







# gv†Qi cny I Lv`" cönyß

FISH NUTRITION AND FEED TECHNOLOGY

CPFP 1202

(weGRGW tcöMögi gv†Qi Lv`" I cny bvgK eB t\_†K msKij Z)

~g Af&GvMövj Pvi GÜ i i`vj w†fj c†gU

SCHOOL OF AGRICULTURE & RURAL DEVELOPMENT

evsj v` k Dbß vekte`"vj q

*gv†Qi cNØ I Lv`" cØivß*  
FISH NUTRITION AND FEED TECHNOLOGY

CPFP 1202

*~g Af&GvMkvj Pvi GÜ i i`vj vW†fj c†g>U*  
SCHOOL OF AGRICULTURE AND RURAL  
DEVELOPMENT  
*evsj v†`k Db†ß vek†e`"vj q*

*tKm© vW†fj c†g>U vlg*

**tj LK**

**W. tgv† Avāj I ne**  
*wdkwi R g`v†bR†g>U vefvM*  
*evsj v†`k Kvl .vekte`"vj q*

**tgv† Awgbj Bmj vg**  
*grm" Awa`Bi, grm" Feb, igbv, XvKv*

**msKj K**

**tgv† kv† Avj g mi Kv†**  
**tgv† bi j Bmj vg**  
*~g Af&GvMkvj Pvi GÜ i i`vj vW†fj c†g>U*  
*evsj v†`k Db†ß vek†e`"vj q*

**msKj †bi mveR ZËjeav†b**  
**W. Ave†nbn tgv† dvi K**  
*Wxb, ~g Af&GvMkvj Pvi GÜ i i`vj vW†fj c†g>U*  
*evsj v†`k Db†ß vek†e`"vj q*



# ORIGINAL PUBLICATION

*gvtQi Lv` " I cNó*

(MACHHER KHADYA O PUSTI)

FISH FEED AND NUTRITION

MACHHER KHADYA O PUSTI (Fish Feed and Nutrition), a 2- Credit Coursebook for the Bachelor of Agricultural Education Programme, **Written by** : Dr. Md. Abdul Wahab and Md. Aminul Islam, **Edited by** : Md. Shah Alam Sarker, **Style Edited by**: Md. Tofazzal Islam, **Published by** : Publishing, Printing & Distribution Division, Bangladesh Open University, Gazipur-1704. © School of Agriculture and Rural Development, Bangladesh Open University. **First edition** : June 1997. **Computer Compose & D.T.P Operator** : Md. Abdur Rahman, Computer Division. **Cover Design** : Md. Monirul Islam. **Cover Photography** : Courtesy of Fisheries Research Institute. **Illustration** : Md. Raisul Islam Khan. **Printed by** : Mohanagar Printers, 81/1 Naya Paltan, Dhaka - 1000.

# fygKv

eBwU 7 Af&GwMkij Pvi GŪ i i'vj wMfj ctg>U KZŔ weGMGW  
tcŪMŏtgi QvÎt`i Rb" iwPZ gvŕQi Lv` I cwp (BAE 2205) bvgK  
eB t\_ŕK msKj b Kiv ntqŕQ| weGRGW tcŪMŏtgi QvÎt`i Rb" `B  
tμwU AbyiŕY gj eBŕqi ctq ctjiv Ask MŏY Kŕi gvŕQi cwp I  
Lv` cŏwŕ (CPFP 1202) bvgKiŕYi gvaŕtg eBwU G ms`iŕY cŕKv  
Kiv ntjv|

# গরুগরু চরু / লরু " চরু

(MACHHER PUSTI O KHADYA PRAJUKTI)

FISH NUTRITION AND FEED TRCHNOLOGY

ISBN 984-34-5046-9

MACHHER PUSTI O KHADYA PRAJUKTI (Fish Nutrition and Feed Technology), a 2- Credit Coursebook for the Bachelor of Agricultural Education Programme, **Written by** : Dr. Md. Abdul Wahab and Md. Aminul Islam, **Adoption Processed by**: Md. Shah Alam Sarker & Md. Nurul Islam. **Published by** : Publishing, Printing & Distribution Division, Bangladesh Open University, Gazipur-1704. © School of Agriculture and Rural Development, Bangladesh Open University. **First Adoption** : July 1998. **Computer Compose & D.T.P Operator** : Md. Abdur Rahman, Computer Division. **Cover Design** : Md. Monirul Islam. **Cover Photography** : Courtesy of Fisheries Research Institute. **Illustration** : Md. Raisul Islam Khan. **Printed by** : -----





= Qwe t` Lly



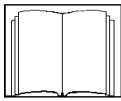
Ablyxj b/Povš gj`vqb



cvfVvEi gj`vqb

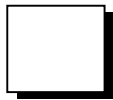


DËi gjv



= Z\_`mÎ

### e· vj Lb



cvfVi ,i ZcY©mk¶Yxq Ask†K Avi I AvKI¶xq K†i cÔk¶bi Rb` gvtS gvtSB Òe· vj L†bi Ó gva`tg Z†j aiv n†qtQ| c†ZiU Òe· vj LbÓ g†bvt†hM w`†q cob Ges g†b ivLvi tPÓv Ki b|

### Ablyxj b

Avcub cvWU f†j v†v†e eS†Z cv†Qb mK bv Zv hvPvB Kivi Rb` cvfVi gvtS tK†bv tK†bv RvqMvq t`qv i†qtQ Ablyxj b| Ablyxj b,tjv Avcb†K mgvar KitZ n†e| Gme Ablyxj b Avcbvi Ávb I `¶Zv e¶x†Z mrvqZv Ki†e|

### mvi gg©

c†ZiU cvfVB mvi gg©t`qv Av†Q| mvi gg©cto Avcub ubv`Ø cvfVi velqe` m¶†K©AvZ mn†RB avi Yv ub†Z cv†eb|

### cvfVvEi gj`vqb

c†ZiU cvfVi tk†l Avcub cvWU KZUKzeS†Z t†i†Qb Zv hvPvB†qi Rb` i†qtQ cvfVvEi gj`vqb| cvWU f†j v†v†e tevSvi ci cvfVvEi gj`vq†bi c†k†j vi DËi t`qvi tPÓv Ki b| AZtci Avcbvi t`qv DËi BD†BU tk†l t`qv DË†i i m†\_ ¶g†j†q ubb| me,tjv DËi m†VK n†j cieZ†cvW ii Ki b Ab`\_vq cvWU c†yi vq cob|

### Povš gj`vqb

c†Z BD†BU†Ui tk†l i†qtQ Povš gj`vqb| G†Z msv¶B I i Pbv†j K c†k†i†qtQ| G c†k†j vi DËi `Zii Kivi tPÓv Ki b, hv Avcb†K cix¶vq f†j v†v†e dj v†j Ki†Z mrvh` Ki†e| G†¶†† Ab`vb` Z\_`m††i mrvh` ub†Z cv†ib| GQ†v c†qvR†b Avcbvi uDU†i i m†\_I K\_v ej†Z cv†ib| BD†BU†Ui me,tjv cv† f†j v†v†e co†j Povš gj`vq†bi c†k†j v†v†e mgvar†b tK†bv Am†ear n†e bv|



**Lv` DĪxcbv (feed stimuli)**

gvQ Bw` tqi gva`tg Gifc DĪxcbv RvbZ cvti | h\_v-

- Lv`i MÜ (smell)
- ˆ (taste)
- `k`gvbZv (sight) Ges
- cvkP Lr c×WZ (lateral line system) |

Gme wbcvgK gvtQi cĀZgūfZP Lv` MhY DĪxcbv RvMvq I wbcšY Kti |

gvQ Lv` wntmte Kx Kx `e` MhY Kite, KLb Lv` MhY Kite Ges Kxfite Lv` MhY Kite, Zv Dcti ewYZ `ġaitbi Dcivb ev wbcvgKmgtni cvi= wiK wvqv cĀZwvqv (interaction) I ci wbfP Kti |

eQti i wvfbæFZzZ cūbi ZvcgvĪv cūewYZ nq| ZvcgvĪv ew× tctj gvtQi wecvKxq KvhĒrg ew× cvq Ges Lv` MhYi nvi teŧo hvq| Abjfcfite ZvcgvĪv nwm tctj wecvKxq KvhĒrg nwm cvq Ges Lv` MhYi nvi Ktg hvq| GRb` kvZKvtj gvtQi Lv` MhYi cĀYZv Ktg hvq Ges MhYKvtj gvtQi Lv` MhYi cĀYZv I MpxZ Lv`i cūgvY ew× cvq |

w` tbi tKvb mgq gvQ Lv` `e` MhY Af` tmiU GKwU ,i Zcywvq| thme gvQ Bw` tqi gva`tg ˆ I MĀU AvKó.nŧq Lv` `e` wbePb Kti, tmme gvQ mavi YZ ivZ Lv` MhY Kti \_vtK| ivĒm gvQ wKvix `fitei | Lv` `e` wKviti i Rb` Avtjvi cĀqvRb| GRb` ivĒm gvQ mavi YZ Avtj wKZ cūteŧk A\_ŧ w` tbi Avtj vq Lv` MhY Kti \_vtK|

gvQ cRbb mgq mavi YZ AŧcĒvKZ.Kg Lv` MhY Kti | AŧbK gvQ cRbŧbi mgq Lv` MhY cĀq eÜ Kti t`q|

gvQ kvixi eĒxq wvfbæKvhĒrg I Rxb Pŧmi wvfbæchĒq Lv` MhYK cŧweZ Kti | gvQ cRbb mgq mavi YZ AŧcĒvKZ.Kg Lv` MhY Kti | AŧbK gvQ cRbŧbi mgq Lv` MhY cĀq eÜ Kti t`q| `Kŧviti gvtQi Lv` Pwv`v meŧPtq tenk nŧq \_vtK|

FZz`ewPĪI gvtQi Lv` MhYK cŧweZ Kti | thgb elvRvtj i cĀKwZK cūteŧk cūbi ,Yv` ŧYi Dbqvb NŧU| GŧZ gvtQi Rxb hvĪvq GK weŧkI aiŧbi DĪxcbv Gŧb t`q| dtj gvtQi wecvKxq KvhĒrg teŧo hvq Ges Lv` MhYi cĀYZv I Pwv`v ew× cvq |

Lv` e`i boiPov, eY` AvKvi BZ`w` `k`gvb `enkó`I gvtQi Lv` MhY cŧve tdtj | Avtjvi ZxeZvi nVr cūeZĒ gvtQi Lv` MhY cĀwvq ,i ZcywvqKv cvj b Kti | cvP` (perch) RvZxq gvQ Avtjvi ZxeZv Abjvqx Lv` MhY Q` wqZ cĀwvq cĀkĒ Kti | G RvZxq gvQ mth`q I mhĒ`i mgq Lv` MhY mteP Zrci nq |

w` b-iwĪi weZĒb Ges Pŧ`i Ae`vŧbi KviŧY cĀwZzZ tek wKQyRuUj I wMmp cūeZĒ mwaZ nq| h\_v- tRvqvī -fvUv, Avtjv, ZvcgvĪv, j eYv<sup>3</sup>Zv, w GBP Ges tmZavi vi nwmew× BZ`w` | Gme th tKvb GKwU wbcvgK A\_ev mgwšZfite GKwaK wbcvgŧKi weP`wZ ev cūeZĒ gvtQi `ŧweK RxbhvĪvtK e`vNz Kti | dtj gvtQi Lv` v`v`m I Lv` MhY cŧweZ nq| GQvor Ējav, Dceim, AvZŧfivRb Ges Lv` e`i cĀZ JrmĒ` gvtQi Lv` MhYK cŧweZ Kti \_vtK|

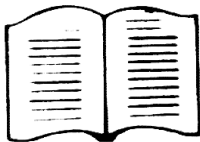
Dctiv<sup>3</sup> AvtjvPbv t`ŧK cĀxqgvb nq th, cūteŧki wvfbæwbcvgK gvtQi Lv` MhY wbcšYKvix wntmte fvgKv ivL |

**cūkuzk Lv` I m̄ iK Lv` i m̄ K**

gvU I cūbi r̄fmeK DePZvq cūb̄Z th cūkuzk Lv` Drcv` Z nq Zv̄Z gv̄Qi Lv` Pm̄v̄ c̄j̄vc̄j̄ ciY nq bv̄| mvi cūq̄m̄i grātg cūb̄Z ch̄B cūkuzk Lv` i thv̄M̄b t̄lqv̄ n̄j, Zv̄Zl me c̄R̄v̄zi gv̄Qi c̄v̄c̄ȳ Pm̄v̄ v̄gUv̄b̄v̄ hv̄q bv̄| Av̄aK Drcv` b cvlqvi j̄t̄j̄ v̄ēf̄b̄ēc̄R̄v̄zi gv̄Qi c̄v̄c̄ȳ m̄v̄t̄bi Rb` cūkuzk Lv` i ch̄B thv̄M̄t̄bi cv̄kvc̄v̄k̄ v̄K̄Qym̄ j̄K Lv` v̄t̄Z nq| gv̄b m̄ b̄ēm̄ iK Lv` cūq̄m̄ K̄ti cūZ GKK v̄t̄b gv̄Qi Drcv` b r̄f̄m̄ēt̄Ki t̄t̄q 5-10 y ch̄S̄ ēv̄x̄ Kiv hv̄q| īagv̄l cūkuzk Lv` i I ci v̄b̄f̄P̄ K̄ti th̄Lv̄t̄b cūZ kZ̄t̄K 5-8 t̄K̄v̄R̄ K̄v̄c̄R̄v̄Z̄x̄q gv̄Qi Drcv` b cvlqv hv̄q, t̄m̄B GKB c̄k̄z̄i cūkuzk Lv` i m̄v̄t̄\_ m̄j̄g m̄ iK Lv` cūq̄m̄ K̄ti cūZ kZ̄t̄K m̄t̄ēP̄ 35-40 t̄K̄v̄R̄ ch̄S̄ K̄v̄c̄ḡv̄Q Drcv` b Kiv m̄ē n̄t̄q̄Q|

Av̄aK Drcv` b cvlqvi j̄t̄j̄ v̄ēf̄b̄ēc̄R̄v̄zi gv̄Qi c̄v̄c̄ȳ m̄v̄t̄bi Rb` cūkuzk Lv` i ch̄B thv̄M̄t̄bi cv̄kvc̄v̄k̄ v̄K̄Qym̄ j̄K Lv` v̄t̄Z nq|

thme gv̄Q cūḡv̄Uv̄b̄f̄v̄R̄x̄ m̄ iK Lv` t̄m̄me gv̄Qi cūkuzk Lv` i K̄v̄h̄R̄v̄i Zv̄ ēv̄x̄ K̄ti | Āt̄b̄K gv̄Q cūkuzk Lv` i t̄t̄q m̄ iK Lv` t̄ēn̄k c̄D` K̄ti | G t̄j̄t̄j̄ M̄p̄x̄Z m̄ iK Lv` Zv̄ov̄Z̄v̄o nRg I v̄ēt̄k̄v̄l̄Z nq Ges Gme gv̄Qi c̄v̄i Z̄<sup>3</sup> ḡj̄ c̄k̄z̄i DĒg m̄v̄i v̄n̄t̄m̄t̄e K̄v̄R̄ K̄ti | d̄t̄j̄ c̄k̄z̄i ev̄ R̄j̄v̄k̄t̄q Av̄aK c̄v̄i gv̄Y cūkuzk Lv` Drcv̄ēn̄q; hv̄ c̄v̄i v̄Uv̄b̄f̄v̄R̄x̄ gv̄Q Lv` v̄n̄t̄m̄t̄e M̄h̄Y K̄ti v̄t̄K| Ḡīf̄c̄ P̄r̄t̄i t̄j̄t̄j̄ t̄K̄v̄b̄ R̄j̄v̄k̄t̄q (GKK v̄t̄bi) t̄ḡv̄U Drcv` t̄bi GK Z̄Z̄x̄q̄v̄sk̄ Av̄t̄m̄ m̄ iK Lv` v̄b̄f̄P̄ gv̄Q t̄t̄K| M̄m̄K̄v̄c̄ḡv̄Q m̄ iK Lv` v̄n̄t̄m̄t̄e c̄P̄z̄ c̄v̄i gv̄Y m̄ēR̄ N̄v̄m̄ M̄h̄Y K̄ti Ges Av̄aK c̄v̄i gv̄Y ḡj̄ Z̄v̄M̄ K̄ti | M̄m̄K̄v̄t̄c̄P̄ ḡt̄j̄ D̄t̄j̄ t̄h̄v̄M̄ c̄v̄i gv̄Y Av̄aK nRg n̄lqv̄ Lv` ē v̄t̄K, hv̄ v̄m̄j̄ f̄v̄i K̄v̄c̄I v̄ēM̄t̄n̄W̄ K̄v̄c̄m̄i v̄m̄v̄i Lv` v̄n̄t̄m̄t̄e M̄h̄Y K̄ti | ḡt̄j̄ i ev̄K̄x̄ Ask c̄k̄z̄i m̄v̄i v̄n̄t̄m̄t̄e ēēüZ nq Ges cūkuzk Lv` Drcv` b K̄ti | m̄z̄iv̄s m̄ iK Lv` gv̄Qi c̄ȳ m̄v̄t̄bi cv̄kvc̄v̄k̄ cūkuzk Lv` Drcv` t̄b̄ c̄v̄i ciK v̄n̄t̄m̄t̄e K̄v̄R̄ K̄ti |



**m̄v̄i ḡḡ:** R̄j̄ R̄ c̄v̄i t̄ēt̄ki v̄ēf̄b̄ēc̄R̄v̄z̄i gv̄Qi Lv` M̄h̄Y t̄K̄ c̄f̄v̄ēZ̄ K̄ti v̄t̄K th̄gb- eQ̄t̄i i v̄b̄v̄t̄ m̄ḡq̄K̄v̄j̄ ev̄ FZz̄ v̄t̄bi v̄b̄v̄t̄ m̄ḡq, Av̄t̄j̄v̄i Z̄v̄ēZ̄v̄, Z̄v̄c̄ḡv̄l̄v̄, v̄c, GBP, Av̄ t̄R̄b, Lv` i M̄U, v̄r̄, v̄k̄ḡv̄b̄Z̄v̄, BZ̄v̄ | v̄t̄bi t̄K̄v̄b̄m̄ḡq gv̄Q Lv` M̄h̄Y Af̄v̄ t̄m̄U ḠK̄v̄U v̄i Z̄c̄Ȳv̄ēl̄q| Lv` ēv̄i b̄ov̄P̄ov̄, eȲ, Av̄K̄v̄i BZ̄v̄ v̄k̄ḡv̄b̄ v̄ēn̄k̄ōl̄ gv̄Qi Lv` M̄h̄Y c̄f̄v̄ē t̄d̄t̄j̄ | Av̄aK Drcv` b cvlqvi j̄t̄j̄ v̄ēf̄b̄ēc̄R̄v̄zi gv̄Qi c̄v̄c̄ȳ m̄v̄t̄bi Rb` cūkuzk Lv` i ch̄B thv̄M̄t̄bi cv̄kvc̄v̄k̄ v̄K̄Qym̄ iK Lv` v̄t̄Z nq| īagv̄l cūkuzk Lv` i I ci v̄b̄f̄P̄ K̄ti th̄Lv̄t̄b cūZ kZ̄t̄K 5 - 8 t̄K̄v̄R̄ K̄v̄c̄R̄v̄Z̄x̄q gv̄Qi Drcv` b cvlqv hv̄q, t̄m̄B GKB c̄k̄z̄i cūkuzk Lv` i m̄v̄t̄\_ m̄j̄g m̄ iK Lv` cūq̄m̄ K̄ti cūZ kZ̄t̄K m̄t̄ēP̄ 35 - 40 t̄K̄v̄R̄ ch̄S̄ K̄v̄c̄ḡv̄Q Drcv` b Kiv m̄ē n̄t̄q̄Q|



**civvĒi gj "vqb 2.1**

**mWK DĒti i cvk WK vPy (√) w b |**

1/ givQi Lv̄ " MhYtK cFmeZKvix ubqvgK, tj vtK cāibZ KZ tkāYtZ fivM Kiv nq?

