

STUDY OF MICROBIOLOGICAL QUALITY OF DIFFERENT VARIETIES OF WHEAT FOR PROCESSING FLOUR

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ABSTRACT

Wheat is one of the main food crops among cereals, after rice. The high microbiological and physico-chemical quality of wheat will be reflected in the best technological properties of wheat and obtaining a better-quality flour. The purpose of the study is to evaluate the composition and microbial load of the samples of different wheat varieties and to evaluate their compatibility with the allowed norms. A key factor in the selection of wheat samples for flour is the moisture content, it is an indicator of quality. The analyzed samples represent wheat of different import and domestic varieties. Moisture content % of wheat samples was determined by the standard method. Microbiological parameters were determined by the standard method of cultivation in Petri dish, with medium PCA, PDA, Capek, Mc Concey, incubation temperatures 30°C and 37°C for 72 hours and the total mesophilic microflora (bacteria, yeast fungi) total coliforms was determined. It resulted that the total mesophilic microflora of the studied wheat samples consists mainly of the highest presence of bacteria and then of fungi. Total aerobic mesophilic microbial load and moisture is within allowed norms. Has resulted in a presence and total coliform bacteria ranging up to the order of 10^3 cfu / gr. From the various colonies developed in Petri dishes, it is observed that fungi are mainly dominated by moulds of the genera *Penicillium spp*, *Aspergillus niger spp*, *Trichoderma spp*, *Mucor spp*, *Fusarium*, *Cladosporium spp*, *Rhizopus spp*. In terms of bacterial load, what prevails are: *Pseudomonas spp*, *Bacillus*, *Mircrococce* etc.

Keywords: Wheat, varieties, evaluate, bacteria, fungi, technological properties, flour.

INTRODUCTION

Wheat is one of the main food crops among cereals, after rice. It can be described as "daily bread". It occupies a main place for the food of the population but also of livestock. Since wheat is a major raw material for the production of other grain-based food products such as flour and other by-products, we can say that it is very important to evaluate the quality of the different varieties of wheat that are processed for flour. The high microbiological and physico-chemical quality of wheat will be reflected in the best technological properties of wheat and in obtaining a better-quality flour. Wheat microflora generally consists of yeast bacteria (Placinta, C.M.; D'Mello, C.P.F.; MacDonald, A.M.C, Magan, N.; Aldred, D.; Mylona, K.; Lambert, R.J.W, Magan, N.; Hope, R.;

Cairns, V.; Aldred, D) The sources of contamination of wheat can be from the field to its storage and processing for flour. (Los, A., Ziuzina, D., & Bourke, P. (2018)., Berghofer et al., 2003). A key factor in the selection of wheat samples for flour is the moisture content, an indicator of quality (storage conditions of wheat. The higher the moisture content of wheat, the higher the chances of development and increase of microbial load, development of protolytic and lipolytic reactions which consequently reduce the nutritional values of wheat and physico-chemical and technological properties of wheat for flour (Trajković et al., 1983). For this reason, our study focused on the study of the composition and microbial load and moisture content of samples of different varieties of wheat for flour processing and the assessment of their compatibility with permitted norms.

MATERIAL AND METHODS

Materials

For our study, wheat samples were taken from the main varieties used for flour processing in the southern part of Albania. These samples represent native and imported samples. Strong Russian wheat tilted to hard (limestone), Serbian wheat - soft (flour), Greek white wheat - soft (flour), Greek yellow wheat - hard (glassy), Korca wheat. The study was focused on some microbiological and moisture content analyzes, performed at the laboratories of Microbiology and Food Technology, of our Faculty (FSHN). The purpose of this paper is: evaluation of physico-chemical characteristics of wheat: moisture content as an indicator of quality storage conditions of wheat and evaluation of microbial load of samples of different wheat varieties: determination of total mesophilic aerobic microflora (bacteria, yeast, mould) and total coliforms. Samples were taken according to the rules of storage of sterile conditions in order to avoid their contamination by the microflora of the environment and air. (Regulation, No 53/83). The subject of research has been not only the microflora of wheat grain (total aerobic mesophilic microflora, molds and yeasts), but also the determining the microflora of the wheat grain embryo. Determination of the total number of microorganisms: (bacteria, yeast and fungi) and total coliforms was done with the standard method of cultivation into Petri dishes with standard medium PCA, PDA, Czapek, Mc Concey. All Petri dishes were incubated in thermostat at 30 °C 37°C for 72 hours. The determination of the embryo microflora was done on Capek solid medium, incubation temperature 30 °C for 72 hours. The standard method was used to determine the moisture content.

