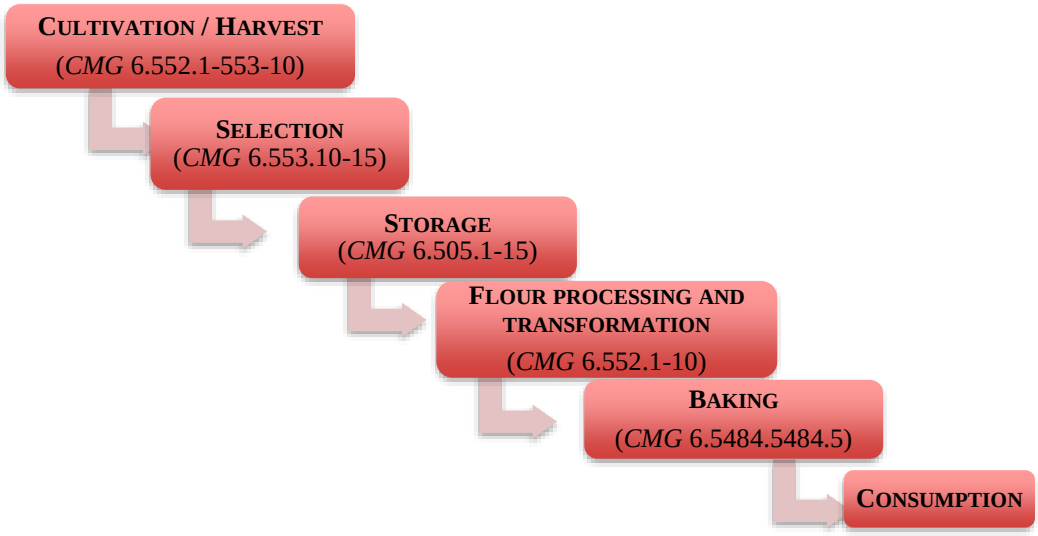
[6] Galen's first approach on grains regarding diet is in *De subtiliante diaeta* (Wilkins 2002, 47-55).
[7] Cool (2016, 10) presents data collected from an ancient site in Britannia, identifying the production of the most common cereals' in antiquity: emmer, spelt and wheat – to which millet should be added.
[8] Zafrai (1994, 63-68) gives a paradigmatic example of the importance of cereals in macro and micro economic organization in Roman Palestine. Erdkamp (2005, 258-330) notes how crucial grain was in the food supply of the population and in the maintenance of a social system.
[9] Vide Garnsey 1988, 198-217.
[10] About the milling process vide Thurmond 2006, 32-51.

predecessors regarding *de alim. Fac.* this would be a highly speculative exercise, and difficult to substantiate[11].

1. *The cereal in* alimentorum facultatibus I

1.1. *Selection and consumption*

Summarizing, the quality of bread depends on the characteristics of the grain and on the purpose motivating the baking of the final product, which depends on the result of five basic steps, according to Galen:



At this point it must be mentioned that the format of main source text for this paper is not schematic, so the data presented here is reconstructed from Galen's reports and not paraphrased, although the diagrams and tables presented here could suggest otherwise.

Galen recognized the great importance of wheat (πυρός, *Pyros*, *Triticum vulgare*) for most of the Mediterranean peoples, and for this reason many doctors who worked with food in their practice wrote about this particular cereal (cf. *CMG* 6.480.10-481.1). Although wheat had been understood as being a single species, Galen identified a variety of physical characteristics distinguishing various kinds of this grain which affect quality and nutritional value. A hierarchy was formulated based upon the effects on the human body rather than agricultural concerns such as the cost/profitability of production, special needs for cultivation (soil types, requirements of water and light, etc.)[12]; biological characteristics (such as resistance to pests), or the impact of meteorological conditions on crop growth, germination time, etc. All commentaries regarding such questions were

[11] There are exceptions as Theophrastus, Aristotle or Dioscorides, whose works are known today.
[12] In depth comment will not be made on the production of cereals since Galen himself makes little reference to production, presenting only generalized and analytical comments on the subject (cf. *CMG* 6. 552.1-553.5, 553.5-553.1).