- K) 4 tkāYtZ
- L) 2 tkāYtZ
- M) 5 tkāYtZ
- N) 7 tkāYtZ

2/ mūi-K Lv̄ " cāqM givQi Drcv`tb wKifc cFve tdtj?

- K) Drcv`b Ktg hvq
- L) givQi evx eU ntq hvq
- M) Drcv`b evx cvq
- N) Drcv`tb tKvb cFve tdtj bv

3/ mūi-K Lv̄ " I cāKwZK Lv̄ "i gta" mē KāKifc?

- K) mūi-K Lv̄ " cāKwZK Lv̄ "i cwi c iK
- L) mūi-K Lv̄ " I cāKwZK Lv̄ "i Drcv`b Kwgtq t`q
- M) mūi-K Lv̄ " I cāKwZK Lv̄ "i Drcv`tb tKvb cFve tdtj bv
- N) mūi-K Lv̄ " I cāKwZK Lv̄ "i gta" tKvb mē KāvB

4/ elKvtj cvbi , Yv, tYi wKifc cwi eZB NtU?

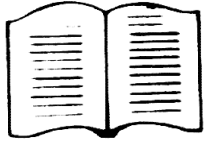
- K) cvbi AagvĪv teto hvq
- L) cvbi , Yv, tYi tKvb cwi eZB nq bv
- M) cvbi , Yv, tYi AebwZ NtU
- N) cvbi , Yv, tYi Dbqvb NtU

## cW 2.2 cūbi ,Yv, Y I Lv` i Pwn`v

### G cW tk̄tI Avcūb -



- gvQ Pr̄tI i Rb` cūqRbixq cūbi űefbæ, Yv, tYi bvg I gvĪv ej tZ cvi tēb|
- cūbi , Yv, Y gv̄Qi RiebĪvĪv Kx Kx cĪve tdtj Zv eYĪv Ki tZ cvi tēb|
- cūbi , Yv, tYi cĪfite gv̄Qi Lv` Pwn`vi űKifc cūieZĪ nq Zv eĪLv` Ki tZ cvi tēb|



Ab`ib` R̄x̄ei b`vq RiebĪvĪv űbef̄n Kivi Rb` gv̄Qi kix̄i cūZūbqZ űefbæi t̄bi `Re i v̄m̄v̄qūbK űeĪqūv Nt̄U| cūbi űefbæ t̄f̄S̄Z i v̄m̄v̄qūbK , Yvej xi Gme űeĪqūv K cĪf̄meZ K̄ti gv̄Qi űecv̄Kixq Kiv̄Īv̄g űbq̄š̄t̄Y , i Z̄cȲf̄v̄gKv̄ cv̄j b K̄ti v̄t̄K| gv̄Qi Lv` M̄h̄Y, tēP v̄Kv, űn̄K eĪx, cĪRbb Ges , i Z̄cȲűecv̄Kixq Kiv̄Īv̄ m̄ḡZ̄v̄te cūi P̄j b̄vi Rb` Gme t̄f̄S̄Z- i v̄m̄v̄qūbK , Yvej xi GKūU Ab̄k̄j gv̄Īv i t̄q̄t̄Q| R̄j R cūi t̄ek Gme , Yvej xi m̄f̄űeK DV̄v̄b̄ḡvi gv̄Īv Ges Ab̄k̄j gv̄Īv m̄i űY 3 G t̄ Lv̄bv̄ n̄t̄j v-

m̄i űY 3 t cūbi űefbæ, Yv, tYi DV̄v̄b̄ḡvi I Ab̄k̄j gv̄Īv

Dc̄v̄t̄bi bvg	DV̄v̄b̄ḡvi gv̄Īv (űcūcGg)	Ab̄k̄j gv̄Īv (űcūcGg)
Aű t̄Rb	3.5 - 12.62	5 - 8
KveĪ űB AKūBW	0 - 9.30	0 - 15
űc GBP	6 - 9.50	7 - 8.5
t̄gv̄U űvi Z̄i	215 - 365	200 - 500
dm̄t̄dU	0.04 - 0.38	-
b̄v̄B̄t̄U	0.43 - 1.74	-
m̄j t̄dU	3.70 - 9.90	-

m̄i űY tZ D̄ij űLZ cūbi űefbæ, Yv, Y gv̄Qi Lv` M̄h̄t̄Yi cēYZv I Pwn`v̄t̄K cĪf̄meZ K̄ti | gv̄Qi Lv` M̄h̄t̄Yi I ci cūbi K̄t̄q̄KūU cāvb űbq̄v̄t̄Ki cĪf̄ve űb̄t̄P Av̄t̄j v̄Pbv̄ Kiv̄ n̄t̄j v|

### Zvcgv̄Īv

Zvcgv̄Īv evotj űecv̄Kixq Kiv̄Īv̄t̄gi n̄vi eĪx cv̄q| dtj Lv` Pwn`v̄l tēto h̄v̄q| GKBF̄v̄te Zvcgv̄Īv K̄ḡt̄j Lv` Pwn`v̄ Z̄j b̄vḡj K̄f̄v̄te n̄m̄ cv̄q|

Zvcgv̄Īvi m̄t̄\_ gv̄Qi Lv` M̄h̄t̄Yi Pwn`v̄ Zvcgv̄Īvi m̄t̄\_ gv̄Qi űecv̄Kixq Kiv̄Īv̄ m̄x̄ t̄K̄P Ab̄j̄f̄c| Zvcgv̄Īv evotj űecv̄Kixq Kiv̄Īv̄t̄gi n̄vi eĪx cv̄q| dtj Lv` Pwn`v̄l tēto h̄v̄q| GKBF̄v̄te Zvcgv̄Īv K̄ḡt̄j Lv` Pwn`v̄ Z̄j b̄vḡj K̄f̄v̄te n̄m̄ cv̄q| űefbæ c̄ix̄űv̄q t̄ Lv̄ t̄M̄t̄Q th, cūbi Zvcgv̄Īv 10 űűM̄ t̄m̄j űmq̄m -Gi űb̄t̄P t̄bt̄ḡ t̄M̄t̄j K̄vcR̄v̄Z̄ixq gv̄Q Lv̄l qv̄ eŪ K̄ti t̄`q Ges 30-35 űűM̄ t̄m̄j űmq̄m Zvcgv̄Īv K̄vcR̄v̄Z̄ixq gv̄Qi Lv` Pwn`v̄ m̄tēP ch̄űq Db̄wZ nq| t̄Zj űc̄qv̄ gv̄Q 24-25 űűM̄ t̄m̄j űmq̄m Zvcgv̄Īv kix̄i i IR̄t̄bi 10 kZ̄v̄sk̄ n̄t̄i Lv` M̄h̄Y K̄ti | űK̄š̄ cūbi Zvcgv̄Īv 15-16 űűM̄ t̄m̄j űmq̄m t̄bt̄ḡ Ḡt̄j t̄Zj űc̄qv̄ Lv` M̄h̄Y eŪ K̄ti t̄`q|

m̄i űY 4 G űefbæ Zvcgv̄Īv t̄Zj űc̄qv̄ Ges K̄t̄q̄KūU K̄vcR̄v̄Z̄ixq gv̄Qi Lv` Pwn`v̄ I eĪx̄i n̄vi t̄`l qv̄ n̄t̄j v :

miwY 4 t űewfbæZvcgvĪvq tZj űccqv Ges KtqKűW KvcRvZxq gvĪQi Lv'' Pűn`v I eĵxi nvi

cĪűWZ	ZvcgvĪv (tm.)	Lv'' Pűn`v	gvĪQi eĵx	gše''
KvZj v, i B	30-35 20 10	meĪPtq teĵk AĪcĪĵvKZ.Kg kb''	mĵeĪ P tgvUvgĵ eŪ	Abĵĵ ZvcgvĪv - LvĪ qv eŪ Kĵi t`q
űmj fvi Kvc©	30 20 15	meĪPtq teĵk AĪcĪĵvKZ.Kg  bĵy`Zg	mĵeĪ P űKQy Kg (Zĵe űeMĵnĵWi tPtq teĵk) LgB Kg	Abĵĵ ZvcgvĪv - -
űeMĵnW Kvc©	30 20-25 15	meĪPtq teĵk AĪcĪĵvKZ.Kg bb`Zg	mĵeĪ P Kg LgB Kg	Abĵĵ ZvcgvĪv - -
Mĵm Kvc	38 35 20-30 10	Kg meĪPtq teĵk AĪcĪĵvKZ.Kg kb''	Kg mĵeĪPP AĪcĪĵvKZ.Kg eŪ	A`i Q` teva Kĵi Abĵĵ ZvcgvĪv - LvĪ qv eŪ Kĵi t`q
tZj űccqv	40 30-35 15-16 10	kb'' meĪPtq teĵk kb'' kb''	eŪ mĵeĪPP eŪ eŪ	gvĪv ĵiq Abĵĵ ZvcgvĪv LvĪ qv eŪ Kĵi t`q gvĪv ĵiq

**űc GBP**

cűbi űc GBP gvĪQi Lv'' Pűn`vi I ci űi ZcY©cĪve tdtĵ | AæZ; evoĵĵ Lv'' Pűn`v Kĵg ĵiq | tKűb Rĵvktq cűbi AæZ; űc GBP 6.5 gvĪvi teĵk ntĵ ev Īvi Z; űc GBP 9 - 9.5 gvĪvi teĵk ntĵ Ges Zv`xNĵ b`vqx ntĵ gvĪQi Lv'' Pűn`v Kĵg ĵiq I eĵx kĵb`i tKűvĵq Gĵm`voiq | űc GBP gvĪv 7 - 8.5 Gi gĵa` gvĪQi Lv'' Pűn`v teĵk \_vĪK |

cűbi űc GBP gvĪQi Lv'' Pűn`vi I ci űi ZcY©cĪve tdtĵ | AæZ; evoĵĵ Lv'' Pűn`v Kĵg ĵiq | tKűb Rĵvktq cűbi AæZ; űc GBP 6.5 gvĪvi teĵk ntĵ ev Īvi Z; űc GBP 9 - 9.5 gvĪvi teĵk ntĵ Ges Zv`xNĵ b`vqx ntĵ gvĪQi Lv'' Pűn`v Kĵg ĵiq I eĵx kĵb`i tKűvĵq Gĵm`voiq | űc GBP gvĪv 7 - 8.5 Gi gĵa` gvĪQi Lv'' Pűn`v teĵk \_vĪK |

**Aw tRb**

cűbtZ`ĕxfZ Aw tRb gvĪv evoĵĵ gvĪQi Lv'' Pűn`v eĵx cvq Ges Aw tRb gvĪv Kgĵĵ Lv'' Pűn`v nűm cvq |

Aw tRb gvĪQi Lv'' Pűn`vĪK mgűbgűWZK nĵi cĪűeZ Kĵi | Aw tRb űecvKĵq Kűhĕrg űbqšY Kĵi | cűbtZ`ĕxfZ Aw tRb gvĪv evoĵĵ gvĪQi Lv'' Pűn`v eĵx cvq Ges Aw tRb gvĪv Kgĵĵ Lv'' Pűn`v nűm cvq | cűbtZ`ĕxfZ Aw tRb gvĪv 10 - 11 űcűcGg ntĵ Kgb KĵtĵcP Lv'' Pűn`v mĵeĪPP chĕĵq DűmZ nq |

**KveĪ WvB AKűBW**

KveĪ WvB AKűBW gvĪQi cĪKűZK Lv'' Drcv`ĵb űbqšK fĵgKv cvĵ b Kĵi |

KveĪ WvB AKűBW gvĪQi cĪKűZK Lv'' Drcv`ĵb űbqšK fĵgKv cvĵ b Kĵi | cűbtZ` KveĪ WvB AKűBW Gi cűi gvY nűm tĵĵ cĪKűZK Lv'' Drcv`b nűm cvq | GĵZ gvĪQi Lv'' Pűn`v ciY nq bĵ | Aveűi KveĪ WvB AKűBĵWi cűi gvY AZ`űaK eĵx tĵĵ cűbi AĵZĵi gvĪv eĵx cvq | dtĵ cĪĵ cĪKűZK Lv''`Zűi ntĵ I gvĪQi Lv'' MĵtYi cĪYZv I Pűn`v nűm cvq |

**Avĵj v Ges tNĵj vZĵi**

Avĵj v Ges cűbi tNĵj vZĵi gvĪQi Lv'' Pűn`vĪK cĪűeZ Kĵi | tNĵj v cűbtZ` KűhĕRi mĵĵĵ vK űbű`Ī Mfxi Zv chš cĪĕk KiĵZ cvĵi bĵ | dtĵ cĪKűZK Lv''i Drcv`b e`vnZ nq | tNĵj v

cmbi Kj tqW `e` gvtQi dZKvq AvUtK t\_tK dZKv eU Kti t`q| GtZ gvtQi klm ubtZ  
Kó nq I `rfmek Rieb hrcb meWuz nq| dtj gvtQi Lv` MhtYi cEbZv I Lv` Pnn`v nwm  
cvq|



**mvi gg©:** gvtQi Lv` MhtY, tetP \_vKv, `mK eWx, cRbb Ges \_i ZcY©mecnKiq KvhW  
mZvte cvi Pj bvi Rb` cmbi tFSZ I imvqubK \_Yvejxi GKwU AbKj gvTn itqtQ|  
ZvcgvTn evotj mecnKiq KvhWtgi nvi eWx cvq| dtj Lv` Pnn`vI teto hvq| GKBFvte  
ZvcgvTn Kgtj Lv` Pnn`v Zzbijj Kfvte nwm cvq| cmbi uc GBP gvtQi Lv` Pnn`vi  
I ci \_i ZcY©cfvte tdtj | evotj Lv` Pnn`v Ktg hvq| uc GBP gvTn 7.0 - 8.5 Gi gta`  
gvtQi Lv` Pnn`v tenk \_vtK| cmbtZ `exfZ Av` tRb gvTn evotj gvtQi Lv` Pnn`v eWx  
cvq Ges Av` tRb gvTn Kgtj Lv` Pnn`v nwm cvq| KveB WvB A· vBW gvtQi cWkuzK Lv`  
Drcv` tb mbqSK figKv cij b Kti |



**cuVvEi gj`vqb 2.2**

**mVK DEti i cuK vK vY (v) w b |**

- 1/ ZvcgvIv evotj gvtQi Lv` Pwn`vq vKifc cFve cto?
  - K) Lv` Pwn`v evx civq
  - L) Lv` Pwn`v nwm civq
  - M) Lv` Pwn`vi tKvb cwi eZB nq bv
  - N) gvQ Lv` MhtY Abxrv cKvk Kti
  
- 2/ vbtPi tKvb&ZvcgvIvq KvcRvZiq gvtQi Lv` Pwn`v mtePP chiq DbwZ nq?
  - K) 5-10 vvvv tmj vvcvqvm
  - L) 40-45 vvvv tmj vvcvqvm
  - M) 30-35 vvvv tmj vvcvqvm
  - N) 10-15 vvvv tmj vvcvqvm
  
- 3/ cvbtZ KveB WvB AKvBW Gi cwi gvY nwm tctj cKwZK Lv` Drcv`bi gvIvi tvtI vbtPi tKvbU mVK?
  - K) evx civq
  - L) nwm civq
  - M) Drcv`b eU ntq hvq
  - N) tKvb nwm-evx nq bv
  
- 4/ tKvb ZvcgvIvq tZj vvcvq gvQ Lvl qv eU Kti t`q?
  - K) 40° tmj vvcvqvm
  - L) 30° tmj vvcvqvm
  - M) 15° tmj vvcvqvm
  - N) 10° tmj vvcvqvm