RESULTS

From the analyzes performed for each sample the results were organized in the following tables:

The formula was used to calculate the microbiological load:

Where: C- number of total colonies counted by dishes - number of colonies of first dilution dishes - number of colonies of second dilution dishes - number of previous dilutions.

To determine the moisture content (%) was used the formula as below:

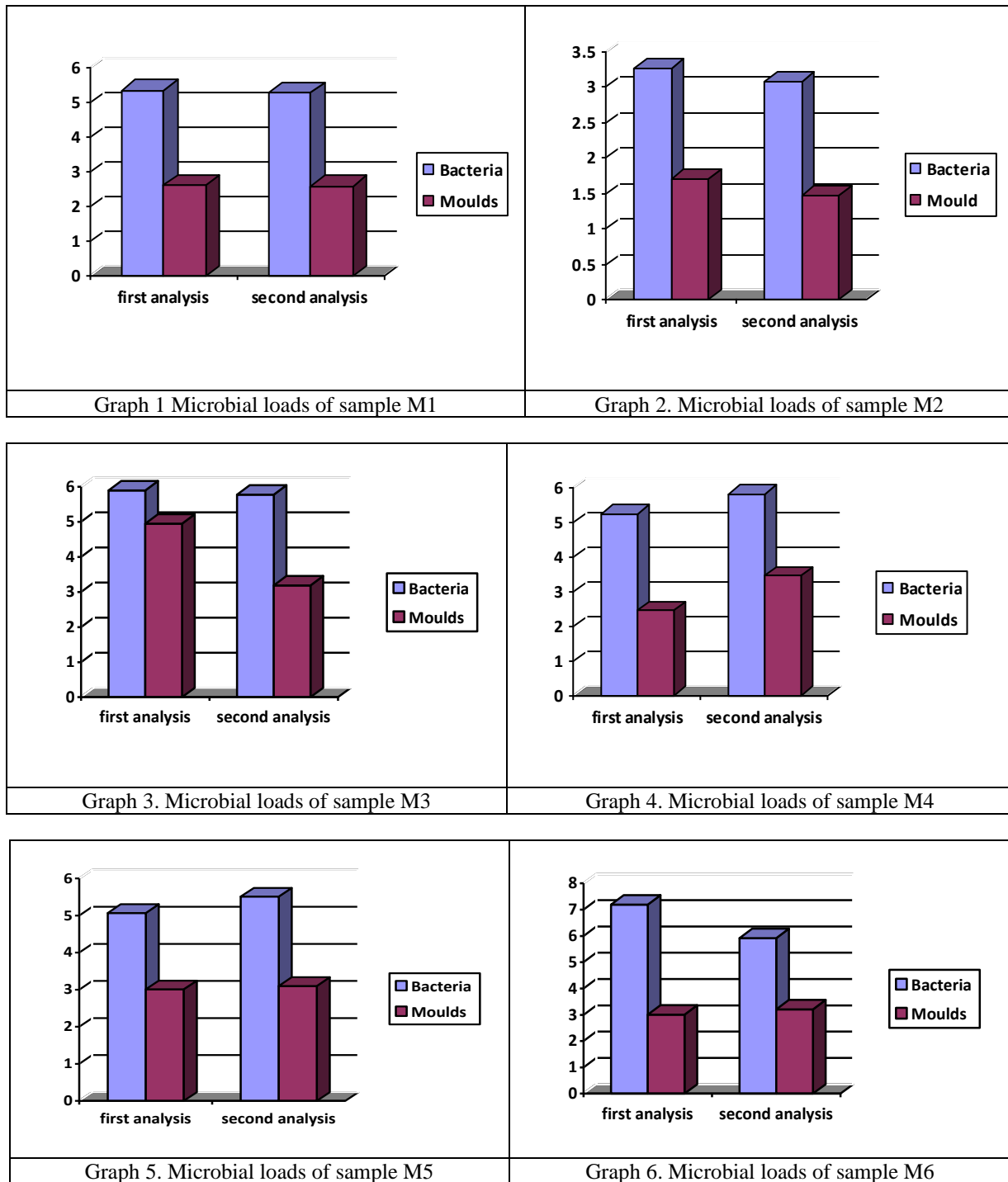
$1\% = (\text{weight of cup} + \text{sample weight before drying}) - (\text{weight of cup and sample after drying}) / \text{sample weight} * 100$