peripheral to his treaty[13]. At this point, it is important to note that it is not always clear whether Galen refers to a specific type of cereal or to a variety of wheat[14]. In fact, Galen himself was unclear, as can be seen repeatedly in *De alimentorum Facultatibus*. Nevertheless, wheat is the point of reference for the classification of cereal in *de alim. fac.*

In his analysis of wheat seeds, Galen observed a crucial factor for the identification of the properties of wheat, which influenced the process of selection, preparation, and consumption. That is, the denser the seed is, the more nutritious it will be (*CMG* 6.481.1-5). In direct contrast, if it is less dense, it will be less nutritious (*CMG* 6.481.1-10).

Such analysis focuses on the interior of the kernel since, according to Galen, the exterior appearance could give misleading results, and only by testing can quality be proven (*CMG* 6.481.5-10). Therefore, a superficial analysis is recognized as useful but fallible, meaning it has little value for appraising the grain itself. The examination of the grain may have been more detailed and more objective when the seed was being prepared for sowing and generally, flour would be only superficially analysed. In this sense, Galen notes that sieving would not always result in the most appropriate seed selection to obtain the purest flour. Thus it can be assumed that the qualitative classification of the wheat crop would be a result of an examination of the seeds subsequent to their selection by appearance, that is, once the bulk of seeds had been chosen; some would be separated and opened in order to verify the consistency of its interior, thus serving as a sample for the remaining harvest. Obviously, this method did not guarantee a perfect, unambiguous filter; however, one must take into account that there would have been a prior 'genetic sieve', as the seeds sown to achieve the present harvest would have been pre-selected - although there is no information in what way and in to what scale such an enterprise would have occurred in cereal cultivation[15].

Perhaps the constant scourge of famine in antiquity, described in the *de. Alim. fac. I*, resulted from widespread negligence in the selection of the best grain (cf. *CMG* 6.517.15-518.5). Agricultural territories were the 'breadbasket' of the empire, and as cities did not produce enough cereal to provide for their citizens, there was an extreme dependence on wheat imports. This meant that the farmers themselves, whose production was sent away, sometimes did not have sufficient wheat for their own consumption (cf. *CMG* 6.517.1-15). In other words, scarcity reduced selectivity and the demand for quality products. In fact, Galen often refers to this throughout his text (cf. *CMG* 6.522.15-523.10)[16]. (see table 1.3)[17].

[13] An exception is made when Galen writes about his father's farming activities (*CMG* 6.552.1-553.10).
[14] Pliny is the greatest literary source of information on cereal varieties in Rome (Plin. *Nat.* 18.48–51). The small 'fava legumes' that could be dried for storage and later consumption are included in the category of grains together with cereal grains. On storing and uses of grains vide Cool 2006, 73-74.
[15] Vide Col. 2.9.
[16] For modern production of various types of cereal in the contemporary and ancient rural Mediterranean area, vide Halstead 2014. On the demand and intervention in the cereal market by imperial and Republican authorities vide Morley 2002, 55-82.
[17] Re selectivity on quality and quantity of food, Columella noted the obvious - that the poorest people had fewer options. (cf. Col. 10 *pr*. 2)

1.2. *The qualities of cereals and the secondary status of millet in* de alim. fac.

Barley is presented as being consumed in equal quantities as wheat, but having a relatively lower nutritional value except when both were bad quality. In such cases, barley is deemed to be slightly superior, probably as it is less harmful to both digestion and excretion (cf. *CMG* 6.501.1-503.5; *CMG* 6.506.5-506.15). Galen also looks at barley and supports his analysis of the quality of wheat itself, either for its nutritional value or for the quality of crops, in regards to the amount of impurities in comparison with other grains (cf. *CMG* 6.552.1-553.5). In fact, he follows the same methodologies for the analysis of all cereals considered in *de alim. I*. However, although Galen does examine other grains, they are all compared to wheat: wheat is the paradigm.