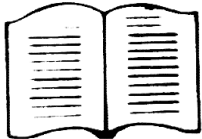
### cW 2.3 Lv` i cni gY Ges cni tek

#### G cW tk tI Avcb -



- cKzi Pvl thvM` gvtQi Rb` cQvRbxq Lv` i cni gY vbyQ KitZ cri teb |
- Lv` i weirfbDcr` vbi AvbgwZK nvi e`vL`v KitZ cri teb |
- gvtQi epx Kx Kx vbyvgtKi I ci vbfP Kti tm, tji vi DttL KitZ cri teb |

#### Lv` i cni gY



hw` cKzi cQwZK Lv`  
tevk vK Zvntj t`q  
Lv` Kg ntj I Ptj |

cQZw`b mvariYZ gvtQi  
IRtbi 3 - 4% nvti  
Lvevi t`lqv DvPZ |

hw` gvQtK m` YPfc evBtii Lv` i I ci bv KitZ nq Zv ntj cKzi Kx cni gY cQwZK Lvevi AvtQ Zvi I ci vbfP Kti evBtii Lvevi w`tZ nq | hw` cKzi cQwZK Lv` tevk vK Zvntj t`q Lv` Kg ntj I Ptj | Avi hw` cKzi Lvevi LvB Kg vK Zvntj Lvevii cni gY tevk Kti w`tZ nq | kvZKvj Ges MvSvKvtj Lvevii gvIvi Zvi Zg` nq | MvSvKvtj gvQ tevk Lvq | thLvB Lvevi t`qv nq gvQ hw` tm` vb tQto Ptj hvq Ges PzPvc vK Zvntj eStZ nte th gvQ tLq mSb nttQ Avi hw` Lvevii v`tb Njv tdiv Kti Zvntj eStZ nte th gvQ Avi I Lvevi Pvt Q | cQZw`b mvariYZ gvtQi IRtbi 3 - 4% nvti Lvevi t`lqv DvPZ | gvtS gvtS Rvj tUtb t`Lv` i Kvi gvQ evotQ vKbv | gvQtK LvI qvi t`qvi mgq j` q` i vL`Z nte thb cQvRtbi tevk Lvevi bv t`qv nq | Kvi Y GtZ DQF Lvevi tKvb KvtR Avtm bv Ges dtj gvtQi Drcr`tb Ab\_R LiP teTo hvq | AvZwi`<sup>3</sup> Lv` cQvMti dtj cvmbi v, Y b`o ntt hvl qvi AvksKv vK |

#### Lv` MhY I cni tek

cni tekki cni cvkR Zvi weirfbagvIvi cni eZB gvtQi RvchvIvq weirfbvati bi cfve tdtj | dtj gvtQi Lv` MhYi cEYzv Ges Lv` MhYi gvIvq Dtt - LthvM` cni eZB t`Lv hvq | cvmbi tFSZ-ivmivubK v, Yv, tji cikvcvck cQZtefki AvvKw LZ Nubv gvtQi Lv` MhYtK cfveZ Kti thgb, cKz ev Rjvktqi avti nVir D PgvIvi ka Kiv ntj gvQ A`vQ` teva Kti Ges gvtQi gta` fmvZKi Ae`v mjo nq GtZ gvtQi Lv` MhYi cEYzv I cni gY vB-B nrm cvq | Aevi bgvqb ev v`v` cixvIvi j`q` Lv` tevk Rvj Uvbr ntj ev Atc`vKZ.eo Rjvktq tQvU Rvj w`tq Lv` nqivb Kti gvQ aiv ntj I gvtQi Lv` Pvv`v I Lv` MhYi cni gY Ktg hvq |

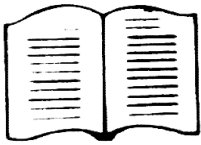
gvtQi Lv` MhYtK thme  
tFSZ-ivmivubK vbyvK  
cfveZ Kti tm, tji v ntj v  
ZvcgvIv, Avtjv, `exFZ  
LvR jeY I thSM c`v`  
`exFZ Av` tRb gvIv Ges  
gvtQi cni Z`<sup>3</sup> eR`  
c`v`

gvtQi Lv` MhYtK thme tFSZ-ivmivubK vbyvK cfveZ Kti tm, tji v ntj v ZvcgvIv, Avtjv, `exFZ LvR jeY I thSM c`v` `exFZ Av` tRb gvIv Ges gvtQi cni Z`<sup>3</sup> eR`c`v` Gv gta` `exFZ Av` tRb gvIv I gvtQi cni Z`<sup>3</sup> eR`c`v` gvtQi NbtZi mvt` m` vK | AvvK NbZj ev AvvK epx Gi th Kvi tYB tnvK cKzi gvtQi cni gY tevk ntj gvtQi Av` tRb Pvv`v epx cvq | Gvfc Ae`vq Av` tRtbi gvIv mvgZ ntj cvmbtZ `exFZ Av` tRb Ktg vMtg vlvZKi Ae`vq tcvvq | cKzi gvtQi NbZj tevk ntj gvtQi Z`vM Kiv etRP cni gY epx cvq, GtZ vektI Kti vlvZKi Avtgvbqv RgtZ vK, hv gvtQ veltvqv Nuvq | Gme Kvi tY gvtQi vevK vlvqv nrm cvq Ges gvtQi Lv` MhYi cni gY nrm tctZ vK | ZvcgvIvi epx gvtQi vevK vlvqv epx Nuvq | vKŠ` Kiv vlvZ gvIvi (optimum range) tPtq AvvK gvIvi ZvcgvIvq gvtQi Lv` MhY I epx nrm cvq |

w`tbi Avtj vKZ mgqKvj  
hZ tevk nq gvtQi Lv`  
MhYi cni gY ZZ epx  
cvq |

ZvcgvIvi tPtq w`tbi Avtj vKZ mgqKvj (photo period) gvtQi Lv` MhYi I ci AvvKzi cfve tdtj | w`tbi Avtj vKZ mgqKvj hZ tevk nq gvtQi Lv` MhYi cni gY ZZ epx cvq |

cmbi Aw tRb gvIv gvQi qIavg`v, Lv` MhY mupiqZv, MpxZ Lv`i cwi gvY Ges MpxZ Lv`i cwi cvtKi nvtK cfmEZ Kti| cmbtZ `exfZ Aw tRb NbZi m<sup>3</sup> gvIv (salutation point) Gi tPtq Kg ntj cwiugZ Lv` MhY mtEj gvQi Kw qIz ep<sup>x</sup> NtU bv| Gi fc Ae`vq MpxZ Lv`i cwi cvK mgvgvIvq nq bv| Avevi `exfZ Aw tRb gvIv 4 ucucGg -Gi Kg ntj gvQi qIavg`v t`Lv t`q I Lv` MhYi cwi gvY Dttj - LthvM` nvti nwm cvq|



**mvi gg:** hwi cktzi cOkuzK Lv` tewk \_vtK Zvntj t`q Lv` Kg ntj I Ptj | Avi hwi cktzi cOkuzK Lvevi LpB Kg \_vtK Zvntj Lvevii cwi gvY tewk Kti t`qv DvPZ| kvZKvj Ges MhYKvtj Lvevii gvIvi ZviZg` nq| MhYKvtj gvQ tewk Lvq| cZw`b maviYZ gvQi IRtbi 3 - 4% nvti Lvevi t`qv DvPZ| gvQi cyp Pvn`vi Ici wfvE Kti Lv`i cwi gvY Kg tewk ntq \_vtK| th gvQi cyp Pvn`v hZ tewk tm gvQi Lv` Pvn`vi ZZ tewk| Rj R cwi tetki wvfbambqvgK Dcv`vb gvQi Lv` MhYtK wvfbavte cfmEZ Kti| cmbi wvfbav`Yv tYi Ici I gvQi Lv`i cwi gvY wvfpkxj | cmbtZ `exfZ Aw tRb, `exfZ KveB-WvB-A- vBW BZ`v`i gvIvi cwieZB ntj gvQi Lvevii Pvn`vi cwieZB nq| dtj gvQi Lv` MhYi cwi gvYI Kg tewk ntq \_vtK|



**cūVvĒi gj̄ vqb 2.3**

**mWk DĒti i cūk wK v̄y (√) w b |**

- 1/ *gv̄Q KLB tenk cui gv̄Y Lvevi Mh̄Y Kti?*
  - K) *eI#Kv̄j*
  - L) *kxZKv̄j*
  - M) *emŠKv̄j*
  - N) *Mh̄YKv̄j*
  
- 2/ *cūZw̄ b gv̄Qi t̄ t̄ni I R̄tbi KZFw̄M Lvevi t̄ qv̄ Dv̄PZ?*
  - K) *1 - 2%*
  - L) *3 - 4%*
  - M) *6 - 7%*
  - N) *7 - 8%*
  
- 3/ *gv̄Qi Lvevi cūqv̄Mi cui gv̄Y Kg tenk w̄fP̄ Kti w̄t̄Pi t̄Kv̄b̄Ūi I ci?*
  - K) *tebt̄\_t̄mi Dcw̄\_w̄Zi I ci*
  - L) *ciR̄wei Dcw̄\_w̄Zi I ci*
  - M) *cūKw̄ZK Lv̄\_t̄\_i Dcw̄\_w̄Zi I ci*
  - N) *ēv̄Kt̄Ūwi qvi Dcw̄\_w̄Zi I ci*
  
- 4/ *c̄k̄zi gv̄Qi NbZj tenk nt̄j Kx Nt̄U?*
  - K) *gv̄Q `^Z ēw̄x cv̄q*
  - L) *c̄w̄b̄t̄Z Āw̄ t̄R̄t̄bi cui gv̄Y ēw̄x cv̄q*
  - M) *c̄w̄b̄t̄Z ¶̄w̄ZKi Āv̄t̄ḡw̄b̄qv̄ R̄ḡt̄Z \_v̄t̄K*
  - N) *gv̄Qi w̄ecv̄K w̄w̄qv̄ ēw̄x cv̄q*

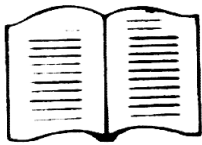
**cW 2.4 m<sup>3</sup> iK Lv` , cKvi t f` , cQqM c x v Z Ges cQqMgv I v**

**G cW tk t I Avcb -**



- m<sup>3</sup>u i-K Lv` i msAv ej t Z I wj Lt Z cvi teb |
- newfbacKvi m<sup>3</sup>u i-K Lv` i wPbt Z cvi teb |
- cKzi m<sup>3</sup>u i-K Lv` i cQqM c x v Z e v L v Ki t Z cvi teb |
- m<sup>3</sup>u i-K Lv` i cQqMgv I v D t j L Ki t Z cvi teb |
- Lv` i cwi e Z b nvi e v L v Ki t Z cvi teb |

**m<sup>3</sup> iK Lv`**



Rjvkq ev cKzi i gvU I cwbi i fmeK DepZiq cKzi th cQkuzK Lv` Drcw` Z nq Zv w t q gv t Qi Lv` Pwn` v ci Y nq bv | cKzi cwngZ mvi cQqv t Mi gva t g chPb cQkuzK Lv` i thvMib ubwOZ Kiv nt j Zv t Z I gv t Qi cwi c Y c w m v ab nq bv | gv t Qi c w Pwn` v c t j v c w t g U v t b v i Rb` cKzi i ev B t i t t K Lv` w t Z nq | cKzi i ev B t i t t K gv t Q t t I qv Gme Lv` e t K m<sup>3</sup> iK Lv` ej v nq | AwaK Drcv` b cvl qv i j t q w e Av b i r f u e K gv Q P r t m<sup>3</sup> iK Lv` i f u g K v ce e Z P c w t t K Avcbv i v t R t b t Q b |

**cKvi t f`**

gv t Qi m<sup>3</sup> iK Lv` t K newfbew f u e t Z t k i w e b` i m Kiv nt q v t K | Lv` k w<sup>3</sup> Ges Awg t I i cwi gv t Y i w f u e t Z m<sup>3</sup> iK Lv` i t k i w e b` i m Kiv nt q | h v - AwaK k w<sup>3</sup> m<sup>3</sup> b e L v` I Kg k w<sup>3</sup> m<sup>3</sup> b e L v` I B Z w` |

gv t Qi Lv` w t m t e e` u Z n t Z c v t i Gi Kg e u m s L` K ` e` Av g v t` i t` t k i t q t Q | gv t Qi m<sup>3</sup> iK Lv` t K newfbew f u e t Z (criteria) t k i w e b` i m Kiv nt q v t K | Lv` k w<sup>3</sup> Ges Awg t I i cwi gv t Y i w f u e t Z m<sup>3</sup> iK Lv` i t k i w e b` i m Kiv nt q | h v - AwaK k w<sup>3</sup> m<sup>3</sup> b e L v` I Kg k w<sup>3</sup> m<sup>3</sup> b e L v` | D` v i Y` t c e j v h v q newfbew i t b i k m` v b i q v (cereal) A t c q v K Z . Kg cwi gv t Y Awg l v t K , w K S` G , t j v AwaK cwi gv t Y k w<sup>3</sup> Drcv` b K t i | Avevi A t b K Lv` Drcv` t b A t c q v K Z . t e n k cwi gv t Y Awg l v t K h v - u l m y u g j , w d k u g j B Z w` w K S` G , t j v Z x b v g j K Kg k w<sup>3</sup> m i e i v n K t i |

m<sup>3</sup>u i-K Lv` t K 2 f v t M f v M Kiv nt q, h v -

- cQkuzK (natural) m<sup>3</sup> iK Lv` Ges
- K w i g m<sup>3</sup>u i-K Lv` ev` Z w i Lv` (processed or formulated)

Drm Abjvqx cQkuzK m<sup>3</sup>u i-K Lv` e t K` v f v t M f v M Kiv nt q | h v -

- D w` e 4 Lv` (plant feed) Ges
- c Q w Y R Lv` (animal feed)

**Lv` cQqM c x v Z**

cKti gRyKZ gv t Qi` w n K I R b A b j v q x Lv` w t Z n t e | G K B m s t M c K t i i newfbew t b Lv` w t Z n t e | Lv` e` m i v m w i v Q u t q b v w t q` p s L v e v i t U` e v c u l v z t b w t Z n t e | c i Z w` b v b w` e` t b , v b w` e` m g t q Lv` w t Z n t e |

cKzi gRyKZ. gv t Qi` w n K I R b A b j v q x Lv` w t Z n t e | K v c R v Z i q gv t Qi t q t i c Q q v R b x Lv` t M v j v K v i u c U` A v K v t i Ges g v s m v k x I i v q t z n gv t Qi t q t i u c t j U A v K v t i w t j f i j d j c v l q v h v q | G K B m s t M c K z i i newfbew t b Lv` w t Z n t e | Lv` e` m i v m w i u Q u t q b v w t q` p s L v e v i t U` e v c u l v z t b w t Z n t e | c i Z w` b v b w` e` t b , v b w` e` m g t q Lv` w t Z n t e | c i Z w` t b i c Q q v R b x Lv` G K e v t i b v w t q K t q K e v t i f v M K t i w t j f i j d j c v l q v h v q | w t b i R b` c Q q v R b x Lv` m a f e n t j f v M K t i w z b e v t i w t Z n q | A i c w i g v t Y I t e n k e v i Lv` w t j Lv` i A c P q n q b v | Lv` w t b i A v t j v q w t Z n t e | m t h P` t q i A v t M e v m h i t` i c i Lv` t I q v D i P Z b q |

**Lv`i cwi eZB nvi**

gvfQi cŁZ GKK IRb  
 epxi Rb` th cwi gvY Lv`  
 MhŕYi cŁqvRb nq ZŕKB  
 D<sup>3</sup> Lv`i cwi eZB nvi  
 (Food conversion ratio  
 er FCR) ej v nq/

Lv`i cwi eZB nvi ej ŕZ gvQ KZR. MpxZ Lv`i cwi gvY Ges D<sup>3</sup> cwi gvY Lv` MhŕYi dŕj  
 gvfQi IRtb th epxi NŕU G` Bŕqi AbgvZŕK eSvq/ A\_ŕ gvfQi cŁZ GKK IRb epxi Rb`  
 th cwi gvY Lv` MhŕYi cŁqvRb nq ZŕKB D<sup>3</sup> Lv`i cwi eZB nvi (Food conversion  
 ratio er FCR) ej v nq/ thgb- gvfQi 1 tKŕR IRb epxi Rb` hŕ 3 tKŕR Lv` cŁqvRb nq  
 Zŕe D<sup>3</sup> Lv`i cwi eZB nvi nŕe 3/ Lv`i cwi eZB nvi GKŕU msL`vgvb; Gi tKŕv GKK  
 bŕB/

$$\text{Lv`i cwi eZB nvi} = \frac{\text{MpxZ Lv`i cwi gvY}}{\text{gvfQi ewaZ IRb}}$$

$$= \frac{\text{cŁqvMKZ.Lv`i cwi gvY}}{\text{Drcŕ`Z gvfQi tgvU IRb - gRŕKZ.tcvbri tgvU IRb}}$$

C 4 1:42 T 4  
 C24 1:33 \$  
 C34 Q14 \$14 ; AT  
 %Q1

mvavi Yfvŕe Lv`i cwi eZB nvi ŕbYŕqi mgq gvQ KZR. Rj R cwi tek t\_ŕK MpxZ cŁKŕZK  
 Lv`ŕK ŕetePbv Kiv nq bŕ/ Lv`i cwi eZB nvi Lv`ŕe`i cŕpvgvb I nRŕgi nŕŕi I ci  
 ŕbFŕP Kŕi/ th Lv`i cwi eZB nvi mPK msL`vgvb hZ Kg tm Lv`i cwi eZB nvi ZZ fŕj  
 Ges Drcŕ` bKŕj Zŕl ZZ teŕk/ Lv`i cwi eZB nvi Lv`i , YMZgvb ŕbŕ`R Kŕi/

e`e`rcbri ŕewfŕe ŕbqvqK (Factor) Lv`i cwi eZB nviŕK cŕfŕeZ Kŕi/ e`e`rcbri  
 tKŠkŕj i Dbqŕb NŕUŕq Lv`i cwi eZB nŕŕi msL`vgvb nŕm Kiv hvq/ A\_ŕ mgcwi gvY Lv`  
 ŕŕŕq AŕcŕŕŕKZ. AŕaK cwi gvŕY gvQ Drcŕ`b Kiv hvq/ ŕbŕŕfc ŕelqmgŕn Lv`i cwi eZB  
 nviŕK cŕfŕeZ Kŕi/