Table1. Total microbial loads of wheat samples in two analysis

Samples of wheat	Total mesophilic aerobic load N1 (cfu/gr)	Total mesophilic aerobic load N2 (cfu/gr)	N TOTAL Cfu/gr	Coliform bacteria Cfu/gr
M1	$1.65*10^1$	$1.63*10^1$	$33*10^1$	71
M2	$1.88*10^1$	$1.78*10^1$	$37*10^1$	49
M3	$4.98*10^3$	$1.28*10^2$	$5*10^3$	41
M4	$1.16*10^2$	$1.36*10^2$	$3*10^2$	66
M5	$1.13*10^2$	$1.19*10^2$	$2*10^2$	118
M6	$1.73*10^3$	$1.35*10^2$	$19*10^2$	68

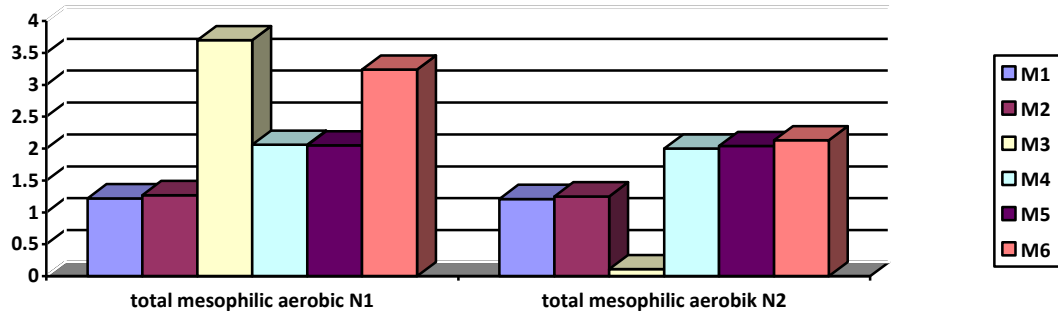
From the summary table above, it can be seen that the microflora of the studied wheat samples consists mainly of bacteria that occupy a higher number and then molds. we did not result in the presence of peaks. Also, it is seen that we have total coliform bacteria content. As can be seen, bacterial microflora predominates, followed by fungi and

not yeast. All the microbiological parameters studied are within the allowed microbiological norms of wheat for flour 5×10^3 cfu / gr (food safety reference microbiology standard of grain safety). Referring to the table above the logarithmic graphs of the microbial composition of each are constructed



The total bacterial load varies from 10^1 to 10^3 cfu / gr. For this parameter decreases in repeated analyzes for the same grain samples. The highest aerobic mesophilic load sample has sample M3 and then M6 and the lower aerobic

mesophilic load has sample M1, M2 M5, M4. The M3 M6 samples has a reduced of total mesophilic aerobic load from order 10^3 to order 10^2 cfu/gr in two estimated, thus improving their microbiological quality will be reflected into the microbiological flour quality. The higher the microbial load of the wheat as result the higher is this load on the flour obtained from it. Samples M4 and M5 have the same stability regarding to this parameter. For M3 and M6 samples should be taken care in controlling of the factors that affect their microbial load. This is also reflected in the general graph below:

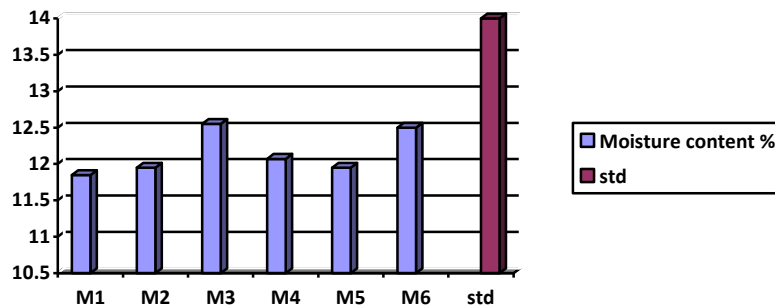


Graph 7. log values of total mesophilic aerobic load of all samples, in two analyses

Various colonies of moulds are developed in Petri dishes, such as: *Penicillium spp*, *Aspergillus niger spp*, *Trichoderma spp*, *Mucor spp* *Fusarium*, *Cladospirium spp*, *Rhizopus spp*. In terms of bacterial load, what prevails are: *Pseudomonas spp*, *Bacillus Mircrococce etc*. The sources of contamination of wheat can be from the field to its storage and processing for flour. (Los, A., Ziuzina, D., & Bourke, P. (2018) Berghofer et al., 2003). A main indicator of storage wheat quality is the moisture content (%) of wheat samples (Trajković et al., 1983).. Below is the table of % moisture content of all samples.

