



. - , :  
 ; -  
 - ;  
 .  
 - , ( [6, 13].

, 700. :

1. 700.
- 2.
- 3.
- 4.

, 700, ( . )  
 2, 3, 4, 5 : . - . - 1, . . - . - ,

**1.**

, ,  
 ,  
 1 [11].  
 1 ( )

25,9%

34%

[14].

450

[18].

[11].

( , , ),

. Dong Chen [31].

[22]. Valerio [64]

[7, 10]

Bong-Kyung

Fermin [33],

[8]  
500

T. Mita H. Matsumoto [43]

$\beta$ -

[60].

2

[6, 11].

[23]

500.

Thomas [62] Pekur [48].

[40],

[51].

[53]

, Onishi

[46]

[25, 66],

[58, 59].

Prieto  
64%

[50]

2

Gobetti [38]

500.

[12]

Bong-Kyung

[22]

( )

[30, 49, 55]

500.

700,

2.

, , :  
 700, 1879:79.  
 2823:92.  
 1,3 100 . 628:77  
 483:72.  
 - 2,38 - 66  
 40% 700  
 (1,35 100 ) 1:1.  
 ( ),  
 QA-212  
 "Labomix".  
 "Aroma" "Lainox"  
 220 . 30-35  
 .( 96 - 98 ).  
 "Merck".

•1 , %-  
 105 , . 754:80;

• , %- , 100  
 , 754:80;  
 • , - ( )  
 4 60- -  
 30 , . [5];  
 • , %- 754:80; -  
 • , %- -  
 700 , 754:80; -  
 • , -  
 - 0,1 N NaOH -  
 , 754:80; -  
 • , %- -  
 . [5].  
 ( ) % :  
 = . ,  
 : - , %;  
 - ;  
 = 5,70;  
 • , - -  
 ( ), 1 10 30 , . [5];  
 • , - -  
 QA - 203.  
 , . [5].  
 :  
 • 100 3 , - , 10 -  
 NaOH -  
 , 483:72;  
 • , -  
 , 35 . ( )  
 .) 70 , . 483:72.  
 :  
 • , %- ,  
 . [5];

• ;  
 - ;  
 • , - 3412:79;  
 • ( ), /D - [5];  
 • -  
 AP-4/2.  
 ( ) 3; 12; 24; 48  
 72 . , . [5];  
 • ( , -  
 )  
 -881 (“Microtechna”), . [15].  
 2007 2008 .,  
 : “ ” -  
 , -  
 ,  
 ” ” -  
 ,  
 .

### 3.

#### 3.1.

**700**

,  
 - ( .1).  
 ,  
 -9,8%.  
 ,  
 [9].



700

1	, %	13,9
2	, %	24,7
3	,	7,7
4	( 9), %	2,6
5	, %	0,692
6	,	1,85
7	,	218
8	:	1'49" 2'06"

[4]

8 25%

[16]

10,3% 12,5%,

[9].

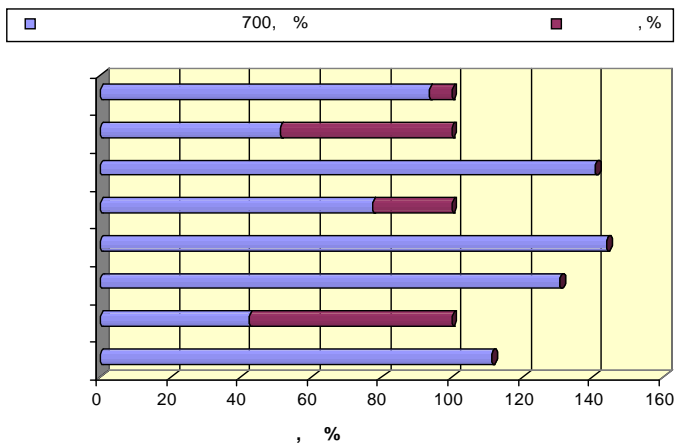
. 2.

700

	700, /100
	5,46
	2,28
	8,98
	5,65
	3,04
	1,38
	1,77
	5,52

.1

700.



.1.

FAO

700

FAO/WHO<sup>3</sup>

42,36%,

- 51,42%

- 6,16%.

700,

44%

- 30,8%,

11,4%

<sup>3</sup> FAO – Food and Agriculture Organization. WHO – World Health Organization.

<sup>4</sup>

. 3

700.

3

700

	700, /100		700, /100
	5,20		3,30
	2,30		3,65
	2,60		6,70
-	4,45		5,14
-	23,40		3,27
	4,80		7,54

/100

- 23,40

[16]

34,60

- 100  
);

100 (

3. 2.