**Lv`i cŁqvMgvŕv**

ce`cŕV t\_ŕK Avcbri v tRŕŕŕb th, gvfQi Rb` cŁqvRbxq mŕ iK Lv`i cwi gvY Rj R  
 cwi ŕeŕk cŁB cŁKŕZK Lv`i cŕŕBZvi I ci ŕbFŕP Kŕi/ cŁKŕZK Lv`ŕ`Z cwi gvŕci tKŕv  
 jŕMmB cŕŕZ tbB/ Zŕv gvQŕK t`q mŕ iK Lv`i cwi gvY ŕKQycŕpMZ ari Yv I eŕ`e  
 AŕfÁZvi ŕbŕŕŕL ŕbŕŕŕY Kiv nq/

gŕsmŕkx I ivŕŕŕm gvfQi  
 tŕŕŕŕ gRŕy gvfQi tgvU  
 IRŕbi 4-5 kZŕsk nŕŕi  
 Lv` cŁZŕb ŕŕŕZ nq/  
 Lv`i cŁqvM gvŕŕv cŕp  
 Pŕn`vi I ci ŕbFŕP Kŕi/  
 ivŕŕŕm gvfQi mŕ iK  
 Lv` mŕeŕP Aŕmŕŕi  
 Pŕn`v 40-45 kZŕsk

gvfQi %ŕnK IRb epxi mŕŕM mŕŕM kŕŕ<sup>3</sup> Drcŕ`bKŕix cŕp Pŕn`v (calorific nutritional  
 requirement) nŕm cŕq/ mŕŕŕis mŕ iK Lv`i cwi gvY tKej gvŕ Lv` Pŕn`vi I ci ŕbFŕP  
 Kŕi bŕ/ eis cŁKŕZK Lv`i cŕŕBZvi Ges gvfQi IRb epxi mŕŕ\_ mŕŕ\_ cŁKŕZK Lv`i  
 Pŕn`vi cwi eZBŕi I ci ŕbFŕP Kŕi/ hŕ gvfQi epxi Kŕjxb mgŕq cŁZ GKK gvfQi Rb`  
 cŁKŕZK Lv`i cwi gvY nŕm cŕq Ges G nŕŕŕi gvŕŕv gvfQi %ŕnK epxi RŕbZ Lv` Pŕn`v  
 nŕŕŕi tŕŕq teŕk nq, Zŕvŕj AŕaK cwi gvŕY mŕ iK Lv` cŁqvM Kŕi G Lv` NŕUŕZ ci Y  
 KiŕZ nq/ ce`cŕV Lv`i cwi gvY Aŕŕk i B RŕZŕq gvfQi Lv` mŕ ŕK`Avŕj vPbv Kiv  
 nŕŕŕŕQ/ gŕsmŕkx I ivŕŕŕm gvfQi tŕŕŕŕ gRŕy gvfQi tgvU IRŕbi 4-5 kZŕsk nŕŕi Lv`  
 cŁZŕb ŕŕŕZ nq/ Lv`i cŁqvM gvŕŕv cŕp Pŕn`vi I ci ŕbFŕP Kŕi/ ivŕŕŕm gvfQi mŕ iK  
 Lv` mŕeŕP Aŕmŕŕi Pŕn`v 40-45 kZŕsk/

tKvb ubw`e` r`tb PrIKZ. gvtQi Drcv`b j`g`v`v`K Lv`i cwieZB nvi w`tq`Y KitjB D<sup>3</sup> r`tb PrIKZ. gvtQi GKwU dmj Drcv`tbi Rb` c`qvRbxq tgvU Lv`i cwi gvY cvl qv hrtel

ubtP gvtQi GKwU dmj (single crop) Drcv`b Kivi Rb` tgvU Lv`i cwi gvY ubY`qi c`wZ eY`v Kiv ntjv| G c`wZtZ cZ`mkZ Drcv`b j`g`v`v`K Kti c`kzi t`q tgvU Lv`i cwi gvY ubY`q Kiv nq|

tKvb ubw`e` r`tb PrIKZ.gvtQi Drcv`b j`g`v`v`K Lv`i cwieZB nvi w`tq`Y KitjB D<sup>3</sup> r`tb PrIKZ.gvtQi GKwU dmj Drcv`tbi Rb` c`qvRbxq tgvU Lv`i cwi gvY cvl qv hrtel

GKwU dmj c`q tgvU Lv`i cwi gvY = m` iK Lv` c`qvM GK i cZ gvtQi ewaZ Drcv`b c`q Lv`i cwieZB nvi |

GKwU D`vniY w`tq`w`lq`w`k Avil cwi`vi Kiv hq| aiv hvK tKvb r`tb c`kuzK Lv`i I ci wbfP Kti GK i cZ 500 tKwR gvQ Drcv`Z nq| m` iK Lv` c`qvM Kti GK i cZ 1000 tKwR gvQ Drcv`tbi j`g`v`v`K Kiv ntjv| A`f gvtQi Drcv`b w`Y KitZ nte| gtb Kwi m` iK Lv`i cwieZB nvi 3| m`z`ivs GK i cZ c`qvRbxq Lv`i cwi gvY = 500 \_ 2 \_ 3 = 3000 tKwR| G cwi gvY Lv` GKwU cY`% Prl Kvj`xb mgq`vcx gvtQi %`w`K IRtbi Avb`w`ZK nrti cZ`w`b c`qvM KitZ nte| A`f gvtQi GKwU dmj Prtli mgqKij 6 gvm ntj 3000 tKwR Lv` Avb`w`ZK nrti 6 gvm e`vcx w`tZ nte|

Dcti Duj`LZ wetePbvq m` iK Lv`i cwi gvY ubY`qi Rb` i`agv`l c`kuzK Lv`i I ci wbfP Kti gvtQi Drcv`bxj Zv Rvrv`\_vKv`iKvi| D`j`L` th m`vavi Yf`vte tKvb Rjvktqi ariY`gZvi (carrying capacity) Awak gvQ Drcv`b m`fe bq| m`z`ivs Drcv`b j`g`v`v`K ariY`gZvi g`a`w`b`Y`Y` KitZ nte|



**mvi gg** gvtQi c`w` Pwn`v c`j`v`v`v` tgvU`v`vi Rb` c`kzi i evBti t`\_K Lv` w`tZ nq| c`kzi i evBti t`\_K gvQ`K t`l`qv Gme Lv` e`K m` iK Lv` ejv nq| gvtQi m` iK Lv` t`K wewf`baw`f`w`E`Z t`k`i`w`eb`v`m Kiv n`q`\_v`K| Lv` kw<sup>3</sup> Ges Awgtli cwi gvtYi w`f`w`E`Z m` iK Lv`i t`k`i`w`eb`v`m Kiv nq| h`\_v` Awak kw<sup>3</sup> m` baeLv` I Kg kw<sup>3</sup> m` baeLv` m` iK Lv` t`K c`kuzK m` iK Lv` I Kw`lg m` iK Lv` GB` f`v`M f`v`M Kiv hq| c`kzi gRyKZ gvtQi`w`K IRb Abv`qx Lv` w`tZ nte| GKB m`st`M c`kzi i wewf`baw`v`b Lv` w`tZ nte| Lv` e` mi`v`v`i w`Q`w`t`q` b`v` w`tq``s` Levi tU`ev cvUvZ`b w`tZ nte| cZ`w`b w`w`e` r`tb, w`w`e` mg`q` Lv` w`tZ nte| gvtQi cZ` GK K IRb e`x`i Rb` th cwi gvY Lv` M`h`t`Yi c`qvRb nq Zv`KB D<sup>3</sup> Lv`i cwieZB nvi ejv nq| gvsmv`k`x` I iv`g`m gvtQi t`g`t`I gRy gvtQi tgvU IRtbi 4-5 kZvsk nrti Lv` cZ`w`b w`tZ nq| Lv`i c`qvM gvU`v`v` c`w` Pwn`vi I ci wbfP Kti| iv`g`m gvtQi m` iK Lv` m`e`P Awgtli Pwn`v 40-45 kZvsk|



**cūVvĒi gj<sup>3</sup> vqb 2.4**

**mWk DĒti i cūk wK vPý (√) w b|**

- 1/ *wbþPi tKvþ& þj v Dv<sup>m</sup>¼ Drþmi m<sup>±</sup> i K Lv<sup>3</sup>?*
- K) *PvDþj i Kzv, Mþgi fv, mwi lvi ^Lj*
  - L) *óUv, wchvkv, tMþqvi*
  - M) *wck wgj, Mew<sup>3</sup> ci i i<sup>3</sup>, þi kgKxU wgj*
  - N) *Dv<sup>m</sup> cäv¼Ub, cþYx cäv¼Ub, tebþ\_vm*
- 2/ *wbþPi tKvþ& þj v cävYR m<sup>±</sup> i K Lv<sup>3</sup>?*
- K) *mqvwb, fUþ`v, AvUv, gq`v*
  - L) *Dv<sup>m</sup> cäv¼Ub, Rj R Dv<sup>m</sup>, ¶þ` cäv*
  - M) *wck wgj, kvþ& wSbþKi gvsm, Mew<sup>3</sup> ci i i<sup>3</sup>*
  - N) *meþ Nvm, ZY.RvZxq Dv<sup>m</sup>, Bvþj Bvþj*
- 3/ *GK tKvR gvQ Drcv`þb 4 tKvR m<sup>±</sup> i K Lv<sup>3</sup> cþqvRb nþj D<sup>3</sup> Lv<sup>3</sup> i cwi eZþ nvi KZ nþe?*
- K) 3
  - L) 1
  - M) 5
  - N) 4
- 4/ *iv¶þm gvþQi Lv<sup>3</sup> mþeþP Avþþl i Pwv`v KZ?*
- K) 40 - 45%
  - L) 30 - 35%
  - M) 20 - 25%
  - N) 10 - 15%

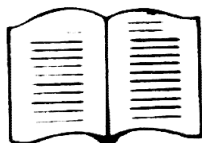
## e`enwiK

### cvW 2.5 gvŕQi Lv` cŕqvŕMi tKŠktj i I ci e`enwiK Abŕxj b



- cŕkzi Lv` cŕqvŕMi veirfbacxūZ mgŕŭ nŕZ Kj ŕg ev`e avi Yr cŕteb|
- cŕkzi Lv` cŕqvŕMi veirfbacxūZ mgŕŭ Abŕŕ iŕK ŕbR nŕZ ŕkŕŕv ŕŕZ cŕiŕeb|

### cŕmŕK Dc`ŕcbv



gvŕQi mŕ iK Lvevi ŕŕiŕŕi nŕZ cŕŕi -

(1) cvDWi ev` av Lvevi Ges (2) `vbr`vi Lvevi |

Argiv GB Lvevi cŕqvŕM cxūZ Abŕxj b Kiŕev| GB Abŕxj ŕbi Rb` ŕbŕPi DcKiY,ŕjv cŕqvRb nŕe

### cŕqvRbxq DcKiY

- cvDWi ev` av Lvevi t PrDŕŕi i Kŕv/Mŕgi fŕl/mŕi lvi ŕŕj
- `vbr`vi Lvevi t KvcRvZŕxq gvŕQi Rb` ŕZŕi `vbr`vi Lvevi
- Lv` ivLvŕŕi i Rb` cvŕ ev`terj &
- Lv` I Rb Kivi Rb` e`ij vŕŕ ev`ŕocvj ŕ
- Lv` vbx ev`tU<sup>o</sup>
- ŕQ`hŕ cŕmŕK ev`cŕj ŕ\_b e`vM

### Kŕŕi aviv

Lv` cŕqvŕMi cŕe`cŕkzi gRZ gvŕQi cvivgvY ŕRŕb ŕbb| Zvici mŕiŕY 5 Abŕvŕx Lv` i cvivgvY ŕbYŕŕ Ki b|

mŕiŕY 5 t KvcRvZŕxq gvŕQi Lv` cŕqvŕMi nŕi

gvŕQi Mo I Rb (Mŕg)	`ŕbK Lv` i cvivgvY (%)
1 - 5	10
5 - 10	5
10 - 15	4
50 - 500	3

- mŕ iK Lvevi ŕnŕŕe Kŕv e`enŕi Kivi Rb` GKŕU cvŕŕ ŕbŕŕ cvivgvY Kŕv tgŕc ŕbb|
- hŕ Kŕv/fŕl i mŕŕ mŕiŕŕi ŕŕj e`enŕi KiŕZ Pŕb Zvŕŕj 12 NŕUv cŕe`cŕmŕŕZ ŕfRvŕbv ŕŕj ŕbŕŕ AbŕvŕZ (50t 50) Kŕv ev`fŕl i mŕŕ ŕgŕkŕŕŕ ŕMj vKvi ej enbŕŕŕ ŕbb (ŕŕŕ 6)|



uPÎ 6 t tMjvKvi ej AvKwZtZ `Zwi m² iK Llevi |

1. tMjvKvi ej AvKwZtZ `Zwi Llevi 2. Llevi ivLvi cvÎ

- %Zwi `vbr`vi Llevi e`envi Kivi Rb` GKwU cvÎ uwr`Ø cwi gvY Llevi tçtc ubb|
- 1 eM`ngUvi gvtci GKwU eçki ev KivVi tdtgi uwr`P bñBj tbi Rivj ev gkvixi Kivco j vMçq Lv` vbr`ev tU`%Zwi Ki b| 1 uNvi cçzi 2 uU tU`vcb Ki tç B Pj ç|
- cvDWvi, av, tMjvKvi ej uKsev `vbr`vi Llevi cçzi i Pri cvçk 3-4 uU uwr`Ø `vrb Qwoçq u`b (uPÎ 7)|



uPÎ 7 t cçzi Lv` cçqvM Kiv nç Q

- `vbr`vi uKsev tMjvKvi ej Kiv Llevi tU`ev Lv` vbr`Z cçqvM Ki b (uPÎ 8)|



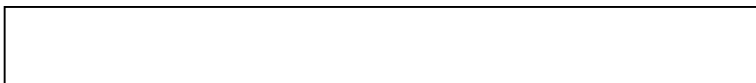
uPÎ 8 t cKzi Lv` vbxZ Lv` f`qv n# 0

1. eviki Luj 2. Lv`mn cvÎ 3. Lv` vbx

- cvDWi uKsev `vbr`vi Lvevi uQ`h# cij u\_b uKsev cmóK e`vM Kti cKzi i `yGKuU  
`vrb LujZ tetu cmbtZ Sij tq u`b (uPÎ 9)|



IPĪ 9 t uQ` hÿ cij u\_b e`iM Lv` c0qM c×uZ |



**mZRZv ev ve teP` ve l qmgn**

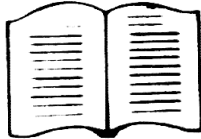
- cÿzi ubqigZ (w`tb 2 evi) Lvevi w`tZ nte |
- Lv` Aek`B `^` m\$Z n`Z nte |
- cÿzi cımbi ZvcgvĪv Ges , Yv , tYi Zvi Ztg`i mĕ\_ Lv` c0qM nvi l Kgtenk nte |
- cÿzi cıv/Utbi Drcv`b Ly tenk n`j Lvev`i cwi gvY Kugtq w`tZ nte |
- kxZKv`j Lvevi c0qvMi cwi gvY A`a`Ki tenk Kugtq Avrb th`Z cıv |
- 15 w`b Aši uKsev gv`m 1 evi bgjv msMh Kti gv`Qi `^`nK ep`xi mĕ\_ msMvZ ti`L Lv``i cwi gvY uWK Ki`Z nte |
- Lv``vbx e`envi Kiv n`j Zv ubqigZ cwi`vi Kiv c0qvRb |

Dij uLZ e`envi K KvRuUi veei Yx Avcbvi e`envi K LvZvq vj`L uDUi`K t`Lv |



**Abkxj b (Activity):** cKzi Lv` c0qvMi wwfbcxwZ, tj v ij Lly Ges GRb` Kx Kx wRwbm wetePbv Ki tZ nte Zv ij Lly?

**gše:** cKzi h\_vh\_fite myg Lv` c0qvM Kiv ntj gvtQi `aZ ewx nte| Lv` i AcPq Kg nte Ges mtePP e`envi wbwDZ nte nte|



**mvi gg®:** gvtQi m# iK Lvevi `gaitbi ntZ cvti thgb- cvDWi ev ,ov Lvevi Ges `vbr`vi Lvevi | gvtQi Lv` c0qvMi tKSkjtj i Ici e`enwiK Abkxj tbi Rb` PwDjtj i Kzw/Mtgi fwl/mwi lvi %j, KvcRvZxq gvtQi Rb` %Zwi `vbr`vi Lvevi, Lv` ivLw/%Zwi i Rb` cvI ev tev j & Lv` IRb Kivi Rb` e`vjvY ev `wocvj w, Lv` vbx ev tU° Ges wQ`hY cmoK ev cwi w\_b e`vM BZ`w` DcKiY c0qvRb| Lv` c0qvMi cte`cKzi gRZ gvtQi cwi gvY tRtb tblqv DwpZ| 15 w`b Aši wKsev gvtm GKevi bglyv mSMh Kti gvtQi `wK ewx i mvt\_ mSMwZ ti tL Lv` i cwi gvY wK Kiv DwpZ|



