BETA-KAZEINA

wpływ mutacji genetycznej krów na nasze zdrowie

8 marca 2022

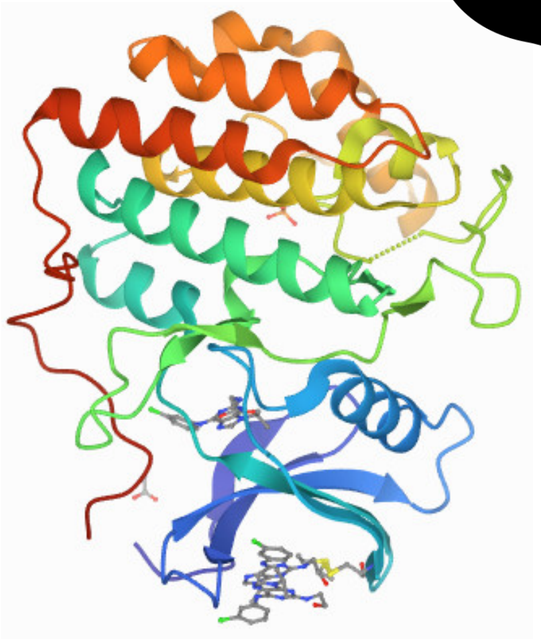
SKN Hexa

Patryk Pastuszek

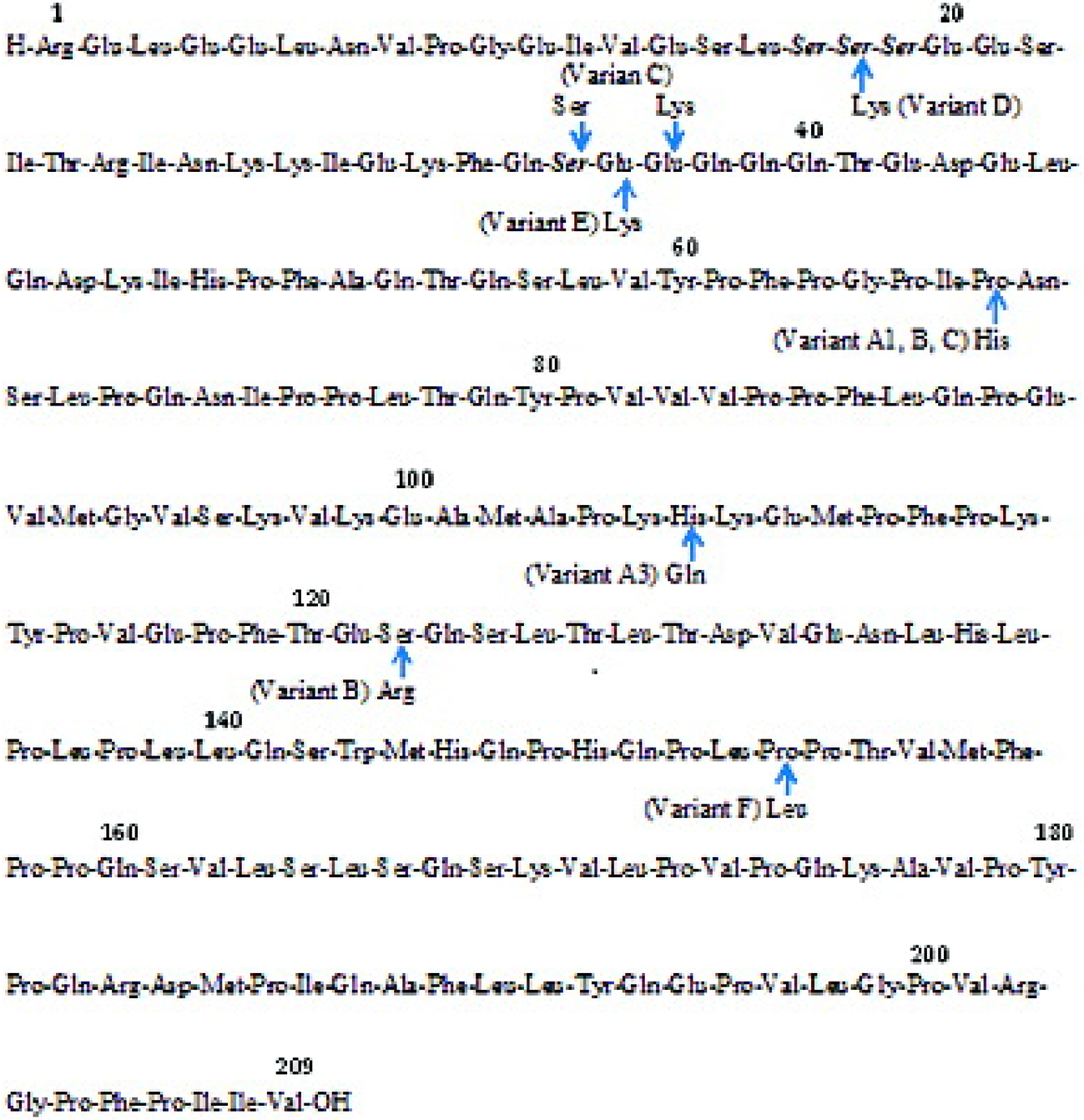
KAZEINA

Białko mleka ssaków

- Nabiał krowi zawiera 4 kazeiny: αs1, αs2, β i κ
- Z czego 13 wariantów beta-kazeiny: A1, A2, A3, A4, B, C, D, E, F, H1, H2, I, H



Enzym ludzki: Casein kinase 1 gamma-1


1
20
H-Arg-Glu-Leu-Glu-Glu-Leu-Asn-Val-Pro-Gly-Glu-Ile-Val-Glu-Ser-Leu-Ser-Ser-Ser-Glu-Glu-Ser-
(Varian C)
Ser
Lys
Lys (Variant D)
40
Ile-Thr-Arg-Ile-Asn-Lys-Lys-Ile-Glu-Lys-Phe-Gln-Ser-Glu-Glu-Gln-Gln-Gln-Thr-Glu-Asp-Glu-Leu-
(Variant E) Lys
60
Gln-Asp-Lys-Ile-His-Pro-Phe-Ala-Gln-Thr-Gln-Ser-Leu-Val-Tyr-Pro-Phe-Pro-Gly-Pro-Ile-Pro-Asn-
(Variant A1, B, C) His
80