.4

4

	, /100		
			%
	5,30	- 0,16	- 2,93
	2,16	- 0,12	- 5,26
	8,76	- 0,22	- 2,45
	4,79	- 0,86	- 15,22
	4,31	+ 1,27	+ 41,78
	1,92	+ 0,54	+ 39,13
	1,65	- 0,12	- 6,78
	7,24	+ 1,72	+ 31,16

*Sa charomyces cerevisiae.*

[1, 34].

[21, 45],

[52].

56].

1971 .

5 10<sup>8</sup> 1 10<sup>9</sup>

Gobbetti [37] De Vuyst [29].

[2].

[42].

- . 2.

7%, - 5,26%.

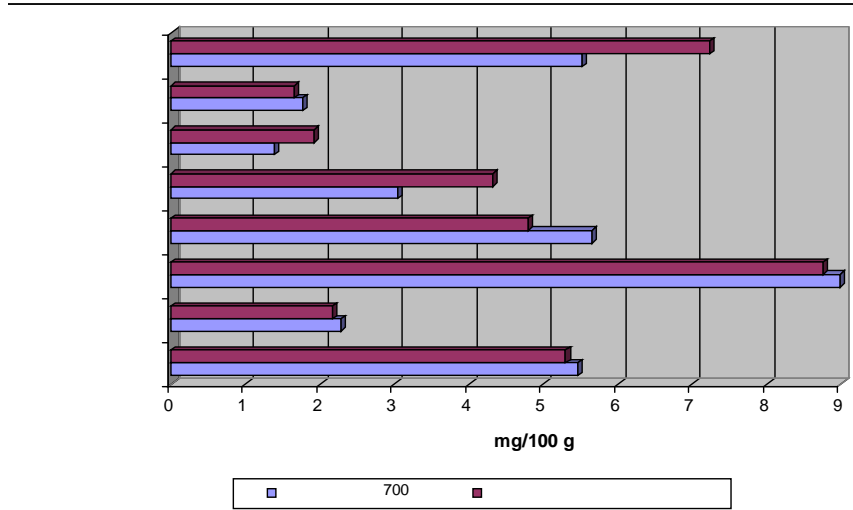
15,22%

[39]. Loenner Ahrne [41]

Corsetti [27].

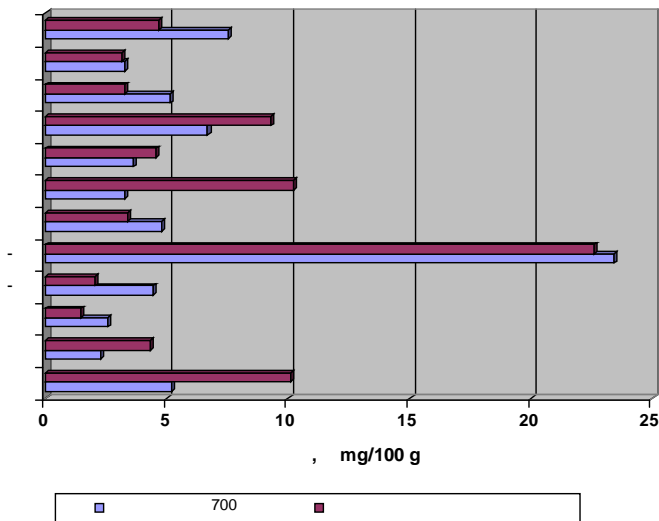
Ottogalli [47],

[3,



. 2.

— 1,27 , — 0,54 , — 1,72 .  
 — , — , 41,78%.



. 3.

.3,

37%,  
43,8%

54%.

[20, 44, 61].  
*Sa charomyces cerevisiae*

Collar [23]

25,48%

38,5%

2,58

( 94,6%)  
2 - , 700. -  
-  
Gerez [24, 54]. [35], -  
80% 12 -  
-  
-  
-  
Gobbetti [36] -  
-  
-  
Gobbetti [36] -  
-  
-  
-  
-  
Thiele -  
[63] -  
-  
Spicher Nierle [57] -  
( , ) -  
( ) -



9,48%.

6%,

**3.3.**

700.

700 5

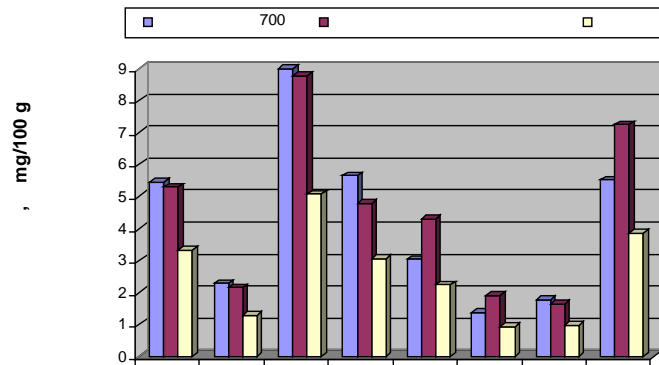
	700, /100
	3,34
	1,29
	5,08
	3,05
	2,25
	0,93
	0,98
	3,87

36,3%.