Povš gj "vqb - BDrbU 2

mswŋ|B I i Pbvj K cŋæ

- 1/ m̄úí-K I cŋKwZK Lv̄ "i gŋa" ŋKifc m̄ Kŋe` "gvb Zv eYŋv Ki b|
- 2/ gvQ PvŋI i Rb" cwi bi ŋewfbæ, Yv, ŋYi Abŋj gvŋv Dŋj L Ki b|
- 3/ gvŋŋi m̄ i K Lv̄ " ŋKvb Lv̄ " Dcv` vb Kx cwi gvŋY \_vKv DŋPZ Zv Dŋj L Ki b|
- 4/ m̄ i K Lv̄ " ej ŋZ Kx eŋq? m̄úí-K Lv̄ " KZ cŋvi I Kx Kx?
- 5/ m̄ i K Lv̄ " i cwi gvY ŋbYŋi c×wZ eYŋv Ki b|
- 6/ ŋgvŋŋi Lv̄ " MŋŋY cwi ŋŋŋki ŋewfbæ ŋbqvgK ŋbqŋYKvix ŋvgKv cij b Kŋi ŋ - Avŋj vPbv Ki b|
- 7/ gvŋŋi Lv̄ " Pwŋ`vi I ci cwi bi , Yv, ŋYi cŋŋe Avŋj vPbv Ki b|
- 8/ ŋ`ŋk cŋB ŋewfbæ cŋvi m̄úí-K Lv̄ " i eYŋv ŋ`b|
- 9/ Lv̄ " i cwi eZŋ nŋŋi i msÁv ŋj Lŋ|



DĚi gjv - BDrbU 2

cW 2.1

1/ L 2/ M 3/ K 4/ N

cW 2.2

1/ K 2/ M 3/ L 4/ M

cW 2.3

1/ N 2/ L 3/ M 4/ M

cW 2.4

1/ K 2/ M 3/ N 4/ K

BDibU 3 Lv` Zwj Kv cÖZKiY

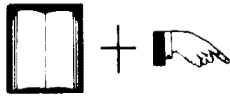
### BDibU 3 Lv` Zwj Kv cÖZKiY

gvfQi Awak epX Z\_v mteP Drcv`tbi Rb` myg cyoKi Lvevi AZxe Ri ix| Awgl , kKPr, tn, wFUmgb, LubR jeY I cmb BZ`w` Lv` Dcv`vbi mgstq myg cyoKi Lvevi `Zwi Kiv hvg| gvfQi Lv` `ZwiZ cÖYR I Dw`4 Dfq ai`bi DcKiYB e`eüZ ntZ cvi | weifbæ Lv` DcKiY w`tq gvfQi Lv` `Zwi i t`f`f` Lv` Zwj Kv cÖZKiY Avek`K| gvfQi Lv` Zwj Kv cÖZKiYi Rb` Lv``i Dcv`vb, Lv` DcKiY, Lv` cÖZ wbgvej x, Lv` ,`vgRvZKiY, e`envi I Avb`wZK Dcv`vbmgn gj`vqb m` tK`ng`K Avb`vKv`i Kvi |

G BDibU i weifbæ cviV Lv` Zwj Kv cÖKiYi Df`k, Lv``i Dcv`vb, Lv` cÖZi wbgvej x, cÖqMc`vZ I Lv` ,`vgRvZKiY Ges Avb`wZK Dcv`vbmgn gj`vqb BZ`w` weI tq we`vni Zfvte Avtj vPbv Kiv ntqfQ|

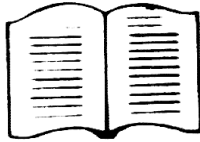
### cW 3.1 Lv``i Dcv`vb

#### G cW tkfI Avcib -



- Lv` Dcv`vb ej tZ Kx eSvq Zv ej tZ cvi teb|
- Lv``i weifbæ Dcv`vb ,tj vi bvg ej tZ I wj LtZ cvi teb|
- gvfQi Rb` cÖqvRbxq AZ`vek`Kxq A`vqvBtbr GimW I d`wU GimW ,tj v Kx Kx tm m`fU ej tZ cvi teb|
- Lv``i cmi e`envi m`fU eY`v Ki tZ cvi teb|

#### Lv``i Dcv`vb



myg cyoKi Lv` Qvor gvfQi mteP Drcv`b m`e bq| myg Lv` Dcv`vb ,tj v ntj v Awgl , kKPr, tn ev `Zj , Lv` cÖY ev wFUmgb, LubR jeY I cmb| w`tp Lv` Dcv`vb ,tj vi msw`fB eY`v Kiv ntj v

#### Awgl

cÖYf`tn th mg`  
A`vqvBtbr GimW w`tR  
w`tR mst`k`l Z ntZ cvi  
bv Ges Gf`i`K Lv``i  
gva`tg emni t`tK MhY  
Ki tZ nq Zv`i`K  
AZ`vek`Kxq A`vqvBtbr  
GimW etj |

gvfQi Lv` Awgl me`ak , i`zcy`Lv` Dcv`vb tKbbv gvfQi Awgl i Pmn`v `j Pi cÖYf`i tP`qI tenk| gvfQi tckxKj v, Ašt`w`Z A½, gMR, Pvgov ev ZK BZ`w` i tenki fivMB ntj v Awgl | GB Awgl weifbæ ai`bi A`vqvBtbr GimW i mgstq MwZ| Awgl mavi YZ gvfQi tckxKj v Mv, f`q`c`B Kj vi c`Mv, tKvI mst`k`- IY I kix`ii tiwM cÖZtiva f`gZv epX Kti | cÖYf`tn th mg` A`vqvBtbr GimW w`tR w`tR mst`k`- w`l Z ntZ cvi bv Ges Gf`i`K Lv``i gva`tg emni t`tK MhY Ki tZ nq Zv`i`K AZ`vek`Kxq A`vqvBtbr GimW (essential amino-acid) etj | gvfQi Rb` w`tPi `k`w A`vqvBtbr GimW AZ`vek`Kxq-

- w`g`w` I wbb (Methionine)
- A`ij wbb (Alanine)
- w`f`wbb (Threonine)
- w`l`c`f`w`v`v` (Tryptophan)
- f`v`ij b (Valine)
- AvB`tmv`-w`j I wbb (Iso-leucine)
- w`j I wbb (Leucine)

- wcbvBj Gj wbb (Phenylalanine)
- wv÷wv (Histidine)
- j vBwmb (Lysine)

**tøn ev `Zj**

gvfQi `wK ewxi Rb`  
Am<sup>3</sup> d`wU GmW<sub>3</sub> tjv  
\_vKv Avek`K|

gvfQi Rb` AZ`vek`Kxq  
d`wU GmW wZbuU ntv-  
wj tbnvj K GmW,  
wj tbnvj wK GmW |  
Gi wKtWwK GmW|

tn ev `Zj Lv` i wZxq , i ZcY`Dcv`vb| c`Yx wKsev Dw`Rij vbx kw<sup>3</sup> wntmte tn ev `Zj Rgv \_vtK| tn RvZxq c`v`GKuU th`MK Dcv`vb hv c`Yx Ges Dw` Dftq cvl hv hvq| GB tn RvZxq c`v`cwb`Z `exfZ bq| wKŠ `Re `etY (solvent) thgb - GmWUvb, B\_vj, tKv`idig BZ`w`tZ `exfZ nq| GB tn RvZxq c`v`wefbæd`wU GmW`Wi mgštq MwZ| wKj wnb d`wU GmWmgntK m<sup>3</sup> d`wU GmW (saturated faty acid) Ges wKj h<sup>3</sup> d`wU GmWtK ejv nq Am<sup>3</sup> d`wU GmW (unsaturated faty acid)| gvfQi `wK ewxi Rb` Am<sup>3</sup> d`wU GmW<sub>3</sub> tjv \_vKv Avek`K| wtkl Kti wPwoi Lv` wDeÜbh<sup>3</sup> d`wU GmWmgn \_vKv Acw nuh<sup>3</sup> th mg` d`wU GmW gvfQi t`tn wbtR wbtR mstk- wZ nZ cvti bv Ges Zt`i`K Lv` i gva`tg MhY KiZ nq Zt`i`K AZ`vek`Kxq d`wU GmW etj | gvfQi Rb` AZ`vek`Kxq d`wU GmW wZbuU ntv- wj tbnvj K GmW, wj tbnvj wK GmW | Gi wKtWwK GmW|

cKZc`f| tn ntv mKj Lv` Dcv`vbi gta` twk kw<sup>3</sup> m<sup>3</sup> | GuU tKv c`Pxi Ab`Zg Kvvtgv wntmte KvR Kti | tn cwb`Z A`exfZ wefbæwUwgtbi `RueK evnK wntmte KvR Kti |

**kKv ev KtewBtWU**

Lv` Awgl | tn Dcv`vbi ci kKv ntv , i ZcY`Dcv`vb| cwigvYi w`K t`K Dw` RvZxq Lv` kKv mteP| mvaviYZ M- tKvR, j`vKtUvR, m<sup>3</sup>UvR, óvP, KvBwU, Ges tmj t<sup>3</sup>vR mgštq kKv MwZ|

kKv mvaviYZ kw<sup>3</sup> i Drm wntmte KvR Kti wKQyKv mvaviYZ nRg nq bv, G<sub>3</sub> t<sup>3</sup>vK w dvBeri (crude fibre) etj | tmj t<sup>3</sup>vR, KvBwU, wj MwU Gi Ašf<sup>3</sup> dvBeri tK mvaviYZ Ac`c` kw<sup>3</sup> i Drm aiv nq| wKŠ GuU Lv` `r Ges tctU Lv` AvUwKtq ivLvi mgq evovq|

**Lv` c`W ev wUwgb**

gvQ | Ab`vb` c`Yxi `wK ewxi Rb` GKwU AZ`vek`Kxq Lv` Dcv`vb ntv Lv` c`W ev wUwgb| wUwgbtK `fvtM fivM Kiv hvq -

- cwb`Z `exfZ wUwgb  
\_vqwg (thiamine), ivBtev`w (riboflavin), cvBwUw b (pyridoxine), c`vUv`wK GmW (pantothenic acid), evtqwu (biotin), dwj K GmW (folic acid), BtbwUj (Inositol), tKwj b (choline), wbtKwUwK GmW (nicotinic acid), mwqvtvKvevj`wgb (cyanocobalamine), GmKi`wK GmW ev wUwgb- w (ascorbic acid) BZ`w` |

- `Zj ev Pw`Z `exfZ wUwgb  
tiwUj (retinol), Kwj K`ij wntdij (colecaceferol), tUvKv`dij (tocoferol)|

wUwgtbi Avek`KZv  
mvaviYZ gvfQi aib,  
Lv` i Mv, gvfQi ewx  
BZ`w` i lci wvP Kti |





### cvŹVvĚi gj''vqb 3.1

#### mŹK DĚti i cvŹk ŹK vŹy (√) w b |

- 1/ AwgI Kx w Źq MŹVZ nq?
  - % d''wU GŹmW mgŹŹq MŹVZ nq  
A''vgvBŹbr GŹmW mgŹŹq MŹVZ nq
  - & wŹUngŹbi mgŹŹq MŹVZ nq  
wewfbŹLubR j eŹYi mgŹŹq MŹVZ nq
  
- 2/ cŹnbŹZ `ŹxfZ wŹUngb tKvŹbŹU?
  - % \_vqngb  
ti wUbj
  - & Kij K''ij wŹŹdij  
tUŹKvŹdij
  
- 3/ wŹŹPi tKvŹbŹU tMŹY LubR Dcr`vb?
  - % K''ij wŹqvg  
g''wŹŹbŹwŹqvg
  - & dŹdŹi vŹm  
tŹwŹi b
  
- 4/ wŹŹPi tKvŹbŹU AcŹŹ Dcr`vb?
  - % AwgI  
Pie©
  - & kKŹv  
cŹnb

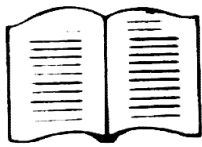
### cW 3.2 Lv<sup>o</sup> DcKiY, Lv<sup>o</sup> c<sup>o</sup>Z vbqvej x l c<sup>o</sup>qM c<sup>o</sup>xWZ



#### G cW tk<sup>o</sup>l Avcib -

- gv<sup>o</sup>tQ Lv<sup>o</sup> DcKi<sup>o</sup>Yi tk<sup>o</sup>Yveb<sup>o</sup>vm Ki<sup>o</sup>tZ cvi<sup>o</sup>teb|
- eisj vt<sup>o</sup> tk cvl qv hvq Ggb me grm<sup>o</sup> Lv<sup>o</sup> DcKi<sup>o</sup>Yi bvg ej tZ l vj LtZ cvi<sup>o</sup>teb|
- Lv<sup>o</sup> c<sup>o</sup>tZi cte<sup>o</sup>h mg<sup>o</sup> melq, t<sup>o</sup> v Rvbr<sup>o</sup> i Kvi tm, t<sup>o</sup> v m<sup>o</sup> tK<sup>o</sup>ej tZ cvi<sup>o</sup>teb|
- Kxfvte Lv<sup>o</sup> DcKiY ube<sup>o</sup>Pb Ki<sup>o</sup>tZ nq tm m<sup>o</sup>tU ej tZ cvi<sup>o</sup>teb|
- Lv<sup>o</sup> m<sup>o</sup>lvq<sup>o</sup>bi cKvi<sup>o</sup>t<sup>o</sup> ej tZ l vj LtZ cvi<sup>o</sup>teb|
- vb<sup>o</sup>tR Lv<sup>o</sup> m<sup>o</sup>l %Zwi Ges Lv<sup>o</sup> c<sup>o</sup>Z Ki<sup>o</sup>tZ cvi<sup>o</sup>teb|
- Lv<sup>o</sup> c<sup>o</sup>qM c<sup>o</sup>xWZ m<sup>o</sup>tU e<sup>o</sup>vL<sup>o</sup> v Ki<sup>o</sup>tZ cvi<sup>o</sup>teb|

#### Lv<sup>o</sup> DcKiY



c<sup>o</sup>YR Ges D<sup>o</sup>W<sup>o</sup> Dfq ait<sup>o</sup>bi DcKiYB gv<sup>o</sup>tQi Lv<sup>o</sup> e<sup>o</sup>e<sup>o</sup>Uz ntZ cvi<sup>o</sup> | m<sup>o</sup>vaviYZ gv<sup>o</sup>tQi Lv<sup>o</sup> %Zwi i Rb<sup>o</sup> wdk vgt<sup>o</sup>ji l ci te<sup>o</sup>wk vb<sup>o</sup>fP Ki<sup>o</sup>tZ nq| KviY gv<sup>o</sup>tQi Lv<sup>o</sup> Avig<sup>o</sup>tl i Pnn<sup>o</sup> v Z<sup>o</sup> bvg<sup>o</sup>YK f<sup>o</sup>ite te<sup>o</sup>wk| Avevi A<sup>o</sup>tBK gv<sup>o</sup>Q g<sup>o</sup>skv<sup>o</sup>m<sup>o</sup> etj Z<sup>o</sup> v<sup>o</sup> i Avig<sup>o</sup>tl i Pnn<sup>o</sup> v l te<sup>o</sup>wk| gv<sup>o</sup>tQi Lv<sup>o</sup> e<sup>o</sup>e<sup>o</sup>Uz DcKiY, t<sup>o</sup> vtK vb<sup>o</sup>t<sup>o</sup> f<sup>o</sup>ite tk<sup>o</sup>Yvef<sup>o</sup>im Kiv th<sup>o</sup>tZ cvi<sup>o</sup> |

#### c<sup>o</sup>YR DcKiY

c<sup>o</sup>YR Lv<sup>o</sup> DcKiY gv<sup>o</sup>tQi K<sup>o</sup>l<sup>o</sup>g Lv<sup>o</sup> %Zwi tZ, i ZcY<sup>o</sup> ve<sup>o</sup>tkl K<sup>o</sup>ti D P gj<sup>o</sup> v<sup>o</sup>b m<sup>o</sup> b<sup>o</sup>e c<sup>o</sup>WZ thg<sup>o</sup>- m<sup>o</sup>v<sup>o</sup>b, vP<sup>o</sup>no BZ<sup>o</sup> v<sup>o</sup> i Lv<sup>o</sup> c<sup>o</sup>YR Avig<sup>o</sup>tl i, i Z<sup>o</sup> Acwi mxg| m<sup>o</sup>viW 6 G v<sup>o</sup>Wfba c<sup>o</sup>YR Avig<sup>o</sup>tl i D<sup>o</sup>rm t<sup>o</sup> Lv<sup>o</sup> v<sup>o</sup> nt<sup>o</sup> v |

m<sup>o</sup>viW 6 t gv<sup>o</sup>tQi Lve<sup>o</sup>t<sup>o</sup> i c<sup>o</sup>YR D<sup>o</sup>rmgn

D <sup>o</sup> rm	DcKi <sup>o</sup> Yi aib	DcKiY
mg <sup>o</sup> y	grm <sup>o</sup> RvZxq	Kv <sup>o</sup> Pr gv <sup>o</sup> Q, wdk m <sup>o</sup> vB <sup>o</sup> tj R, wdk v <sup>o</sup> g
	A <sup>o</sup> tgi `Ux	vP <sup>o</sup> no, `KBW, v <sup>o</sup> v <sup>o</sup> vP <sup>o</sup> no
`j fvM	Km <sup>o</sup> vBLv <sup>o</sup> vi DcRvZ	n <sup>o</sup> v <sup>o</sup> to i, av, e <sup>o</sup> vW v <sup>o</sup> g j, v <sup>o</sup> U v <sup>o</sup> g j, P <sup>o</sup> govi DcRvZ, av
	t <sup>o</sup> c <sup>o</sup> w <sup>o</sup> e <sup>o</sup> DcRvZ	t <sup>o</sup> c <sup>o</sup> w <sup>o</sup> e <sup>o</sup> DcRvZ, av, n <sup>o</sup> v <sup>o</sup> B <sup>o</sup> t <sup>o</sup> W <sup>o</sup> v <sup>o</sup> BW cvj K, av
	t <sup>o</sup> W <sup>o</sup> Bi x DcRvZ	t <sup>o</sup> K <sup>o</sup> mb (casein), i K <sup>o</sup> t <sup>o</sup> br `g
	Ab <sup>o</sup> vb <sup>o</sup>	t <sup>o</sup> i kg, v <sup>o</sup> U, e <sup>o</sup> v <sup>o</sup> t <sup>o</sup> i, av, kv <sup>o</sup> g <sup>o</sup> v <sup>o</sup> Sb <sup>o</sup> t <sup>o</sup> Ki, av, e <sup>o</sup> vW v <sup>o</sup> g j