Ser-Leu-Pro-Gln-Asn-Ile-Pro-Pro-Leu-Thr-Gln-Tyr-Pro-Val-Val-Val-Pro-Pro-Phe-Leu-Gln-Pro-Glu-
100
Val-Met-Gly-Val-Ser-Lys-Val-Lys-Glu-Ala-Met-Ala-Pro-Lys-His-Lys-Glu-Met-Pro-Phe-Pro-Lys-
(Variant A3) Gln
120
Tyr-Pro-Val-Glu-Pro-Phe-Thr-Glu-Ser-Gln-Ser-Leu-Thr-Leu-Thr-Asp-Val-Glu-Asn-Leu-His-Leu-
(Variant B) Arg
140
Pro-Leu-Pro-Leu-Leu-Gln-Ser-Trp-Met-His-Gln-Pro-His-Gln-Pro-Leu-Pro-Pro-Thr-Val-Met-Phe-
(Variant F) Leu
160
180
Pro-Pro-Gln-Ser-Val-Leu-Ser-Leu-Ser-Gln-Ser-Lys-Val-Leu-Pro-Val-Pro-Gln-Lys-Ala-Val-Pro-Tyr-
200
Pro-Gln-Arg-Asp-Met-Pro-Ile-Gln-Ala-Phe-Leu-Leu-Tyr-Gln-Glu-Pro-Val-Leu-Gly-Pro-Val-Arg-
209
Gly-Pro-Phe-Pro-Ile-Ile-Val-OH

Holsztyno-fryzyjska rasa bydła (dominuje A1)

Guernsey rasa bydła (dominuje A2)

BETA-KAZOMORFINA 7

Dlaczego ser "uzależnia"?