– 37%.

-42%,  
 -46,5%  
 40% ( -40,3%, -47,8%).  
 51,5%  
 -40,6%

. 4.



. 4.

2,12  
 3,90  
 -46%  
 26%  
 -30 46,5%  
 38,8%  
 43,4%  
 32,6 51,5%  
 48%

700

	/100		/100
	3,38		2,85
	1,56		2,58
	0,94		7,10
-	1,80		2,60
-	19,20		1,76
	2,06		3,40

, , , - -  
 , , , 40% -  
 , , ( - 64% ) -  
 ( Gobbetti 67%). [38] -  
 250 -  
 40 75% , - -  
 , - , -  
 220 . , - -  
 , - , -  
 , - , -  
 ( - ) -  
 . -  
 .5. -  
 . -  
 . -  
 ) ( -  
 . Gobbetti [38] , -  
 350



4.

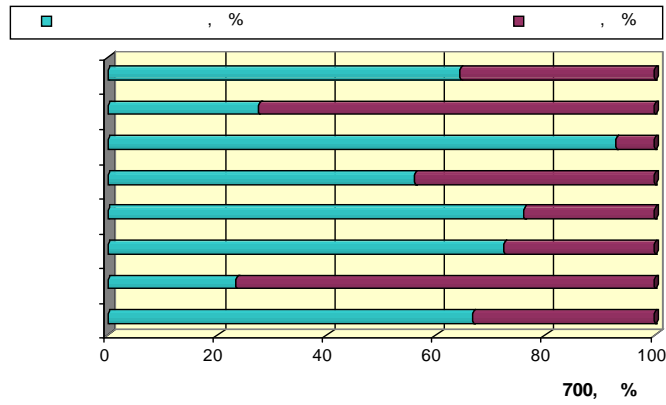
4.1.

FAO – . 6.

5%.

3'

700



. 6.

700

77,8% 74%,  
3/4

[28],

,

[26].

68,2%,

31,8%.

-

,

66%

- 57%.

28%,

- 24%.

( , , ),

( ).

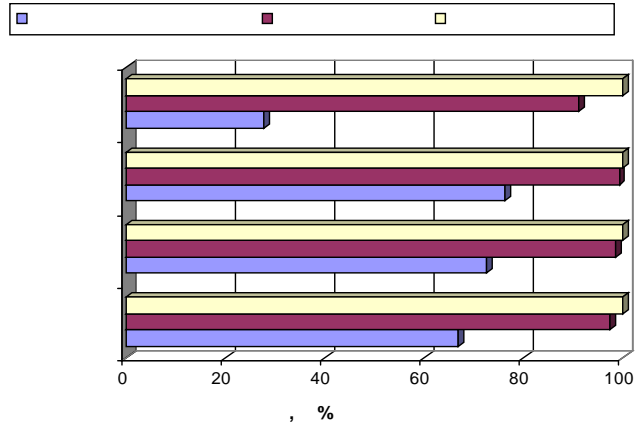
700

FAO,

• ( , , );

• ;





.7.

4.2.

( ).

.7



	1,84	2,76
	5,93	5,06
, %	75	81,6
	0,528	0,668
	1,71	2,57

(B. subtilis)

5,5 - 8,5.

5,1 - 5,4.

75%,

6,6%

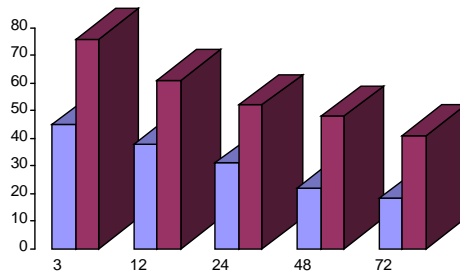
4.3.

: . , -  
 . -  
 .  
 - ( ), ( ) -  
 ( ). 8 -  
 8

	,				
	3 .	12 .	24 .	48 .	72 .
	74	59	52	34	29
,	125	92	79	67	58

, -  
 , , .  
 , -  
 . 3 . 74 -  
 , (72 .)  
 2,55 .  
 ,  
 .3 . 125 -  
 , . . . 1,69 -  
 (72 . ) 58, . . 2 -  
 . 8 ,

(72 . ) , 2,28 -



.8.

.9.

9

	3 .	12 .	24 .	48 .	72 .
	28,3	22,6	18,5	13,0	10,0
,	49,3	31,0	26,5	19,0	17,0

72 .