There are some issues with his dealing of the three cereals, *tife*, *Olyra* and *zea,* the differentiation and classification of which are not clear in Galen's commentaries - perhaps because the author himself was not able to distinguish them accurately (see table 1.3)[18]. Moreover, this problem indicates the lack of a well-defined vocabulary for botanics at that time. Such predicaments can also be appreciated in the texts of other authors quoted by Galen, such as Menesitheos. In fact, Menesitheos may serve as a scapegoat for Galen's ignorance, although sometimes the latter states his disagreement with Menesitheos, stating his own position on the subject (cf. *CMG* 6.510.15-514.10). There are also differences with other authors, such as Theophrastus (cf. *CMG* 6.516.1-10), Herodotus (cf. *CMG* 6.516.10-15), Dioscorides (cf. *CMG* 6516.15-517.5) or Homer himself (cf. *CMG* 6.522.1-522.10), highlighting discrepancies for regional classifications and different uses for different grains. Taking the difficulty of having a precise definition and name for each of the three above-mentioned cereals as his starting point, Galen expands on his discussion, naming other cereals that could be related, such as *setanius*, 'naked barley' (γυμνὴ κριθή) or *zeopyros,* about which he gives no further information; he also reviews the regions where these grains would have been used and their suggested relationship with the group of *tyfê*, *olyra* and *zea,* which had similar features (cf. *CMG* 6.520.5-520.15). Galen sometimes considers all those cereals to be on an equal standing, but at other times he distinguishes them according to the habits among the peoples who consumed them. Such information may have been taken from Galen's own experience or from the cultural habits narrated by other unidentified authors.

The ambiguity concerning species of grain may have been due to a lack of definition of a standardized vocabulary for botanics, which the author recognizes as a problem. Furthermore, in general these seeds would result in a very similar end product, which would be easier to evaluate on a superficial and generic level. Galen's attention is also focused on the final product (cf. *CMG* 6.520.10-521.5).

The selection process of the seed for production and sieving are obviously key in defining the quality of flour. More important than obtaining a perfect flour was obtaining the 'right' flour. That is, a specific type of flour for baking. Galen gives some limited data about the harvesting process and quality control taken from his father's life experience

[18] Vide Wilkins 2005 on this matter.

(*CMG* 6.552.1-553.10). As well as identifying the importance of crop selection, Galen notes the frequent neglect of those who worked to obtain larger harvests, with no regard to quality; he believed and that this would have consequences for consumer health:

"He also found some such changes occurring with other seeds, which is why he instructed those using them, so that they might be healthy when used, to pick out everything harmful whenever the seeds are brought and not to ignore them as the public millers do.

Mark you, once, when it had been a bad year, a great deal of darnel had been generated in the wheat, which neither the farmers properly cleaned out with the appropriate sieves (for the total of wheat cultivated was small), nor did the bakers for the same reason, and at once many headaches occurred and, with the onset of summer, skin ulcers, or some other occurrence indicating an unhealthy humoral state, arose in those people eating it." (*CMG* 6.553.1-553.10, trans. Powell [2003])[19].

The author notes the negligence of the public services during the processing of cereals and supply of the population, in what should have been a redistribution role of the State [20]. Nevertheless, a description of bad practice does not imply a generalized ignorance of the best way to obtain good bread (cf. *CMG* 6.553.10-15). Rather, it reflects something quite common and can be seen today: mass production at the expense of quality, i.e. – profit as a driving force for production.

Millet is another common cereal produced in most regions of ancient Mesopotamia and the Mediterranean. The frequency this grain was sown was not so much a result of its properties as a high-quality supply, but a consequence of its resistance when compared to other cereals in areas where soils were less fertile and the weather drier. In fact, during the 1990s, it was the main cereal cultivated in the south of the Sahara, and it still enjoys a production on a large scale on the Russian steppes[21]. The difficulties of farming in ancient times should be borne in mind: both tilling techniques and care of the seeds, as well as the limitations imposed by the maintenance of soil fertility and by the irrigation techniques available. One would expect Galen to have paid greater attention to this cereal, at least considering the levels it would have been consumed at in antiquity. Nonetheless, Galen did not write at length about it. The lower quality of this grain may have led Galen to consider its analysis superfluous; he may have thought people should not consume it at all, so there would not be need for advice and instruction on it. However, this may contradict what went on in reality according to ancient sources (cf. Plin. *Nat* 18.100; Col. 2.9.17-19).