- Przy rozpadzie kazeiny tworzą się kazomorfiny które są peptydami opioidowymi
- Podejrzewa się że działanie tych opioidów może nawet mieć swój udział w tworzeniu silniejszej więzi pomiędzy matką karmiącą a dzieckiem
- beta-kazomorfina 7 jest charakterystyczna dla rozpadu beta-kazein A1

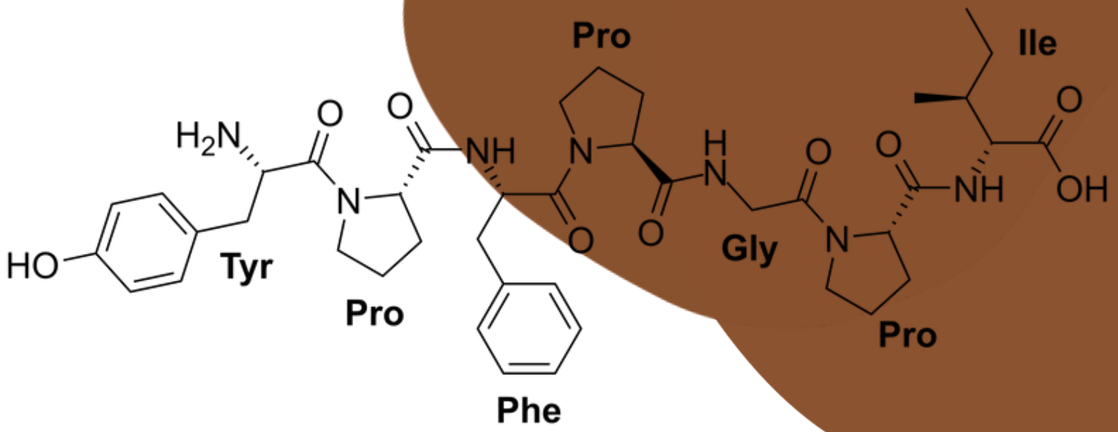
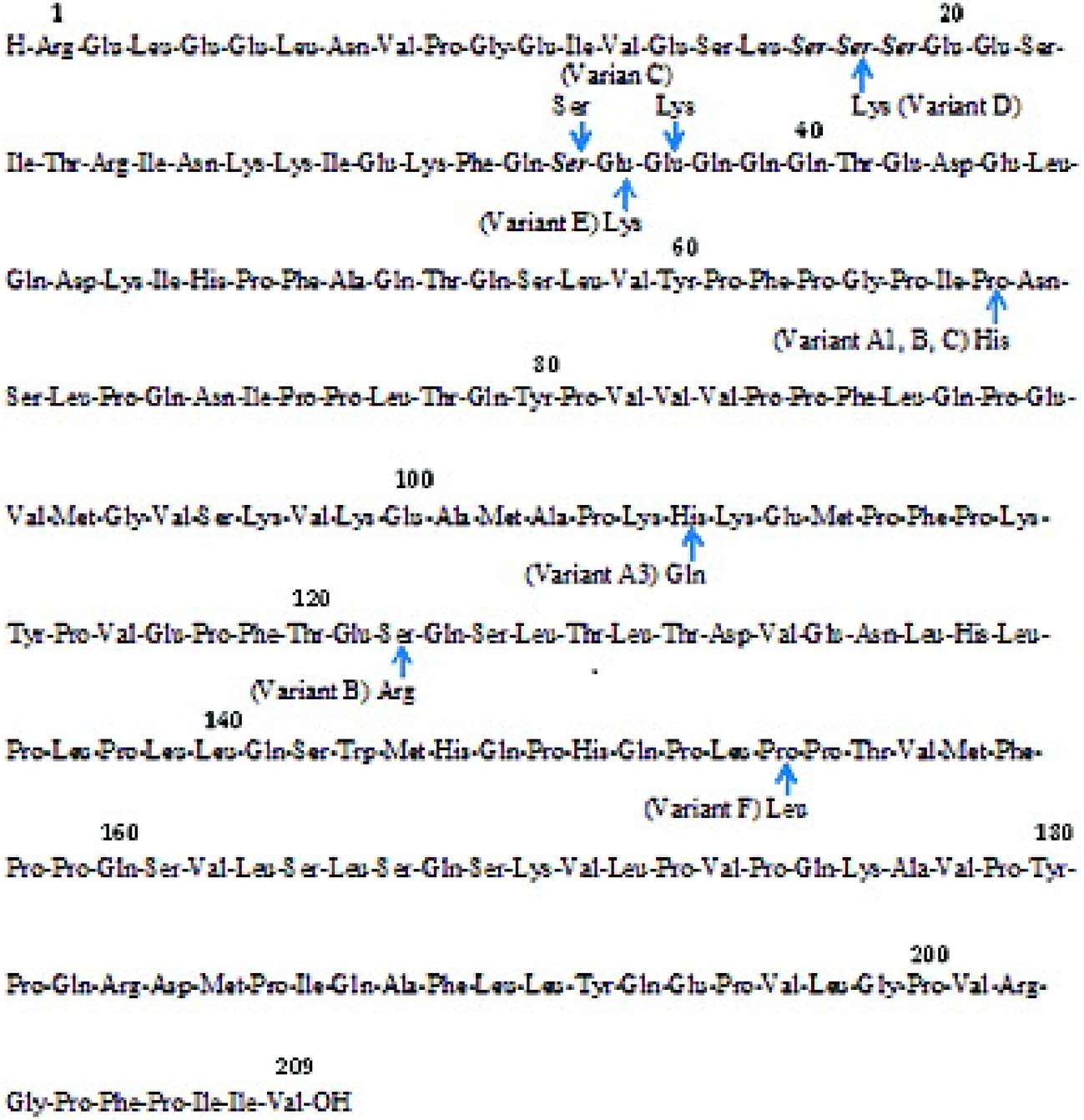


