PROSPECTS OF THE USE OF VITAMIN AND MINERAL COMPLEXES DEVELOPED FOR ELIMINATION OF IRON AND ACID FOLIC DEFICIENCY IN THE REPUBLIC OF MOLDOVA

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Abstract: Practical Scientific Institute of Horticulture and Food Technology performs activities to implement the National Programme 2012 on approval of measures to reduce diseases caused by deficiency of iron and folic acid. There were developed two groups of vitamin and mineral complexes for fortification of the superior quality wheat flour in the Laboratory of Functional Foods: I type - complexes of vitamins and minerals including iron in its various forms with vitamins (B1, B2, B6, B9, PP) and type II - iron complexes including its various forms and folic acid (B9).
Under industrial conditions fortified flour was prepared and analyzed for the establishment of shelf life and quality parameters. Tasting industrial bakery samples made from fortified wheat flour and regular flour mentioned the identity of organoleptic characteristics, including appearance (shape, size and color) pulp status, taste and smell. Consumption of 250 g bread made from superior quality wheat flour additionally fortified, will allow to meet the daily needs of vitamins in human nutrition up to 30% and of iron up to 40%.
Key words: flour fortification, vitamins, minerals, complexes

Epidemiological surveys carried by UNICEF and the Ministry of Health of the Republic of Moldova indicate the lack of micronutrients affecting significant part of youth and adult population. Micronutrient deficiency in Moldova hasn't been revealed in a limited category of children and adults; it is typical for almost all populations in all regions of the country:

- More than 30% of children aged 6 to 24 months are at the risk of under-development of the brain due to lack of iron;
- From 75 to 100 infants die each year because of the tough anemia during pregnancy;
- Each year, approximately 50 children are born with abnormalities, including with infantile paralysis due to a deficiency of folic acid;
- Reason for the increase in adult mortality from heart disease and myocardial infarction is a lack of folic acid;
- Because of the adults' loss of productivity due to lack of iron and iodine losses in particular in the Republic of Moldova are about 21.4 million U.S. dollars per year, or 0.7% of GDP [1].

The most effective and affordable way of micronutrients and vitamins availability is further enrichment of foodstuff of mass consumption such as, flour and bakery products with these compounds .

Fortification of food products should not worsen their quality and consumer characteristics, for example to change significantly the taste and digestibility of the other

important nutrients found in them, to reduce the period of storage, to change the safety performance of food products, etc.

One of the important micronutrients is iron; the various forms of iron deficiency within Moldovan population are over 60%. This population segment suffers from lack of vitamins B_1, B_2, B_6, PP, folic acid, vitamins C, which are involved in various stages of absorption and metabolism of iron in the body.

Food fortification with iron is a difficult task, since the transition metals, readily catalyzes the oxidation processes, such as lipid peroxidation, thereby expediting the rancidity of fats, flour spoilage during storage and destruction of a number of vitamins [2].

There is a wide range of vitamin and mineral supplements for the enrichment of flour and bakery products in world practice. More often as a source of iron is used: electrolytic iron Fe^0; sulphate monohydrate Fe_2+$FeSO_4$•H_2O; Fe_2+sulfate heptahydrate $FeSO_4 \cdot 7H_2O$.

It is known that, for example, heptahydrate of iron in the presence of a small amount of moisture (water activity values $a_w = 0.52$) can influence the lipase and lipoxygenase and initiate flour lipid oxidation [3].

The use of iron in this form is undesirable because it can lead to an acceleration of oxidative damage and reduce the shelf life of flour.

The aim of this work was to determine the effect of various forms of iron compounds, in combination with the introduction of vitamins on the quality of enriched flour.

Flour fortification was made in accordance with the recommendations of [4-7], and the doses recommended by the manufacturers, and considering the initial content of iron in flour.

Fortification of flour was carried out based on the satisfaction of 30-50% of the adult daily requirement of iron and vitamins from the consumption of 200-250 grams of bread. The daily recommended dose for adults is: in iron – 14 mg, vitamin B_1 – 1.4 mg, vitamin E – 18 mg and folic acid – 200 micrograms.

For research was used the wheat flour, freshly ground, obtained in a mill plant district from the Chadyr-Lunga district of the Republic of Moldova.

Flour fortification was conducting using the following vitamin-mineral complexes: "Kolosok-1"– Russia (sample 1), "Fortamin"– Russia (sample 2), "KAP-KOMPLEX-1" – USA (sample 3). As a control (sample 4) was used the original flour without added mineral and vitamin complexes.

Premixes "Fortamin" and "Kolosok-1" contain the following components: iron sulphate Fe_2+monohydrate $FeSO_4 \cdot H_2O$, thiamine (B_1), riboflavin (B_2), pyridoxine (B_6), niacin (PP), folic acid; "KAP-KOMPLEX-1 "- electrolytic iron Fe^0, thiamine (B_1), riboflavin (B_2), pyridoxine (B_6), niacin (PP), folic acid, and are additionally enriched with zinc.

These systems are designed for flour fortification at the stage of production, and also for the enrichment of flour at the stage of kneading the dough.