[19] *CMG* 6.553.1-553: εὗρε δὲ καὶ κατ' ἄλλα σπέρματα τοιαύτας τινὰς γιγνομένας μεταβολάς, ὅθεν ἐκέλευσε τοὺς χρωμένους αὐτοῖς ἐκλέγειν ἅπαν τὸ μοχθηρόν, ὅταν εἰς χρῆσιν ὑγιεινὴν ἄγηται τὰ σπέρματα, καὶ μὴ καταφρονεῖν, ὥσπερ οἱ τοῖς δήμοις ὑπηρετούμενοι σιτοποιοί. μοχθηρᾶς γέ τοί ποτε γενομένης ἀγωγῆς ἔτους αἶραι πάμπολλαι κατὰ τοὺς πυροὺς ἐγεννήθησαν, ἃς οὐκ ἀκριβῶς οὔτε τῶν γεωργῶν ἐκκαθαράντων τοῖς εἰς ταῦτ' ἐπιτηδείοις κοσκίνοις (ὀλίγος γὰρ ὁ σύμπας ἐγεωργεῖτο πυρός) οὔτε τῶν ἀρτοποιῶν διὰ τὴν αὐτὴν αἰτίαν, ἐν μὲν τῷ παραχρῆμα κεφαλαλγεῖς ἐγίγνοντο πολλοί, τοῦ θέρους δ' εἰσβάλλοντος ἕλκη κατὰ τὸ δέρμα τῶν φαγόντων οὐκ ὀλίγοις ἤ τι σύμπτωμα ἕτερον ἐγίγνετο κακοχυμίας ἐνδεικτικόν (cf. *CMG* 6.518.10).

[20] For data on Roman government interventions in the grain market and the purchase of grain to supply Roman requirements see Temin 2013, 29. Vide also Garnsey 1988, 69-86; 182-197; 218-243.

[21] Cf. Spurr 1983.

Roman agronomists debated on the most suitable type of soil for cultivation, however, they did say that there was no generalized awareness as to how to nurture this cereal. It was Columella who best seemed to identify the needs of this crop. This Latin agronomist said that millet did well in sunny, loose terrain, also in sand, if watered, or planted in a wet environment. It did not prosper on dry, extremely poor soil (Col. 2.9.17). In this context, Galen agrees with Cato, who recommends rich soils in humid areas (Cat. *Agr*. 5.6.1) for planting rape, turnips, millet and panic-grass. It should be noted that this statement refers to the Italian peninsula, which was also mentioned by Pliny (cf. Plin. *Nat*. 18.100-1). Later, the same author notes that this cereal does not do well in irrigated areas during the summer, unlike most crops, so should receive less water; this agrees with Theophrastus' teachings (*HP* 8.7.3). The variety and volume of comments denotes its widespread cultivation and the easy adaptation of millet to zones of higher ground or that are close to large water sources in the Mediterranean area. Galen did not directly compare millet with other cereals, at least in respect to its properties for baking, most likely because of its low quality. Still, humans did consume this cereal (cf. *CMG* 6.523.10-524.1), and consumption of poor quality grain is noted for other crops, such as *Zea*. Consumption may have been out of necessity (cf. *CMG* 6.5131-513.10)[22].

Millet does not seem to have been the most popular cereal for human consumption but it was, and still is, a source of food for livestock, serving as fodder for farm animals (Col. 6.3.3; Cat. *Agr*. 54.4). Columella gives instructions on how to prepare it (cf. Col. 6.24.5). Both Diocles of Athens and Celsus refer to it as a potential *pharmacon* (cf. Plin. *Nat*. 22.30; Col. 6.12.4), but there is not a great deal of information on the importance of this cereal for bread production (vide table 1.4), although it may have been widespread.