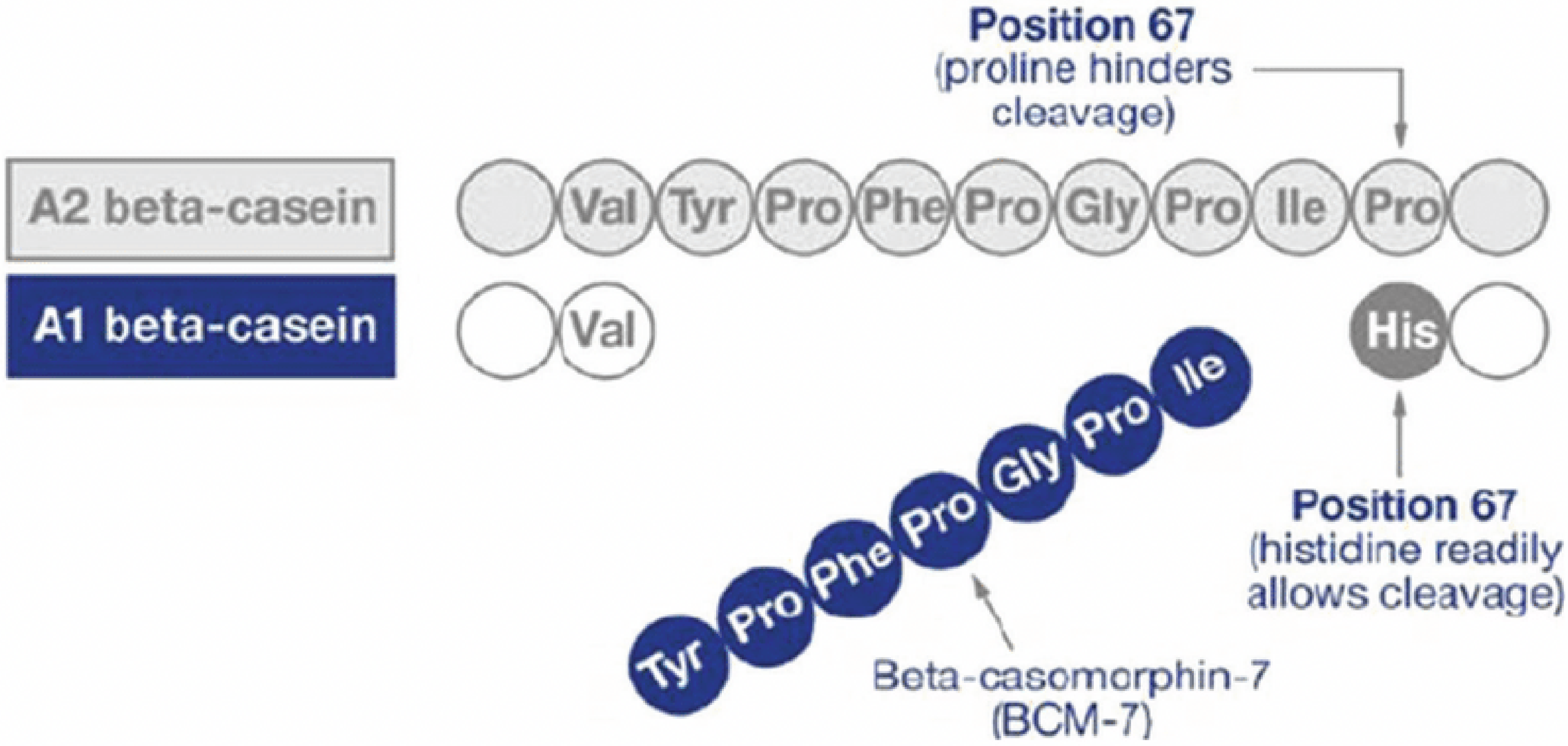
Tabela 1. Zmiany w sekwencji aminokwasów wariantów β-kazeiny (Sebastiani i in., 2020)
Table 1. The change in the amino acid sequence of β-casein variants (Sebastiani et al., 2020)