#### D<sup>o</sup>W<sup>o</sup> RvZ DcKiY

m<sup>o</sup>vaviYZ D<sup>o</sup>W<sup>o</sup> RvZ Lv<sup>o</sup> DcKi<sup>o</sup>Y c<sup>o</sup>YR DcKi<sup>o</sup>Yi b<sup>o</sup>vq te<sup>o</sup>wk c<sup>o</sup>vi gv<sup>o</sup>tY Avig<sup>o</sup>l v<sup>o</sup>tK bv| ve<sup>o</sup>tkl K<sup>o</sup>ti AZ<sup>o</sup> v<sup>o</sup>ek<sup>o</sup> K<sup>o</sup>xq Av<sup>o</sup>gv<sup>o</sup>B<sup>o</sup>t<sup>o</sup>br GimW Gi c<sup>o</sup>vi gv<sup>o</sup>Y Z<sup>o</sup> bvg<sup>o</sup>YK f<sup>o</sup>ite Kg v<sup>o</sup>Kvq D<sup>o</sup>W<sup>o</sup> Lv<sup>o</sup> c<sup>o</sup>Y gv<sup>o</sup>t<sup>o</sup>bi v<sup>o</sup> K t<sup>o</sup> t<sup>o</sup> vb<sup>o</sup>gv<sup>o</sup>t<sup>o</sup>bi nq| m<sup>o</sup>te<sup>o</sup> c<sup>o</sup>vi D<sup>o</sup>W<sup>o</sup> Avig<sup>o</sup>tl i c<sup>o</sup>Yve<sup>o</sup>t<sup>o</sup>ivax (anti-nutrient) Dc<sup>o</sup>v<sup>o</sup> vb ve<sup>o</sup>gv<sup>o</sup> v<sup>o</sup>Kvq gv<sup>o</sup>tQi Lv<sup>o</sup> Gi e<sup>o</sup>envi m<sup>o</sup>vgZ K<sup>o</sup>ti t<sup>o</sup>q| Z<sup>o</sup>te v<sup>o</sup>Wfba ait<sup>o</sup>bi c<sup>o</sup>Y<sup>o</sup>qv<sup>o</sup>RvZKi<sup>o</sup>Yi gra<sup>o</sup> t<sup>o</sup>g Gme c<sup>o</sup>Yve<sup>o</sup>t<sup>o</sup>ivax Dc<sup>o</sup>v<sup>o</sup> vbmgn A<sup>o</sup>tBKvsk<sup>o</sup> i Kiv m<sup>o</sup>te | Gme Am<sup>o</sup>veav m<sup>o</sup>tZ<sup>o</sup>l kK<sup>o</sup>P<sup>o</sup>vi D<sup>o</sup>rm Ges v<sup>o</sup>t<sup>o</sup>g m<sup>o</sup> v v<sup>o</sup>earv gv<sup>o</sup>tQi Lv<sup>o</sup> Gi e<sup>o</sup>v<sup>o</sup>ck e<sup>o</sup>envi nt<sup>o</sup> Q| m<sup>o</sup>viW 7 G D<sup>o</sup>W<sup>o</sup> RvZ Lv<sup>o</sup> DcKiY mgn t<sup>o</sup> Lv<sup>o</sup> v<sup>o</sup> nt<sup>o</sup> v -

D<sup>o</sup>W<sup>o</sup> Avig<sup>o</sup>tl i c<sup>o</sup>Yve<sup>o</sup>t<sup>o</sup>ivax Dc<sup>o</sup>v<sup>o</sup> vb ve<sup>o</sup>gv<sup>o</sup> v<sup>o</sup>Kvq gv<sup>o</sup>tQi Lv<sup>o</sup> Gi e<sup>o</sup>envi m<sup>o</sup>vgZ K<sup>o</sup>ti t<sup>o</sup>q|

mvi wY 7 t Dw<sup>MC</sup> RvZ Lv` DcKiYmgn

Drn	Lv` DcKiYmgn	cĀuqRvZKiY c×iZ
`Zj exRmgn	mquieb űgj	tguktb űbhĀZ, `ētb űbhĀZ/
	i vB mvi l v	tguktb űbhĀZ, `ētb űbhĀZ/
	mvi l vi `Lj	tguktb űbhĀZ
	uZtj i `Lj	
	uZumi `Lj	
	ev`vtgi `Lj	
	Zĵv exRi `Lj	
km` vbv	Mg	civDwvi
	fĀv	
	PvDtj i Kov	
	fĀl	
	uēwfbačKvi Wvj exR	

GK tKvl űekó Awgl

e`vKtUwi qv, QĀvK, B÷, `kej BZ`w` GKtKvlx Awgl %Zwi i Rb` cĀZ MtelYv ntqtQ| Zte embuR`Kfvte eZgvtb e`vKtUwi qvi GKtKvlx tcĀUbB e`vcKfvte Drcw Z nt Q| Gi ewYwR`K bvg cĀUb (Pruteen)| GB cĀUb ewYwR`Kfvte %Zwi KZ.gvtQi Lv` mdj Zwi mvt\_ e`envi nt Q| GB Dcv`vb Lv` 45% chS e`envi Kiv nt Q|

Kul I űktĀ i DcRvZ

uēqv i g` %Zwi KviLvbi DcRvZ `ē`w` thgb - Brewer's yeast, dried distiller's soluble, distiller's dark grain BZ`w` gvtQi Lv` i , i ZcY<sup>Q</sup>Lv` Dcv`vb| Gme DcKiY gvtQi Lv` 20% msthvRb Kti fvjtj v dj cvl qv tMtQ| mvi wY 8 G ersj vt`tk cvl qv hvq Ggb me Lv` DcKiĀYi i vmiqubK MVb t`qv ntj v|

mvi wY 8 t uēwfbačLv` DcKiĀY cĀDc`vĀbi , YMZ gvtbi űeeiY (% i Kbv Ae`vq)

DcKiĀYi bvg	% Awgl	% tøn	% kK <sup>Q</sup> v
uclK űgj (Fish meal)	50-65	8-12	2-3
nvtoi , av (Bone meal)	45-55	8-10	1-2
gjmMi bmo fĀD (Poultry offal meal)	55-60	12-18	2-3
uPsvoi , av (Shrimp meal)	40-55	3-5	5-8
বঁাড মিল (Blood meal)	90-95	1-2	1
PvDtj i Kēv (Rice bran)	12-16	10-15	40-45
Mtgi fĀl (Wheat bran)	14-17	4-5	50-60
mvi l vi `Lj (Mustard oil cake)	30-35	10-12	35-45
uZw i `Lj (Linseed meal)	35-40	7-10	40-45
uZtj i `Lj (Sesame meal)	35-40	8-10	35-40
mquieb `Lj (Soyabean meal)	45-55	5-15	30-35
ev`vtgi `Lj (Groundnut meal)	50-55	5-7	25-30
Zĵv exR űgj (Cotton seed meal)	40-45	4-6	35-40

### Lv` cŕZ vbgvej x

Lv` cŕZi cte<sup>9</sup>ibaj uLZ melq,tjv Avgv<sup>7</sup>i Rvbr`i Kvi -

1. th gvtQi Rb` Lv` %Zwi Kiv nŕQ Zvi evRvi gj` uK %Zwi Lv`i gŕj`i mvt\_ mvgAm`cY?
2. vbe<sup>9</sup>PZ gvtQi Lv`vfm Ges cwi cvKZŕši MVb uKi c? GuU uK ivŕjtm, me<sup>9</sup>K, bv uK ZYŕfvrX|
  - GuU uK cvbi Zjŕ`tki, ga`fvM<sup>i</sup> ev Dcwi fvM<sup>i</sup> Llevi Lrq?
  - GuU uK v`ŕbi tejv, i m<sup>7</sup> tejv, fv<sup>i</sup> uKsev mU`vtejv Llevi MhY Kŕi?
  - GuU uK big, Arar big A\_ev k<sup>3</sup> Llevi cQ` Kŕi?
3. tKv&aitbi Pvl nŕe - tPŕev P<sup>v</sup>, LvBr uKsev cKŕi?
4. Kx c<sup>x</sup>uZŕZ Llevi cŕZnŕe?
5. vbe<sup>9</sup>PZ gvtQi AZ`vek`Kxq c<sup>9</sup>Dcv`vŕbi Pvn`v uKi c?

Dcti i melq,tjv vetePbv Kŕi B`iayc<sup>9</sup>Dcv`vŕbi i/cŕi Lv (Profile) vbu`<sup>9</sup> KŕiZ nŕe|

- Avigŕi i cwi gvY (mte<sup>9</sup>P/melb<sup>9</sup>)
- AZ`vek`Kxq A`vgvBŕbv GuUW (melb<sup>9</sup>)
- tm ev `Zj (mte<sup>9</sup>P/ melb<sup>9</sup>)
- AZ`vek`Kxq d`mU GuMŕWi cwi gvY melb<sup>9</sup>
- vfvUvgb (melb<sup>9</sup>)
- LvBR jeY, vŕkl Kŕi K`vj vmqvG Ges dmdim (mte<sup>9</sup>P)
- kKŕi cwi gvY (mte<sup>9</sup>P)
- Avk ev dvBeri (mte<sup>9</sup>P)|

c<sup>9</sup>vgvb, Ac<sup>9</sup> Dcv`vb,  
 c<sup>9</sup> vŕivax Dcv`vb,  
 cŕc`Zv I`vŕgi Ici  
 vfv<sup>9</sup>E Kŕi Lv` DcKIY  
 vbe<sup>9</sup>Pb Kiv DvPZ|

### cŕc` Lv` DcKIY vbe<sup>9</sup>Pb

c<sup>9</sup>vgvb, Ac<sup>9</sup> Dcv`vb, c<sup>9</sup> vŕivax Dcv`vb, cŕc`Zv I`vŕgi Ici vfv<sup>9</sup>E Kŕi Lv` DcKIY vbe<sup>9</sup>Pb Kiv DvPZ| cŕc`KvU m<sup>9</sup>te` DcKIY vŕv<sup>3</sup> vŕlŕqi Ici vfv<sup>9</sup>E Kŕi vbe<sup>9</sup>Pb KŕiZ nŕe|

- Pŕvš Lv` cŕc`KvU DcKIY uK DcKvix fv<sup>9</sup>kv cij b KŕiQ?
- cŕc`KvU DcKIY Kg-`vgx Lv` cŕc`Zi Dm vntmte KvR KŕiQ uK bv?

### Lv` mŕvqb

Lv` mŕvqb uZb fvŕe Kiv thŕZ cvŕi -

- nvZ ev K`vj Kŕj Ui e`envi Kŕi
- t` W kvU (Spread sheet) ev m<sup>v</sup>avi Y Kv<sup>9</sup> DUvi mdUI q`vi e`envi Kŕi
- Kv<sup>9</sup> DUŕi vj v<sup>9</sup>qv<sup>i</sup> t<sup>9</sup>Mŕg ev c<sup>x</sup>uZi gv<sup>9</sup>ŕg

GB Avŕj vPbvq Avgiv`iaynvZ ev K`vj Kŕj Uŕi i m<sup>v</sup>vŕth` Kiv GKvU D`vniY vŕlŕq Avŕj vPbv Kŕiŕv|

**mtefKó. μq gj`vqb (Best buy analysis)**

nevfbeai`bi Lv` DcKi`Yi GKK gtj` Kx cwi gvY Dcv`vb wKsev Kx cwi gvY AvigI ev tcU`Ub cvl qv hvq Zvi Z`jbr KivB ntjv mtefKó. μq| mvi wY 9 G GKwU mtefKó. μq gj`vq`bi D`vni Y t`qv ntjv -

mvi wY 9 t mtefKó. μq gj`vq`bi D`vni Y

DcKiY	cwb (Water)	AvigI (Protein)	tn (Fat)	F`š (Ash)	kKfV (NFE)	Avka (Fibre)	`vg (UvKv/Ub)
wdk wj	9.7	55.0	8.0	23.7	2.2	1.4	30,000
mwi lvi `Lj	9.5	30.5	13.7	10.6	25.0	10.7	6,000
mqwieb `Zj	10.3	45.8	17.9	4.5	14.5	6.0	20,000
PvD`tj i Kev	8.9	13.3	2.4	9.6	56.4	9.4	4,000
M`gi fwl	11.2	16.11	3.9	4.22	52.17	12.4	4,000

cU`Z tKwR AvigI i `vg -

$$wdk wj = \frac{30,000}{550} = 54.55 \text{ UvKv}$$

$$mqwieb `Zj = \frac{20,000}{458} = 43.67 \text{ UvKv}$$

$$mwi lvi `Lj = \frac{6,000}{305} = 19.67 \text{ UvKv}$$

$$PvD`tj i Kev = \frac{4,000}{133} = 30.00 \text{ UvKv}$$

$$M`gi fwl = \frac{4,000}{161} = 24.83 \text{ UvKv}$$

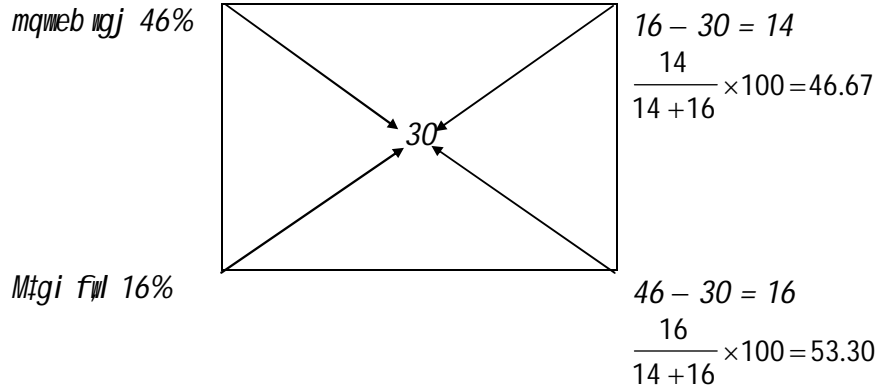
cU`Z tKwR wdk wj, mwi lvi `Lj, Ges mqwieb `L`ji tcU`U`bi gta` mwi lvi `L`ji tcU`U`bi `vg mefPtq Kg Ges GUV ntjv U`mtefKó. μq|

GLv`b t`Lv hvq th, cU`Z tKwR wdk wj, mwi lvi `Lj, Ges mqwieb `L`ji tcU`U`bi gta` mwi lvi `L`ji tcU`U`bi `vg mefPtq Kg Ges GUV ntjv U`mtefKó. μq| Ab` w` tK cU`Z tKwR PvD`tj i Kev l M`gi fwl i `vg hwi l mgvb, cU`Z tKwR AvigI i gtj` i w` K t`\_tK M`gi fwl μq ntjv mtefKó. μq|

**nv`Z Lv` m` %wv**

gj Zt Lv` i AvigI i cwi gvY tKB cU`tg mefPbv Kiv nq| Zvi ci AZ`vek`Kxq A`v`vB`bv GimW, kw<sup>3</sup> Ges Ab`vb` cyb Dcv`vb mefPbv Kiv nq| cU`qvR`tb DcKi`Yi m`vqb clyeB`vm Kiv th`Z cvti | GB c`xwZwU clyt clyt AY`xj b Kiv nq hZ`qY chS bv Lit` cyb Dcv`vbmgt`ni KwLZ gv`lv AwR` nq| GB c`xwZ`Z m`vaviYZ Ast`Ki ev MwY`Zi GKwU tKŠk`ti m`v`v`th` hMcr mgx`KiY mgvav`bi gva`tg dg`j kb Kiv nq| Gim U`vcqvi m`Y` `qvi U` (Pearson`s square) c`xwZ b`v`tg cwi wPZ|

ԳԼԿԵԲ ԵՂԵՂ Դ՝ՎՆԻԿՅԻ ԵՂԵՂԻՆ՝ ԳԿԻՍ 30% ԱՅԿԼ ԵՂԵՂ ԼՐ՝՝ ԴԵՂԵՂԻ ԵՂԵՂԻ ԵՂԵՂԻՆ՝ -  
 ԵՂԵՂԻՆ՝ ԱՅԿԼ = 46%  
 ԵՂԵՂԻՆ՝ ԱՅԿԼ = 16%



46.67% ԵՂԵՂԻՆ՝ + 53.33% ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ 30% ԵՂԵՂԻՆ՝ ԼՐՎԻ ԵՂԵՂԻՆ՝  
 ԵՂԵՂԻՆ՝ ԴԶԿԻԿ՝ ԵՂԵՂԻՆ՝ ԱՅԿԼ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԴԶԿԻԿ՝ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝

$\text{ԱՅԿԼԻ ԵՂԵՂԻՆ՝} > 30\%$   
 $\text{ԱՅԿԼԻ ԵՂԵՂԻՆ՝} \leq 30\%$

ԳԼ Դ՝ՎՆԻԿՅԻ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԱՅԿԼԻ ԵՂԵՂԻՆ՝

ԱՅԿԼ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ = 46% ԱՅԿԼ  
 ԵՂԵՂԻՆ՝ = 55% 0

ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ = 13% ԱՅԿԼ  
 ԵՂԵՂԻՆ՝ = 16% ԱՅԿԼ

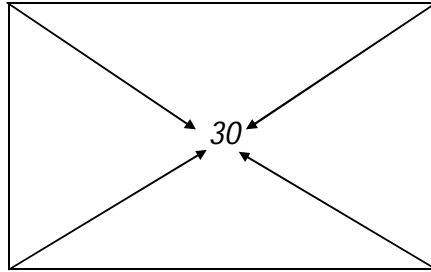
ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ 50% ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝

$\text{ԵՂԵՂԻՆ՝} + \text{ԵՂԵՂԻՆ՝} (50 \text{ t } 50) = \text{-----} = 50.5\% \text{ ԱՅԿԼ}$

$\text{ԵՂԵՂԻՆ՝} + \text{ԵՂԵՂԻՆ՝} (50 \text{ t } 50) = \text{-----} = 14.5\% \text{ ԱՅԿԼ}$