3 -

, -  
 .  
 1,74 - 1,7.  
 72- ( 48-  
 72- ) - ,  
 . -  
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 36 .  
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 - ( 48 72 . ) ,  
 36- .  
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**5.**  
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 1999 .  
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 58,5 ; - 60 ; - 72 ;  
 84,4 . 2009 . 109,5 .  
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 ( , , ).  
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 2008 . 354 303 .  
 89% , 315 329 . -

26,3% ,  
 232 398 .  
 36 .  
 4 000 ,  
 : ( 65% ) -  
 ,  
 36-  
 ,  
 1,20 . , 2%, . . 4 648 .  
 5 577 600 .  
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 ,  
 ( , ) . -  
 ,  
 30 50% ( 836 640 . 1 394 400 .  
 (2 324 )  
 2 788 800 .  
 ,  
 3 625 440 . 4 183 200 .  
 ,  
 - 48 72 .  
 10% ,  
 ,  
 23 239,8 . ,  
 209 158,2 ,  
 36 , 464 796 4 183 .

3 262 860 3 764 840 .

-0,09%, -0,05%, -0,005% -0,32%.  
100 2,82

.6

(20-25 .)

. , -  
 .  
 700 , -  
 , , -6,16%, - -  
 (57,64%). - 2,30 /100 23,40 /100  
 . -  
 - , , -  
 . -  
 ( ) 51,5% ( ). 36,3%  
 700 FAO -  
 - , - - 700  
 , , .  
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1. , ,, - , . // , 1995, . 2-3, . 18-19.
2. , . // , 1996,

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 - , 1998, . XLIII, . 2, . 229-235.
8. , “ , “ , . .//  
 , 1994, . 5-6, . 19-22.
9. , “ , “ : , 1998.
10. , “ , “ , .  
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11. , “ , . :  
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13. , “ , . .// , 1989, . 11, . 36-40.
14. , “ , “ , . : , 1981.
15. I. :  
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16. , “ , . . 2.  
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17. : , 2008.
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19. , . .// “ -99”. ,  
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#### **A STUDY OF THE CHANGES IN FREE AMINO ACIDS CONTENT DURING THE PRODUCTION OF WHEAT BREAD**

**Prof. Dr Grozdan Karadzov  
Chief Assist. Prof. Dr Denka Zlateva**

##### **Abstract**

The present work studies the content of free amino acids in type 700 wheat flour. There are also determined the changes occurring in their quantity during the technological process of producing bread. It was found that during the fermentation of the dough the content of all amino acids changes, but in different direction and different intensity. As a result of the baking of the bread the quantity of all amino acids decreases, and there is established a considerable deficit of the essential amino acids methionine and lysine, which reduces its nutritional and biological value.

The addition of essential amino acids into bread leads to an increase in its nutritional value and its quality. Enriched bread possesses better preservability, which allows for the realization of economic effect with the start of its production.

#### **UNTERSUCHUNG DER SCHWANKUNGEN DES GEHALTS AN FREIEN AMINOSÄUREN BEI DER PRODUKTION VON WEIZENBROT**

**Prof. Dr. Grozdan Karadshov  
Hauptass. Denka Zlateva**

##### **Zusammenfassung**

In der vorliegenden Studie wird der Gehalt an freien Aminosäuren im Weizenmehl Typ 700 untersucht. Überdies werden die Gehaltsschwankungen im Laufe des Produktionsprozesses beim Brot dargestellt. Wir sind zu der Schlussfolgerung gekommen, dass während der Gärung des Brotteigs der Gehalt an allen Aminosäuren schwankt, aber in verschiedenen Richtungen und mit unterschiedlicher Intensität. Beim fertig gebackenen Brot wird ein verminderter Gehalt an allen Aminosäuren festgestellt, wobei ein erhebliches Defizit an den unersetzlichen Aminosäuren Methionin und Lysin festgestellt wird, was den Nährwert und den biologischen Wert des Brotes reduziert.

Die zusätzliche Anreicherung des Brotes mit unersetzlichen Aminosäuren führt zur Erhöhung seines Nährwertes und seiner Qualität. Das angereicherte Brot besitzt eine bessere Aufbewahrungsfähigkeit, was zusätzlich einen ökonomischen Effekt der Anreicherung mit sich bringt

700.

1.	.....	332
2.	.....	333
3.	.....	337
3.1.	.....	339
3.2.	700.....	339
3.3.	.....	342
4.	.....	348
4.1.	.....	352
4.2.	.....	352
4.3.	.....	355
5.	.....	357
	.....	359
	.....	362
	.....	362
	.....	367
	.....	367
	.....	368