Wariant beta-kazeiny Beta-casein variant	Pozycje aminokwasów Amino acid position								
	36	37	67	72	88	93	106	122	138
A2	Glu	Glu	Pro	Gln	Leu	Met	His	Ser	Pro
A1	Glu	Glu	His	Gln	Leu	Met	His	Ser	Pro
A3	Glu	Glu	Pro	Gln	Leu	Met	Gln	Ser	Pro
B	Glu	Glu	His	Gln	Leu	Met	His	Arg	Pro
C	Glu	Lys	His	Gln	Leu	Met	His	Ser	Pro
D	Glu	Glu	Pro	Gln	Leu	Met	His	Ser	Pro
E	Lys	Glu	Pro	Gln	Leu	Met	His	Ser	Pro
F	Glu	Glu	His	Gln	Leu	Met	His	Ser	Leu
G	Glu	Glu	His	Gln	Leu	Met	His	Leu	Pro
H1	Glu	Glu	Pro	Gln	Ile	Met	His	Ser	Pro
H2	Glu	Glu	Pro	Glu	Leu	Leu	His	Ser	Glu
I	Glu	Glu	Pro	Gln	Leu	Leu	His	Ser	Pro

Arg – arginina, Gln – glutamina, Glu – kwas glutaminowy, His – histydyna, Ile – izoleucyna, Leu – leucyna, Lys – lizyna, Met – metionina, Pro – prolina, Ser – seryna.

Arg – arginine, Gln – glutamine, Glu – glutamic acid, His – histidine, Ile – isoleucine, Leu – leucine, Lys – lysine, Met – methionine, Pro – proline, Ser – serine.