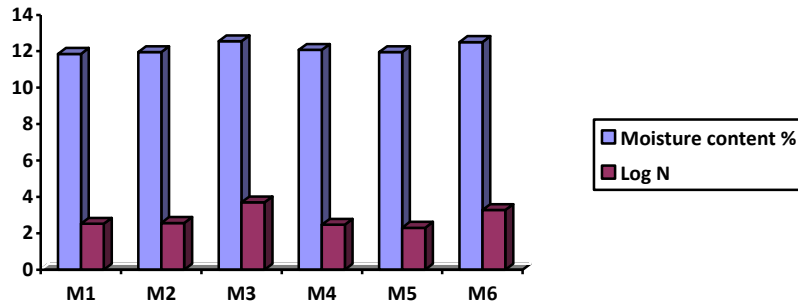
Table 2. The moisture content % values of wheat samples

Samples	Moisture content %	Standard
M1	11.85	Not more than 14%
M2	11.95	
M3	12.55	
M4	12.07	
M5	11.95	
M6	12.50	



Graph 8. Values of moisture content (%) for all samples

Wheat grain moisture content is one of the factors that affect the microbial load of wheat grain. the higher the % of moisture the higher will be the possibility of growth of microorganisms and the possibility of proteolytic and lipolytic reactions activation which reduce the quality and safety of wheat grain and its technological properties for its processing for flour. (Trajković et al., 1983) (Minali Masih, Tushar V. Desale and Shivani Saini. 2020).



Graph 9. Values of moisture content % and log N total mesophilic aerobic bacteria for all samples

Based on the above graph, which shows the relationship between % moisture and total N microflora, we see that sample M3 has the highest % moisture and also the highest value of total log N because the higher the moisture the more will be developed mean. M1 sample that has the lowest moisture value also has the lowest total N log value.

CONCLUSIONS

- For all samples, the microflora composition of the wheat grain, consists of bacteria and fungi, where bacteria colonies have the highest presence and then moulds. The main factors can be: from the fields to storage conditions (variety, different processing operations such as harvesting, transportation, cleaning, air insects, dust, season (temperature relative humidity) etc.
- All samples were found to contain moulds. Their presence is low, but should be taken care in their control. Since moulds are the main pests of the technological properties changes in grain during storage or processing, they pose a potential risk, all these values are within the allowed norms. The presence of moulds in wheat samples, is related to storage conditions, air, seasonal conditions, variety (physico-chemical characteristics), etc.
- Sample M3 has the highest total microbial load, then sample M6 is of the order of 10^3 cfu/gr. The lowest is sample M1, M2 of the order of 10^1 cfu/gr and then M4 of the order of 10^2 cfu/gr. From the graphic, all samples have a decrease in the microbial load in the order of 10^2 cfu/gr. Sample M4 and M 5 has kept the same order (10^2 cfu/gr).
- It is seen that we have a significant load of total coliform bacteria. This load bacterial mainly varies up to 10^{*3} cfu/gr. It is observed that high bacterial load presents samples Russian wheat and lower farcella yellow wheat. It turns out that from the analysis of repeated for the same samples these results improve. Some samples have maintained the same microbiological quality in all repeated analyses.
- It is observed that dominant moulds genus are: *Penicillium spp*, *Aspergillus niger spp*, *Trichoderma spp.*, *Mucor spp.*, *Fusarium*, *Cladospodium spp*, *Rhizopus spp*. In terms of bacterial load, what prevails are: *Pseudomonas spp*, *Bacillus Mircrococce etc*.
- The microbial quality of wheat is important to ensure a high-quality flour microbial. The higher the microbial load of wheat, this load will be reflected in the flour obtained from the processing. For this, one must be very careful in controlling every factor that influence the microbial load of wheat from the field to the moment of its storage and processing.
- Based on the sample graph above, showing the relationship between % moisture content and N total aerobic mesophilic microflora, we see that sample M3 has the highest moisture content (%) and also the highest total mesophilic total N load, while sample M1, which has the lowest moisture value, also has the lowest value of total mesophilic total N load.
- Moisture is also an indicator of grain stability. A grain with a higher moisture content has more premises for the development of bacteria and moulds and as a consequence a shorter storage period. Also, the moisture content is an indicator of the quality of wheat for flour.

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