Conclusion

Galen's observations are important not only for the study of ancient medicine and culinary history, but also for understanding the productive and economic value of certain goods within social history. Galen would not be the only scholar considering these matters and relating those products with an empirical and generalized consumption, therefore, his assumptions probably reflected a historical reality. Galen's observations would reflect demand, production and cost of breads for the consumer: the variables defining the volume of consumption of each cereal by the general population.

This brief survey has aimed to systematize the information on grain provided by Galen in the first book of *de alimentorum facultatibus*, to make it more accessible to other researchers working in different fields of science, and hopefully bring some light to blind spots in the realm of archaeology. The first volume of *De. Alim*. is an important source for knowledge on the consumption of and the attitude toward cereal in antiquity, not so much for the encyclopaedic information it can provide, but for the explanation of what seems to be the generalized and traditional knowledge respect on different types of grain

[22] Columella mentions *zea* as a grain used among the Greeks to feed animals and also that it was known also as *carnicis* or *tripharis* (*De arboribus* 28.1).

in Galen's time. The following tables summarize the information provided by Galen in his treaty.

Listed cereals

Table I.1 The quality of wheat for baking, dense vs. porous: consistency, nutrition and appearance

Mass F (density)	**Nutrition**	**Appearance**	**Mixed bran (Πιτυρίας) – f. proportional**	**Flour Purity**	**Volume F (nutrition)**	**Digestive potential**	**Excretory potential**
Dense (*CMG* 6.481.1; 483.5-15)	Superior (*CMG* 6.481.1-5; 483.5-15)	Yellower (*CMG* 6.481.1-10; 522.1-10)	Inferior	Superior	Smaller (*CMG* 6.481.1-10)	Superior (= all cereals (*CMG* 6.520.15-521.5)	Inferior (= all cereals (*CMG* 6.520.15-521.5)
Porous (*CMG* 6.481.1-5; 483.5-15)	Inferior (*CMG* 6.481.1-5; 483.5-15)	Whitish (*CMG* 6.481.1-10; 522.10-15)	Superior	Inferior	Scattered	Inferior (= all cereals (*CMG* 6.520.15-521.5)	Superior (= all cereals (*CMG* 6.520.15-521.5)

Table I.2 The quality of barley for baking: consistency, nutrition and appearance [23]

Mass F (density)	**Nutrition**	**Appearance**	**Mixed bran – f. (Proportional)**	**Flour Purity**	**Volume F (Nutrition)**	**Digestive potential**	**Excretory potential**
Dense (*CMG* 6.504.10-15)	Superior (*CMG* 6.504.10-15; 6.522.5)	Whitish (*CMG* 6.522.5; 504.10-506.5)	F = wheat (*CMG* 6.501.1-503.5)	F = wheat	F = wheat	Superior (= all cereals *CMG* 6.520.15-521.5)	Inferior (= all cereals *CMG* 6.520.15-521.5)
Porous	Inferior (*CMG* 6.504.10-15)	Yellower (*CMG* 6.504.10-15)	F = wheat (*CMG* 6.506.5-15)	F = wheat	F = wheat	Inferior (= all cereals *CMG* 6.520.15-521.5)	Superior (= all cereals *CMG* 6.520.15-521.5)

[23] The author notes the superficial evaluation as an unreliable method of verification, when made on the basis of external appearance, weight and colour (cf. *CMG* 6.481-15).