1
20
H-Arg-Glu-Leu-Glu-Glu-Leu-Asn-Val-Pro-Gly-Glu-Ile-Val-Glu-Ser-Leu-Ser-Ser-Ser-Glu-Glu-Ser-
(Varian C)
Ser
Lys
Lys (Variant D)
40
Ile-Thr-Arg-Ile-Asn-Lys-Lys-Ile-Glu-Lys-Phe-Gln-Ser-Glu-Glu-Gln-Gln-Gln-Thr-Glu-Asp-Glu-Leu-
(Variant E) Lys
60
Gln-Asp-Lys-Ile-His-Pro-Phe-Ala-Gln-Thr-Gln-Ser-Leu-Val-Tyr-Pro-Phe-Pro-Gly-Pro-Ile-Pro-Asn-
(Variant A1, B, C) His
80
Ser-Leu-Pro-Gln-Asn-Ile-Pro-Pro-Leu-Thr-Gln-Tyr-Pro-Val-Val-Val-Pro-Pro-Phe-Leu-Gln-Pro-Glu-
100
Val-Met-Gly-Val-Ser-Lys-Val-Lys-Glu-Ala-Met-Ala-Pro-Lys-His-Lys-Glu-Met-Pro-Phe-Pro-Lys-
(Variant A3) Gln
120
Tyr-Pro-Val-Glu-Pro-Phe-Thr-Glu-Ser-Gln-Ser-Leu-Thr-Leu-Thr-Asp-Val-Glu-Asn-Leu-His-Leu-
(Variant B) Arg
140
Pro-Leu-Pro-Leu-Leu-Gln-Ser-Trp-Met-His-Gln-Pro-His-Gln-Pro-Leu-Pro-Pro-Thr-Val-Met-Phe-
(Variant F) Leu
160
180
Pro-Pro-Gln-Ser-Val-Leu-Ser-Leu-Ser-Gln-Ser-Lys-Val-Leu-Pro-Val-Pro-Gln-Lys-Ala-Val-Pro-Tyr-
200
Pro-Gln-Arg-Asp-Met-Pro-Ile-Gln-Ala-Phe-Leu-Leu-Tyr-Gln-Glu-Pro-Val-Leu-Gly-Pro-Val-Arg-
209
Gly-Pro-Phe-Pro-Ile-Ile-Val-OH



Ryc. 1. Uwalnianie beta-kazomorfiny-7 z wariantu β-kazeiny A1 w układzie pokarmowym człowieka (Woodford, 2009)

Ryc. 1. Release of beta-casomorphine-7 from β-casein A1 variant in the human digestive system (Woodford, 2009)

Cheese	β-casomorphins	Content (μg/g)	References
Brie	BCM7	5–15	Jarmolowska et al. (1999)
		0.15	De Noni and Cattaneo (2010)
		6.48	Sienkiewicz-Szlapka et al. (2009)
	BCM5	3.14	Sienkiewicz-Szlapka et al. (2009)
Cheddar	BCM7	0.11	De Noni and Cattaneo (2010)
	BCM5	Not reported	De Noni and Cattaneo (2010)
	BCM9	Identified	Singh et al. (1997)
Gorgonzola	BCM7	0.01	De Noni and Cattaneo (2010)
	BCM5	Not reported	De Noni and Cattaneo (2010)
Fontina	BCM7	0.04	De Noni and Cattaneo (2010)
	BCM5	Not reported	De Noni and Cattaneo (2010)
Gouda	BCM7	0.06	Sienkiewicz-Szlapka et al. (2009)
		0.1	De Noni and Cattaneo (2010)
	BCM5	0.05	Sienkiewicz-Szlapka et al. (2009)
	BCM9	Identified	Saito et al. (2000); Toelstede and Hofmann (2008)
	BCM10	Identified	Toelstede and Hofmann (2008)
Rokpol	BCM7	1.66	Sienkiewicz-Szlapka et al. (2009)
	BCM5	2.57	Sienkiewicz-Szlapka et al. (2009)
Edamski	BCM7	1	Sienkiewicz-Szlapka et al. (2009)
	BCM5	0.46	Sienkiewicz-Szlapka et al. (2009)
Kasztelan	BCM7	0.04	Sienkiewicz-Szlapka et al. (2009)
	BCM5	0.14	Sienkiewicz-Szlapka et al. (2009)
Taleggio, Caprino and Grana Padano	BCM7	No detected	De Noni and Cattaneo (2010)
	BCM5	Not reported	De Noni and Cattaneo (2010)
	BCM5	Not reported	De Noni and Cattaneo (2010)