ԳԼ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝ ԵՂԵՂԻՆ՝

uĉk + mqweb 50.5%



$$\frac{14.5 - 30 = 15.5}{\frac{15.5}{15.5 + 20.5}} \times 100 = 43.05$$

Kəv + Fvĭl 14.5%

$$\frac{50.5 - 30 = 20.5}{\frac{20.5}{15.5 + 20.5}} \times 100 = 56.95$$

mŕZivs, GB 30% Avngl ubaŕi Z Lv'' i ngkY nte -

- mqweb ugj = kZKiv 21.53 fVM
- uĉk ugj = kZKiv 21.53 fVM
- PvDŕj i Kəv = kZKiv 28.47 fVM
- Mŕgi fvĭl = kZKiv 28.47 fVM

-----  
kZKiv 100.00 fVM

RvZe'' t GB aiŕbi unŕmŕei mgq GK Avngl gvĭv t\_ŕK Ab'Uv tŕŕŕĭ ŕetqvŕMi memgq ŕetqvM (-) ŕPŕŕK AMŕn'' KiŕZ nŕe|

**Lv'' cŕZ**

PvĭKZ. gvŕQi AvKvi ev gŕŕLi AvKŕŕi I ci ŕfvĕ Kŕi Lveŕŕi AvKvi ubaŕŕY Kiv DvPZ|

evQvBKZ. ŕevfbaLv'' Dcv`vb fvj fvŕe ŕav Kŕi ev PŕŕKŕi ŕbv`ŕ Pŕjŕb ŕŕŕq tPŕj ŕbŕZ nŕe| Zvi ci mĭ ev dgŕv Abŕvqx ŕbv`ŕ I Rŕbi DcKiY tŕŕc ŕbŕZ nŕe Ges GKŕU cvŕŕ me\_ŕjv DcKiY fvj fvŕe ŕgkŕŕZ nŕe| ŕgŕkZ LveŕŕK cŕvb ŕgŕkŕŕq big KiŕZ nŕe| cŕi ŕbv`ŕ hŕŕi mŕvŕŕh'' ŕŕŕj U ev `bv`vi Lveŕi %Zŕi Kiv nŕq| PvĭKZ.gvŕQi AvKvi ev gŕŕLi AvKŕŕi I ci ŕfvĕ Kŕi Lveŕŕi AvKvi ubaŕŕY Kiv nŕq| n`Pŕj Z hŕŕ ŕbv`ŕ AvKŕŕi Pŕjŕb e`enŕi Kŕi ŕevfbaAvKŕŕi `bv`vi Lveŕi %Zŕi Kiv hvŕq| emŕŕR`Kfvŕe Lveŕi %Zŕi i Rb'' eo AvKŕŕi hŕŕ e`enŕi Kiv nŕq|

**Lv'' cŕqM cŕŕZ**

gvQ PŕŕL Lv'' cŕqvŕMi Dŕŕk'' nŕjv Kg LiŕP ŕenk Drcv`b ŕbv`ŕZ Kiv|

gvQ PŕŕL Lv'' cŕqvŕMi Dŕŕk'' nŕjv Kg LiŕP ŕenk Drcv`b ŕbv`ŕZ Kiv| Lv'' cŕqvM cŕŕZ ŕbfŕP Kŕi gvŕQi Lv'' ŕf`vm Ges gvQ Pŕl cŕŕZi I ci | Pŕl ŕbŕeo ŕKŕev Avav ŕbŕŕŕŕŕ I ci ŕbfŕP Kŕi cŕqvM gvĭv| hŕ cŕqvMKZ.Lveŕi gvQ mŕ YŕvB MŕY Kŕi Zŕe ŕenk jvŕ ŕbv`ŕZ nŕZ cvŕi| Gŕŕŕŕĭ PvĭKZ.gvŕQi Rb'' Lv'' mŕVK Mŕŕbi, cŕvbŕZ ŕŕqZj mŕ baGes mŕŕ`y nŕZ nŕe|

gvŕQi Lv'' MŕY gvŕQi AvKŕŕi I ci ŕbfŕPkvj | gvŕQi AvKvi evŕŕi mŕŕ\_ mŕŕ\_ Lveŕi MŕŕYi cŕi gvY Ges gvĭv KgŕZ \_ŕŕK| Aveŕi cŕvb Zvcgvĭv Lv'' MŕŕYi MŕZŕK cŕŕmeZ Kŕi | cŕvb Zvcgvĭv evŕŕj Lv'' MŕŕYi cŕi gvY evŕŕ cŕvq, Zŕe GB Zvcgvĭv gvŕQi evŕŕi mŕvqK mŕgvŕi gŕa'' nŕZ nŕe| gvĭvZŕi<sup>3</sup> Zvcgvĭvq Lveŕi cŕqvŕMi gvĭv Kŕgŕŕ ŕŕŕZ nŕe| cŕvb `ŕŕfZ Aw`ŕRb| Lv'' MŕYŕK cŕŕmeZ Kŕi | Aw`ŕRŕbi cŕi gvY Kgŕj Lv'' MŕŕYi gvĭv KgŕZ \_ŕŕK|

Lv'' cŕqvŕMi gvĭv ŕVK KiŕZ nŕj bgŕv I Rŕbi gva`ŕg gvŕQi Mo I Rb ŕVK Kŕi Zv ŕbYŕ KiŕZ nŕq| mŕvŕYZ gvŕQi ŕŕŕni I Rŕbi 3-5% I Rŕbi Lveŕi mieivn Kiv nŕq| Zŕe gvŕQi

I Rb ewxi mif\_ mif\_ Lvevi t`qvi cwiġvYI mgšq KiġZ nte| tQvU AvKvġi i ġvġQi Rb`  
Lr'' cĦqvtMi ġvġv eo ġvġQi tPtq Nb Nb (frequent) nġZ nte|

ġvġK ġj Z wZb fite Lvevi t`qv hġq -

- nġZ w`ġq Lvl qvtbv (Hand feeding),
- Pwv`v AYġvqx Lvl qvtbv (Demand feeding) Ges
- ħsqwġq fite (Automatic)|

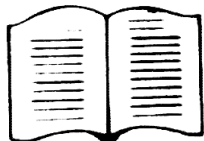
Dctiv<sup>3</sup> 2 Ges 3 bs c×wZġZ mvari YZ ewwYR`K wfvġġZ Mfxi mgġ`<sup>a</sup>Lvġq ġvġ PrġI i tġġġ  
e`eüZ nq| BDġiġc m`vġb Ges UġDU (Trout) ġvġQi PrġI GB c×wZ e`envi Kiv nq| GB  
`ġ c×wZ G aiġbi i vġġm cRwZi Rb` Dchġ|

nġZ w`ġq Lvl qvtbv ev nġZ w`ġq Lr'' cĦqvm ġġ mva` Ges mgq mġcġ| Zey GB c×wZi  
tek mġav iġġQ| KviY Lvevi i cĦZ ġvġ wKġc mġov t`q Zv Lr'' cĦvbKvi x`Ptġ t`LġZ  
cvti hv ġvġ PrġI tek , i ZcYġ wRv Lvevi nġZ Qvov Ab` c×wZġZ cĦqvm Kómvā`| Zv  
Qvov GKB e`w<sup>3</sup> mew`b Lvevi w`ġj ġvġ, tġv H e`w<sup>3</sup> i DcġwZġZ cwiġPwZ I Af` nġq hġq|

ġvġK Lvevi t`qvi mgq cġġi tKvb wv`ġ ħ`ġb t`qvB fġġv| Gi dtġ wKQm`ġbi ġġav  
ġvġ tRġb hġq tKv`vq tMġj Lvevi cvġ qv hvġe| KġqKw`b ci ci Lvevi i`vb cwi eZġ Kiv  
fġġv| ġvġS ġvġS cixġv Kġi t`LġZ nte ġvġ mg` Lvevi tLġġQ wKbv? mg` Lvevi bv tLġj  
Lvevi cġP wlv<sup>3</sup> M`vm mġó nġZ cvġi | ZvB`vb cwi eZġ Kġi Lvevi t`qv fġġv| AġbK mgq  
Dcti i Ask tLġv ġiġc evġ- Kġi I Lvevi t`qv nq| hv cġi cixġv Kġi t`Lv hġq th ġvġ  
Lvevi tLġġQ wKbv| GKw`ġbi Lvevi GKevġi cwi eZġ<sup>2/3</sup> evġi t`qv ġvġQi ewx` Rb`  
mġvqK| i B RvZxq ġvġQi Rb` mvi wY 10 Abġvqx Lvevi cĦqvm Kiv nq -

mvi wY 10 t Lr'' cĦqvm nvi I c×wZ

Lvevi i cġvi	cĦqvm nvi	cĦqvm c×wZ	cĦZw`b cĦqvm msL`v
bvmġ x Lr'' (cvDwvi / vbr`vi)	ġvġQi t`ġni I Rġbi 10-15%	cġġi i Pvi cvġk 3-4 wJ wv`ġ ħ`ġb Qwotq w`ġZ nte	3-4 evi
wġk <sup>a</sup> PrġI Lr'' (vbr`vi)	ġvġQi t`ġni I Rġbi 3-5%	cġġi i Pvi cvġk 3-4 wJ `ġb wQwġq w`ġZ nte	2-3 evi



**mvi ġġ:** cĦYR I Dv<sup>4</sup> Dfq aiġbi ġvġQi Lr'' wġmte e`eüZ nġZ cvġi | cĦYR Lr''  
DcKiY ġvġQi Kwġġ Lr''`ZwiġZ AZġe , i ZcYġ Kwġv ġvġ, wdk wġj , eww wġj , nvti , av,  
tcwġ<sup>a</sup> DcRvZ , av, kvġġ wSbġKi , av BZ`w` ġvġQi cĦYR Lr'' DcKiY| Pvdġj i Kġv  
Mġġi fwl , mġweb wġj , mvi lvi `Lj , wZġj i `Lj BZ`w` ġvġQi Dv<sup>4</sup> RvZ Lr'' DcKiY| th  
ġvġQi Lr''`Zwiġ KiġZ nte Zvi evRvi ġġ` Lvġ`i ġġ`i mif\_ mġAm`cY<sup>3</sup>wK bv, ġvġQi  
cwi cvKZġši Mvb, Lr''v`vm, i vġġm `fġei bwiK meġK BZ`w` wetePbv Kġi B Lr'' cĦZ  
KiġZ nq| ġvġQi Lr'' DcKiY, tġvġK Lr'' mġvġvqx wv`ġ I Rġbi tġc GKġġ wġkZ Kġi  
cwb wġkġq big Kivi cġi wv`ġ ħġši mġvġh` wġġ U ev`vbr`vi Lvevi`Zwiġ Kiv nq| ġvġ  
Prġ c×wZ I ġvġQi Lr''v`vġmi I ci ġvġQi Lr'' cĦqvm c×wZ wbfġ Kġi | cwbġZ `evfZ  
Av` tRġbi cwi ġvY Kġġ tMġj ġvġQi Lr'' MġġYi ġvġv KġġZ`vġK|



### cŕVvĚi gj''vqb 3.2

#### mŕK DĚti i cŕk ŕK ŕŕy (√) ŕ b |

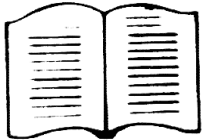
- 1/ ZbŕfŕRx gŕŕQi Zŕbvq gŕsmŕkx gŕŕQi AvigŕI i Pŕn`vi tŕŕŕŕ tKŕbŕU mŕK?
    - % Pŕn`v teŕk
    - Pŕn`v Kg
    - & Pŕn`v mgvb
    - tKŕbŕvB bv
- 2/ gŕŕQi mŕyg Lv'' %ZŕiŕZ AvigŕI i Drm ŕntŕte teŕk e`eüZ nq ŕbŕPi tKŕbŕU?
    - % Pŕŕj i Kŕv
    - Mŕgi fŕl
    - & ŕck ŕgj
    - gq`v
- 3/ embŕR`Kfŕte Drcŕ`Z e`ŕŕŕi qŕi GKŕKŕx tŕŕŕbŕK Kx ej v nq?
    - % B÷
    - cŕŕb (Pruteen)
    - & `keŕj
    - A`ŕgvBŕbv Gŕmŕ
- 4/ cŕnbŕZ Av ŕRŕbi gŕŕv Kgtj gŕŕQi Lv'' MŕŕYi cĚYZŕi tŕŕŕŕ ŕbŕPi tKŕbŕU mŕK?
    - % cĚYZŕ eŕŕo
    - cĚYZŕ Kŕg
    - & cĚYZŕ ŕ`i \_ŕŕK
    - cĚYZŕ ŕ`i \_ŕŕK bv

### cW 3.3 Lv`'i `vgRvZKIY Ges e`envi

#### G cW tkñI Avcib -



- Kx Kx ubqvGK `vgRvZKIYi mgq Lv`'i `YMZ gvb ¶wZMõ Kti Zv eYõv KiñZ cviñeb|
- `vgRvZKIYi mgq Lv`'i Kx Kx ivmivubK cwi eZõ nq Zv ejñZ I wj LtñZ cviñeb|
- `vgRvZKIYi mgq Kx Kx wetñi cõZ j ¶i ivLñZ nq tm m`ñUI e`vLv KiñZ cviñeb|



m` Yõv `vbr`vi Lv`'i %ZwiñZ e`eüZ Lv`'i DcKIY ev %Zwi Lvevi `vgRvZKIYi cõqvRb nq| `vgRvZKIYi mgq I Rb I `bMZ gvb Ges mteñcwi A`ñwZK ¶wZ nñZ cviñeb| Lv`'i msi ¶ñYi Rb` mgyñte `vgRvZKIY AZ`vek`K| KviY gvñK t`q Lveñi i gvb `vgRvZKIYi I ci ubfñKxj | `vgRvZ Kivi mgq Lv`'i cõ`vgK `YMZ gvñbi I ci `vgRvZ Lv`'i Gi `Z ev añi bó nI qv ubfñ Kti |

Lv`'i msi ¶ñYi Rb` mgyñte `vgRvZKIY AZ`vek`K|

ubaj wLZ ubqvGKmgñ `vgRvZKIYi mgq Lv`'i `YMZ gvb Ges I RbñK ¶wZMõ Kti -

- gvbly KZñ Pzi nI qv, AwMë» nI qv wKsev Bñj I tcvKvñKo õvñ ¶wZMõ nI qv|
- eñõ, Av`Zv, wKsev D P Zvcgvñv õvñ ¶wZMõ nI qv|
- QñvK KZñ ¶wZMõ nI qv|
- GbRvññgi wewñqv Ges RviñYi dñj cPb|

#### Lv`'i tñZ AcPq (Physical loss)

µgñMZ ¶ñZ`¶ñZ`AcPñi dñj Lv`'i eo aiñbi AcPq NUñZ cviñeb|

µgñMZ ¶ñZ`¶ñZ`AcPñi dñj Lv`'i eo aiñbi AcPq NUñZ cviñeb| Bñj I wewñbñcñvñ gvñKtoi AvµgñY Lv`'i `vñgi cñZ ¶wZ mñab KiñZ cviñeb| mñavi YZ Lv`'i `vg tcvKv gvñKtoi cñRbb tññI wññte KvR KiñZ cviñeb|

#### cwb wKsev D P Zvcgvñv

Lv`'i `vgRvZKIYi mgq Zvi cwbñi cwiñY 10% Gi Kg nI qv ev`ñbñq| D P Zvcgvñv Lv`'i AcPq Ges Lv`'i bó nI qvñi MñZñK ZjññSñZ Kti |

evZñtm D P Avñcñ¶ñK Av`Zv Lv`'i DcKIY Ges %Zwi Lv`'i cõ`¶ñ ¶wZ KiñZ cviñeb| tenk cwbMñY Ktiñj Lv`'i DcKIY LõB wñRvñ nñZ cviñeb| Avevi `vbr`vi Lv`'i nñj Zvi ewññK MVB I bó nñq thñZ cviñeb| Zvõvov D P Av`Zv tcvKv gvñKtoi ewññi Rb` mñvñK| cõññKññ fñte i`Kvñ Lvevi I hñ `vñg msi ¶ñY Kiv nq, Avñ Avñ Zv `vñgi Avñcñ¶ñK Av`Zvi mgchñq Av`Zv tkvñY Kti | MññSññb GjñKvñ Lv`'i `vgRvZKIYi tek Amññevñ| KviY evZññmi Avñcñ¶ñK Av`Zv cõqk 75% fññMi tenk `vñK| Lv`'i `vgRvZKIYi mgq Zvi cwbñi cwiñY 10% Gi Kg nI qv ev`ñbñq|

D P Zvcgvñv Lv`'i AcPq Ges Lv`'i bó nI qvñi MñZñK ZjññSñZ Kti | D P Zvcgvñv Lv`'i QñvK Ges tcvKv gvñKtoi `Z ewññZ mñvñZv Kti |

#### QñvK õvñ ¶wZ

evZññtm 15% Gi I ci cwbñi Ges Avñcñ¶ñK Av`Zv 65% Gi Dcñi `vñKñj Zv QñvñKi ewññi Rb` wññKññ fñte mñvñK| tenki fññM QñvKB 2.50 tñt Gi tenk Zvcgvñv Ges 85% Gi tenk Avñcñ¶ñK Av`Zvñ Rñññ `vñK| D P Zvcgvñv GB ewññK Avñ I mñvñZv Kti | Lv`'i

DcKiY cġqRvZKiġYi mgq tenki fivm QġvK givv tMġj l wKQyKQyġ vi (spore) t\_ġK hġq Ges Dchġ cwiġetġ Avevi ewx cvq| QġvġKi ewxi dtġ Lv` vġKiġYi l Rb nwm cvq, Zvcgvġv ewx, weeYnġl qv Ges Lv` gvBġKvUw b (QġvK KZġ wbtmZ weLv<sup>3</sup> c`v\_ġ Drcbe nq| Lv` Dġj - LthvM` gvBġKvUw tbi gġa` 00Avdjv Uw b00gvġQi Rb` weLv<sup>3</sup> |