Table I.3 The quality of *tyfe*, *olyra* and *zea* for baking: consistency, nutrition and appearance

	Massa F (density)	**Nutrition**	**Appearance**	**Mixed bran – f. (proportional)**	**Flour Purity**	**Volume F (nutrition)**	**Digestive potential**	**Excretory potential**
Tifê (F = wheat?) (wheatgrass? *CMG* 6.522.1-10) (*CMG* 6.522.10; 520.5-15; 517.15-519.10)	Dense (smaller c / wheat) (*CMG* 6.522.5)	Superior	yellower (**reddish** c/ wheat) (*CMG* 6.522.1)	Inferior	Superior	Smaller	Superior (= all cereals 520.15-521.5)	Inferior (= all cereals 520.15-521.5)
	Porous (smaller c / wheat) (*CMG* 6.522.5)	Inferior	Whitish	Superior	Inferior	Scattered	Inferior (= all cereals 520.15-521.5)	Superior (= all cereals 520.15-521.5)
Olyra (*CMG* 6.522.1)	(= *tifé*?)	(= *tifé*?)	White (*CMG* 6.522.1)	(= *tifé*?)	(= *tifé*?)	(= *tifé*?)	Superior (= all cereals 520.15-521.5)	Inferior (= all cereals 520.15-521.5)
	(= *tifé*?)	(= *tifé*?)		(= *tifé*?)	(= *tifé*?)	(= *tifé*?)	Inferior (= all cereals 520.15-521.5)	Superior (= all cereals 520.15-521.5)
Zeia (=*Olyra*? Hesiod *CMG* 6.516.10)	?	?	?	?	?	?	Superior (= all cereals 520.15-521.5)	Inferior (= all cereals 520.15-521.5)
	?	?	?	?	?	?	Inferior (= all cereals 520.15-521.5)	Superior (= all cereals 520.15-521.5)

Table I.4 - Other cereals referred for baking

Millet	It is considered a neutral food for it has a smaller nutritional value and causes little effects on the body (*CMG* 6.523.15-524.5).
Oat	It has a low consumption rate and it is of hard excretion (*CMG* 6.522.15-523.5).

Table II. Types of flour for baking: general considerations

Cereal	**Nutrition: f. Quality (density)**	**Consumption volume**	**Terms of use**	**Regions where they are regularly consumed**	**Rude quality**
Wheat	High (> barley)	High (= barley) (*CMG* 6.504.5-15)	Staple food	All regions of the empire	Generates poor nutritious food of hard digestion
Δ Semolina of wheat (*CMG* 6.496.5-497.5)	High (< Wheat) (*CMG* 6.496.5-497.5)				
Barley	High (< Wheat)	High (= Wheat) (*CMG* 6.510.15-511.1)	Staple food	All regions of the empire	Generates poor nutritious food of hard digestion (> rude Wheat)
Zea [24]	??? < Wheat	< Barley < Wheat (*CMG* 6.510.15-511.1)	food shortage (*CMG* 6.515.15-516.1)	Cold regions (*CMG* 6.511.1-514.10) Egypt (Herodotus. *Historiae* 2.32) (*CMG* 6.516.10-15)	
Tyfê or *Briza** (Βρίζα) (*CMG* 6.514.1-10; 6.517.15-519.15)	< Barley < Wheat (*CMG* 6.510.15-511.1)	< Barley < Wheat (*CMG* 6.510.15-511.1)	food shortage instead of wheat sold to the cities (*CMG* 6.517.1-15)	Regions of Thrace; Macedonia; Asia Minor; Pergamum region (*CMG* 6.517.15-518.5); Misia (*CMG* 6.522.5-523.1); Nicaea (*CMG* 6.515.5-516.1)	

*[24] Menesitheos' commentaries (*CMG* 6.512.5-513.10) quoted by Galen where not considered for the analysis of these cereals.

Cereal	**Nutrition: f. Quality (density)**	**Consumption volume**	**Terms of use**	**Regions where they are regularly consumed**	**Rude quality**
Olyra *	< Barley < *Olya* < Wheat (*CMG* 6.517.1-519.10)	< Barley < Wheat (*CMG* 6.510.15-511.1)	Food shortage (*CMG* 6.517.15-518.5)		
Oat	Inferior (*CMG* 6.522.5-523.5) (for animals?)	< *Zeia, tyfê, Olyra* < Barley < Wheat (*CMG* 6.522.5-523.5)	Food shortage (*CMG* 6.522.5-523.5)	Asia Minor; Misia (*CMG* 6.522.5-523.5)	

Abbreviations

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