WPŁYW BETA-KAZOMORFINY 7 NA ZDROWIE

01
choroba niedokrwienia serca

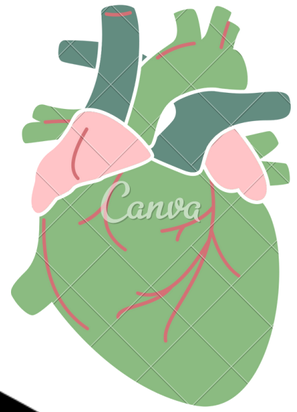
02
miażdżyca

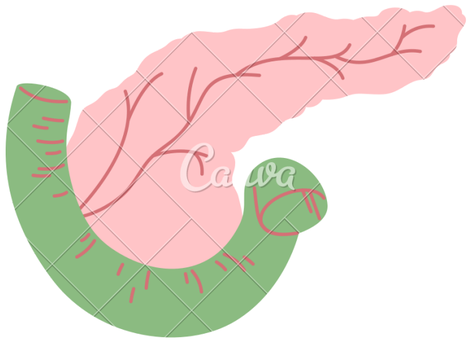
03
cukrzyca typu I

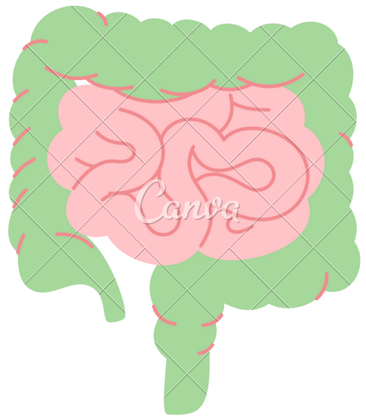
04
zespół nagłej śmierci niemowląt

05
wzdęcia

06
działanie imunosupresyjne w jelitach







WPŁYW BETA-KAZOMORFINY 7 NA ZDROWIE

Badania

"Liczne badania wykazały również związki między β-kazeiną A1 (BCM-7)
a problemami neurologicznymi takimi jak autyzm i schizofrenia"

R e i c h e l t K.L., K n i v s b e r g A.M. (2003). Can the pathophysiology of autism be explained by the nature of the discovered urine peptides? Nutr. Neurosci., 6: 19–28.

K a w a s h t i M.I., A m i n O.R., R o w e h y N.G. (2006). Possible immunological disorders in autism: concomitant autoimmunity and immune tolerance. Egypt J. Immunol., 13: 99–104.

J a r m o ł o w s k a B., B u k a ł o M., F i e d o r o w i c z E., C i e ś l i ń s k a A., K o r d u l e w s k a N.K., M o s z y ń s k a M., Ś w i ą t e c k i A., K o s t y r a E. (2019). Role of milk-derived opioid peptides and proline dipeptidyl peptidase-4 in autism spectrum disorders. Nutrients, 11(1): 87.

N i e b u h r D.W., L i Y., C o w a n D.N., We b e r N.S., F i s h e r J.A., F o r d G.M, et al. (2011). Association between bovine casein antibody and new onset schizophrenia among US military personnel. Schizophr. Res., 128: 51–55.

ŹRÓDŁA

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- http://sjafs.selcuk.edu.tr/sjafs/article/view/1064
- https://www.healthline.com/nutrition/a1-vs-a2-milk#a1-concerns
- https://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.781189
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- https://rnz.izoo.krakow.pl/files/RNZ_2020_47_2_art02.pdf
- https://upload.wikimedia.org/wikipedia/commons/thumb/3/34/Bovine_%CE%B2-casomorphin_7.svg/2880px-Bovine_%CE%B2-casomorphin_7.svg.png

DYSKUSJA

- https://youtu.be/oakWgLqCwUc
- Badania sponsorowane przez przemysł mleczarski