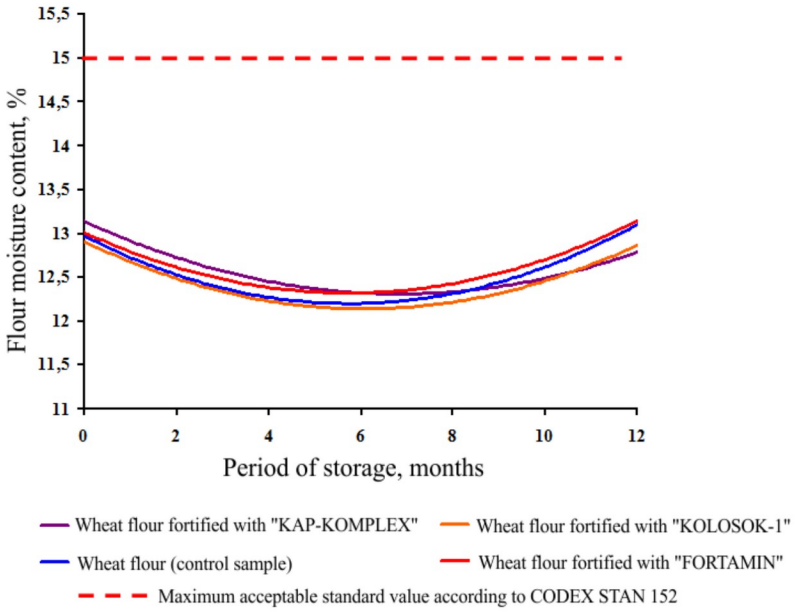

Fig. 1 Changes in moisture content of investigated wheat flour during storage

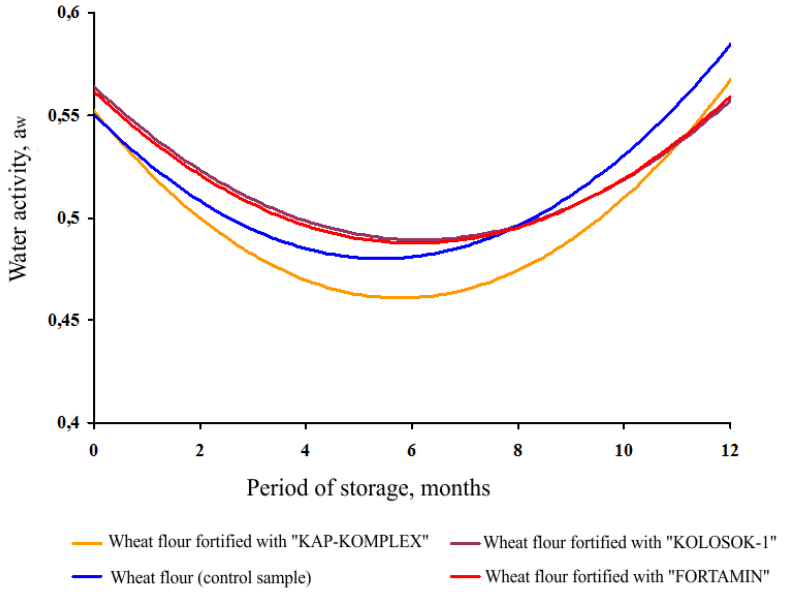

Fig. 2 Changes in water activity level of investigated wheat flour during storage

Storage process is implemented in storage production facilities under unregulated conditions for 12 months of guaranteed storage. Periodicity of the flour quality monitoring (organoleptic, physical, chemical and microbiological parameters) – once in 2 months.

It was found that during the storage of flour organoleptic characteristics (taste, odor, and color) have not changed, both for control and experimental samples.

Microbiological parameters for all the flour samples throughout the research period were similar and did not exceed the standards set for the instant flour for child nutrition, fortified with vitamins and minerals [8].

Flour humidity for all of the samples throughout the storage period was in line with regulatory requirements and was at the level of 12.0% -13.1% (Figure 1).

There was an increase of acidity of the flour from 2.7 degrees to 3.2-3.3 degrees during storage for all samples, including the control samples (Fig. 3), but the organoleptic evidence of food spoilage wasn't revealed.

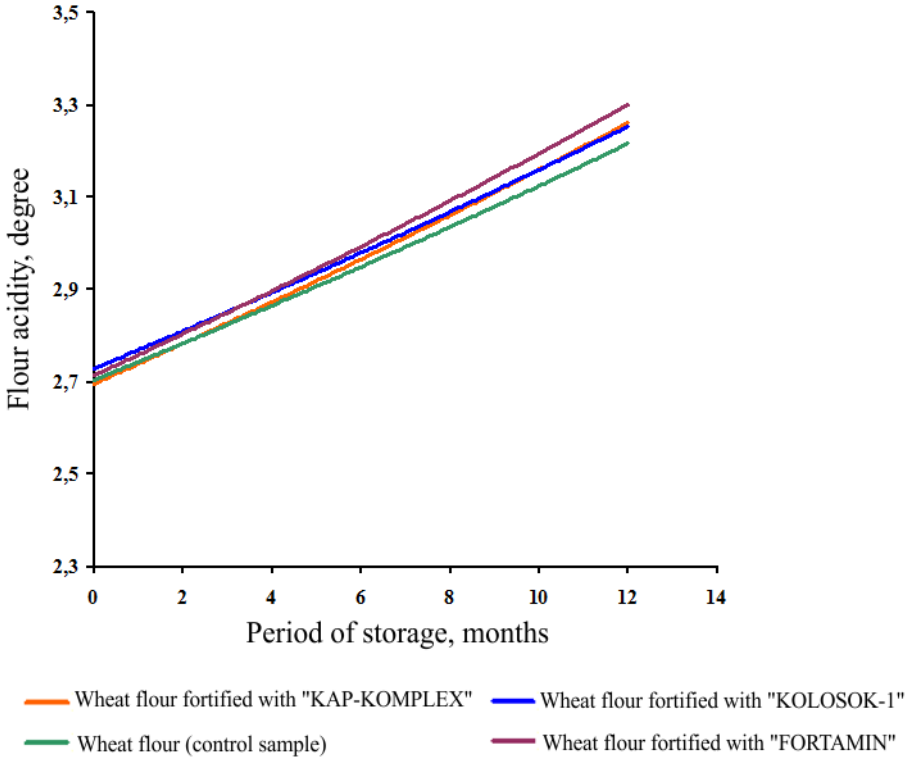

Fig. 3 Changes in acidity of investigated wheat flour during storage

Acid number of fats for wheat flour according to [3] should not exceed 50 mg KOH/ 100 g dry matter.

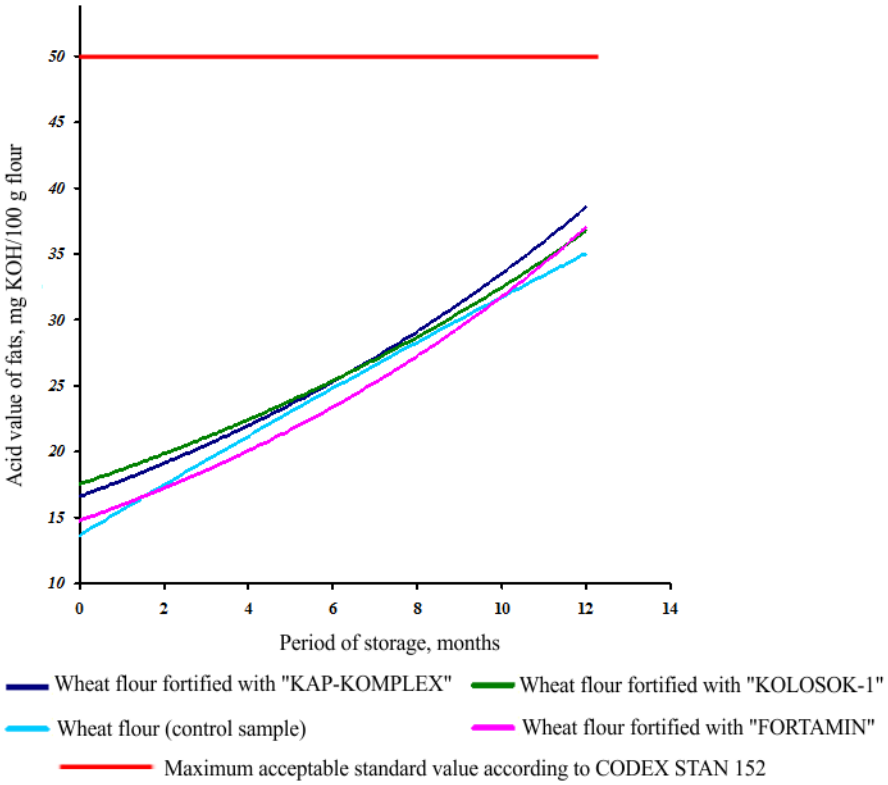

Fig. 4 Influence of vitamin-mineral complexes

There was observed an increase of acid number of fats both for the control and experimental samples of the flour. Acid number of fats of the investigated flour within 12 months of storage increased: for the control by 2.2, fortified flour - by 2.0-2.3 times, while its value is lower than the rated limit (Fig. 4). For the control sample this index does not exceed 65% from the rated value, for the flour enriched with "Kolosok - 1" – 66%, with "Fortamin" – 65%, and with "CAP KOMPEKS" – 68%.

Mass fraction of nicotinic acid during storage varied slightly and was at baseline, both in the control and experimental samples of flour.

During the storage of flour there weren't found any significant effects of the studied vitamin-mineral complexes on the organoleptic and microbiological parameters of the enriched flour.

Storage process is characterized by increasing acidity and acid number of fats in the wheat flour enriched with vitamin and mineral complexes.

Acid numbers of fats during storage increased both for the control and experimental samples, however, for the studied complexes, these indexes do not exceed levels established by CODEX STAN 152 FOR WHEAT FLOUR.

Research is currently being conducted on establishing quality of the wheat flour enriched with a complex containing various forms of iron and folic acid.

Obtained results suggest the possibility of using the studied vitamin and mineral premixes for the fortification of the wheat flour with high consumer properties and guaranteed quality.

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