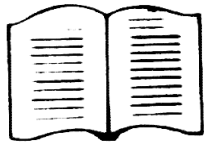
**ġvġRvZKiġYi mgq Lv` iuvqibK cwi eZġmgn**

Rviġbi dtġ Lv` i tm ev ġZj tġt0 gġ d`vUġvmtW ifcivšwiZ nq, hv Lv` MġUi mġo Kġi | tcvKv gvKġoi mspġgb Ges QġvġKi ewx d`vUġvmtWi fivObġK Avġiv ZġvšZ Kġi | th me Lv` tenk cwi gvY Am<sup>3</sup> wġ-eÜb weikó ġZj vġK tm me Lv` Mġhġ cPġbi mġebv tenk vġK | ġvġRvZKiġYi vġqġZġi mġ\_ mġ\_ Lv` cġY ev wFvUvġġbi ġġZv nwm cvq| Lv` cġKvZKfġte th mg` wFvUvġb vġK tm, tġv ġvġRvZKiġYi dtġ bó nq| weġkl Kġi wFvUvġb LġB mste` bkxj |

**ġvġRvZKiY c`vġ**

Dġj - wLZ Avġj vPbvi t\_ġK ešv tMġj th, ġvġRvZKiġYi mgq Lv` DcKiY Ges %Zwi Lvevi bó ev ġvZMġ' nġZ cġi | weġkl Kġi MġšKvġxb Ges Mġšcġvġb GġvKvq Lv` ġvġRvZKiġYi ci hZ ZvovZwi o mġe e`envi Kiv DvPZ | ġvġRvZKiġYi mgq wġvġ wLZ weġġi cġZ j ġ' ivLv cġqvRb t

- tQvU tQvU vġKvġi Lv` ġvġRvZ KiġZ nġe |
- mġe nġj fġg t\_ġK DġġZ KvġVi l ci vġKvġi msi ġY Kiv DvPZ |
- Lv` DcKiY l %Zwi Lv` mġvKfġte tġġej ev vPvġ Z Kġi ivLġZ nġe |
- vġKZ.evġMi l ci AcġqvRġb nvUvPġv Kiv wK bq | GġZ vbrvi Lvevi tġsġM, tġv nġq thġZ cġi |
- vġgi t`qvġj i mġ\_ j wMġq e`vM vġKZ.Kiv DvPZ bq |
- Lv` tgvġKi Rb` mġe nġj eü-i weikó Av`ZvġivaK \_ġj ev ev e`envi Kiv DvPZ |
- vġgi Zvcgvġv mġe nġj 20<sup>0</sup> tm. Gi wġP ivLġZ nġe |
- vġg B`ġy l Ab`vb` ġZ`cġYxi AYġġek tiva KiġZ nġe |
- vġg msi ġġYi cġeLv` ev Lv` DcKiġYi cġbi cwi gvY 10% Gi Kg nġZ nġe |



**mvi gg<sup>o</sup>:** gvġQi Lv` ZwiġZ e`eüZ Lv` DcKiY Ges vZwiKZ. Lv` ġvġRvZKiġYi cġqvRb nq| Lv` msi ġġYi Rb` mġvġte ġvġRvZKiY AZ`vek`K | KvY gvQġK t`q Lvevġi i gvġ ġvġRvZKiġYi l ci wġfġKxj | Pwġ nġqv, AvMġe` nġqv wKsev D P Zvcgvġv, QġvK 0vġv ġvZMġ' nġqv Ges GbRvBġgi weġqv l RviY BZ`vġ wġqvġmgn ġvġRvZKiġYi mgq Lv` i YMZ gvġ l l RbġK ġvZMġ' Kġi | MġšKvġxb Ges Mġšcġvġb GġvKvq Lv` ġvġRvZKiġYi ci hZ ZvovZwi o mġe e`envi Kiv DvPZ |



### cŕVvĚi gj`vqb 3.3

#### mŕK DĚti i cŕk ŕK ŕŕy (√) ŕ b |

1/ Lr`" , `vgRvZKiŕYi mgq Lr`" cŕbi cŕi gvY KZ nI qv DŕPZ?

- % 10% Gi Kg  
10% Gi teŕk
- & 20% Gi teŕk  
20% Gi Kg

2/ gvŕQi Lr`"i me gvBŕKvUŕ ŕbi gŕa" ÓAvdjv Uŕ bó Gi ŕŕŕŕ ŕbŕPi ŕKvbŕU mŕK?

- % ŕelv<sup>3</sup>  
ŕelv<sup>3</sup> bq
- & DcKvix  
Lŕ DcKvix

3/ , `vgRvZKiŕYi ŕŕŕŕŕŕi mŕŕ\_ mŕŕ\_ gvŕQi %Zwi Lr`" ŕfUŕŕŕŕŕi ŕŕgZv Gi ŕŕŕŕŕ ŕKvbŕU mŕK?

- % eŕŕ× cŕq  
nŕm cŕq
- & Acŕi eŕZŕ\_ŕŕK  
`ŕZ eŕŕ× cŕq

4/ , `vgRvZKiŕYi mgq Lr`" Kŕfŕŕe i vLŕ DŕPZ?

- % tLŕjv Ae`ŕq  
KŕŕVi eŕŕ.
- & Av`ŕv ŕivaK tgŕoŕK  
PŕUi \_ŕj ŕZ



**f`š (Ash) ev LubR jeY**

tKvb Lv` bglv`K 600<sup>0</sup> tm. Zvcgv`vq tcvov`bvi ci Aevkó A%Re e`B ntjv f`š ev LubR jeY|

**kKv**

Lv` kKv ci gvY mi vmi vbYq Kiv Kóvva`| ZvB Ab` me Dcv`vb vbYq Kivi ci 100% t`K veqvM w`q mnt`R kKv ci gvY vbYq Kiv nq|

**Lv`i , Yv, Y vbYqi i vqvBK c`vZ (Chemical tests for diet quality)**

GKvU D Pgvb m` b`Lv` %Zvi KiZ ntj D Pgvb m` b`Lv` DcKiY e`envi KiZ nte| Lv` DcKiYi gvB hvvBtqi Rb` vbaj vLZ veLq, tjv ve`Pbv Kiv nq t

**Avgt`I i , YMZgvb**

mvavi YZ AZ`vek`Kxq A`vqvBt`v Gvmt`Wi ci gvY Ges tccvmb cwi cvP`Zv vbYqi gva`tg Avgt`I i , YMZgvb vbYq Kiv nq|

**PveP , Yv, Y**

AvtqvMvb gvB, cvv-A· vBW gvB, gv` d`vU Gvmt`Wi ci gvY BZ`v` cwi gv`ci gva`tg PveP , YMZgvb vbYq Kiv nq|

**f`š ev LubR jeY**

mvavi YZ vdk vgtj LubR jeYi ci gvY Rvbi Rb` GB ve`k`Y Kiv nq|

**cvp ve`ivax Dcv`vb I veLv` `e`v`**

mvavi YZ `Zj exR RvZxq Lv` Dcv`v`b vevfbcv`ve`ivax Dcv`vb thgb- MjKvmiBt`vtj U, Mvvcj , dvBuUK Gvmt`W BZ`v` \_v`K| G me Dcv`vb Avgt`I i , YMZgvb nvm Kti |

**`RveK gv`vqb**

`RveK c`v`vq Lv` DcKiY Ges %Zvi Lv` gvQ`K LvL qv`bvi ci Zvi evx ev cwi cvP`Zv vbYqi gva`tg Gi gv`vqb Kiv nq| GB c`vZ`Z gvQ`K Lvevi LvL qv`bvi ci gv`Qi t`n Kx ci gvY cvp Rgv ntjv A`ev Gi dtj gv`Qi Kx ci gvY evx ntjv Zv vbYq Kiv nq| GB c`vZ`Z vbaj vLZ c`vZi mrvv`h` tKvb Lv` `K gv`vqb Kiv nq|

**evx**

tKvb vbi`v mgvq GK M`c gvQ`K tKvb Lvevi LvL qv`bvi ci Zv`i evx vbYq I Zj`v Kiv nq|

**`vbK `Zt`Z`evx (Daily instantaneous growth)**

GB gvB vbaj vLZ m` t`K cvl qv hvq|

$$G_w = \frac{\ln W_1 - \ln W_0}{T}$$

thLv`b, W<sub>1</sub> = cix`vi tk`l gv`Qi I Rb|  
W<sub>0</sub> = cix`vi `i`i `Z gv`Qi I Rb|  
T = mgq|  
ln = Natural Log

**cwi cvP`Zv , busK (Digestibility Coefficient)**

Lv` DcKIY I %Zwi Lv` Df`qi Rb` GUV , i ZcYq` maviYZ ubw`q t`mvgK A· vBW Lv`i mvt\_ ugij`q gvQ`K Lvl qv`bv nq| cti gv`Qi gj (faeces) msMh Ges c`qvRbxq w`k- I`Yi gva`tg ubw` m` e`envi Kti GB cwi cvP`Zv , YisK ubYq` Kiv nq|

**t`tni Mvb**

gvQ`K Lv` Lvl qv`bvi ci gv`Qi t`tn Kx cwi gvY c`p Rgv ntjv Zv ubi c`Yi gva`tg Lv` DcKIY ev %Zwi Lv`i gj `vqb Kiv hvq| G Rb` gvQ`K t`Kvb Lv` Lvl qv`bvi cte`Ges ubw` Pvl mg`qi ci Zvi t`tni c`p Mvb ubYq` Kti Zvi gj `vqb Kiv nq|

**tc`Uub `qZvi AYgvZ (Protein efficiency ratio)**

tc`Uub `qZvi AYgvZ ev uc.B.Avi. Gi gva`tg t`Kvb Lv` tc`Uubi `qZvi cwi gvY Kiv nq| gv`Qi GKK IRb ep`x i Rb` c`qvRbxq tc`Uubi cwi gv`Yi AYgvZ`K uc.B.Avi.ej | uc.B.Avi Gi m`T

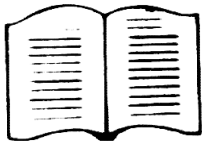
$$\text{uc.B.Avi} = \frac{\text{gv`Qi IRb ep`x (uK. Mh.)}}{\text{Lvl qv`bv tc`Uubi cwi gvY (uK. Mh.)}}$$

**Lv` k`w` gj `vqb**

Lv` DcKIY ev Lv`i KZUKzk`w` gv`Qi Rb` MhY`hvM`Zv Lv` dig`j k`bi Rb` w`kl , i ZcYq` Lv` tgvU k`w`, cwi cvP` k`w`, Ges w`civKxq k`w`i cwi gvY GKwU Lv`i c`p gvb`K w`k` R Kti | M`elYvM`ti i v`vqubK w`k- I`Yi gva`tg Lv`i tgvU k`w` Ges gvQ`K Lvl qv`bvi ci w`kl c`w`Z`Z cwi cvP` k`w` I w`civKxq k`w` ubYq` Kiv nq|

**Lv`i AYR`xq gvb**

Lv` ev Lv` DcKIY e`vK`Uw`qv ev tgvU AYR`xtei cwi gvY ubYq`i gva`tg Lv`i AYR`xZw`E`K gj `vqb Kiv nq| Lv` %Zwi i mgq fij `v`w`wa tg`b Pjvi gva`tg Lv` AYR`xtei ms`vgy nwm Kiv m`e|



**mvi gg`.** Lv` Dcv`vb I c`ZKZ.Lv` t`K w`vfb`ei v`vqubK I `Rw`K cix`qvi gva`tg gj `vqb Kiv hvq| Lv` `Zwi c`w`Zi h`v`Zv ubYq` Lv` `Zwi I , `vgRvZKi`Yi mgq c`p i AcPq, Lv` dig`j kb ev Lv`i c`p gvb m`f`U AwMh` aiYv t`c`Z ntj Gme cix`qvi c`qvRb| i v`vqubK c`w`Z`i gj `vqb maviYZ cix`qviM`ti Kiv nq| Lv`i Dcv`vbmgt`K Zv`i i v`vqubK ag`ev , Yv`Yi Ici w`f`E Kti w`vfb`e t`k`Y`Z w`f`KiyB ntjv c`p` tgU w`k- IY| maviYZ t`Rj Wj c`w`Z`Z Lv` Awgt`li cwi gvY ubYq` Kiv nq| gv`Qi GKK IRb ep`x i Rb` c`qvRbxq tc`Uubi cwi gv`Yi AYgvZ`K tc`Uub `qZvi AYgvZ ev uc B Avi etj |



### civVëi gj`vqb 3.4

#### mivK DËti i civk vK vPy (v) w b |

1/ Liv` civbi civi givY ivbYqvi Rb` Liv` tK I tftb ivb tPi tKiv& ZivcgvI vq 24 NbUv i KivZ nq?

- % 500° tmj imqvm
- 150° tmj imqvm
- & 105° tmj imqvm
- 115° tmj imqvm

2/ mivavi YZ tRj Wvj (Jeldahl) c×vZi gva`tg ivb tPi tKivvU ivbYq Kiv nq?

- % civb
- Piv©
- & kKvPv
- AvngI

3/ givQvi Liv` Div` Dciv` vtb divvUJK Givm tWi tvt tKivvU mivK?

- % AZ`vek`Kxq d`vU GivmW
- civb ivb vax Dciv` vb
- & AZ`vek`Kxq A`vqvB tbr GivmW
- vFvngb

4/ civi -A- vBW givtbi gva`tg Yv, tYi givb ivbYq Kiv nq ivb tPi tKivvU?

- % tcvU tbi
- PivP
- & kKvPv
- civbi



**BDibU 4  
cʔvKvi K KgRw³**

**BDibU 4 cʔvKvi K KgRw³**

Lv` MhY cʔYxi `wK ewx mlab Kti | GB bmxZ gvQ Qvov Ab` jPi cʔYxi tʔtI cʔhvR | tKvb Pvl cxiZtZ hLb gRtZi NbZ; ewx Kiv nq ZLb cʔKwZK Lv` gvQoi ewxi Rb` ht\_ó bq, ewni t\_ʔK Kwlg Lvevi mieivni cʔqvRb nq | Avi GB Lvevi ntZ nte mlyg, hv gvQoi ewx Ges myt`i Rb` cʔZwU Dcv`vb mieivn Kite | GB aiʔbi mlyg LveviK macy(complete) Lvevi etj | macyLvevi %Zwi i Rb` PIKZ.gvQoi weifbæcʔ Pwv`v h\_v- wUwgb, Awgl, PwekKʔv I LubR Z\_v cʔvKvi K KgRw³ mgʔU Rvbr AZ`š cʔqvRb |

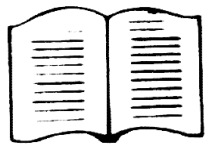
G BDibʔUi weifbæcʔv wUwgb, `vkʔK gZev`, HwZwvmK cUfvgKv, cwbʔZ `exfZ wUwgbmgn, LubR Dcv`vb I Zvi Pwv`v, Awgl, PwekKʔv I LubR Gi msÁv, cKviʔ Ges gvQoi weifbæeqtm gvQoi Awgl, PwekKʔv I LubRi Pwv`v BZ`w` wltqi Ici we`wi Zfite Avtj vKcvZ Kiv ntqtQ |

**cw 4.1 wUwgb, `vkʔK gZev`, HwZwvmK cUfvgKv**

**G cw tkʔI Avcib -**



- wUwgb ejʔZ Kx eSvq Zv ejʔZ I wj LtZ cviʔeb |
- wUwgbʔbi cKviʔf` macy ʔKejʔZ cviʔeb |
- wUwgbʔbi `vkʔK gZev` macy ʔKeyʔv KiʔZ cviʔeb |
- wUwgbʔbi HwZwvmK cUfvgKv e`vL`v KiʔZ cviʔeb |



kixʔii Rb` AZxe cʔqvRbxq cʔvi gʔa` wUwgb Ab`Zg | wUwgb AwZ Aí cvi gvʔY cʔqvRb nq | wKš`Gi Afite Rʔei kixʔi weifbæaiʔbi mgn`v t`Lv t`q | Awakvsk wUwgb cʔYxi kixʔi `Zwi nq bv | Zvb evBʔi t\_ʔK wUwgb gvQoi Lvevʔii mvt\_ mieivn Kiv ntq \_vtK | cʔYx`tn wecvKxq Kihʔej x macybæKivi Rb` wUwgb AZxe , iʔcyʔ

**wUwgb**

cʔq 15 aiʔbi wUwgb  
`Re c`v\_ʔ\_ʔK c\_wK Kiv  
macy ntqtQ |

wUwgb ejʔZ eSvq GK aiʔbi A`k` `Re c`v\_ʔhv Rʔei eaʔ I teʔP\_vKvi Rb` AZ`š Ri ix | G\_tjv tKvʔI wecvK wlvqvii Rb` wtkl fvgKv cvj b Kti \_vtK | cʔq 15 aiʔbi wUwgb `Re c`v\_ʔ\_ʔK c\_wK Kiv macy ntqtQ | Gt`i me\_tjvB GKB cRwZi gvQoi Rb` cʔqvRbxq bq | tKvb wUwgb tKvb gvQoi Rb` cʔqvRb Zv gvQoi cRwZ, eaʔbi nvi, Lvevʔii cKwZ. BZ`w`i Ici wbfʔkxj | wUwgb nitgvʔbi tʔq wfbzʔi, KviY wUwgb cāvzbZ Lv` MhʔYi gva`tg t`tn mieivn ntq \_vtK | Ab`w`ʔK t`tni wv`ʔ Mhš t\_ʔK nitgvbmgn mstkwL Z nq |

`èYxqZvi Ici wfvE Kti wUwgbʔK cāvzbZ `ʔfvʔM fvM Kiv hvq

- cwbʔZ `exfZ wUwgb Ges
- `Zj RvZxq c`vt\_ʔ `exfZ wUwgb

mviwY 11 G weifbæaiʔbi wUwgb t`Lv ntjv -

mvivY 11 t cwbZ `xfZ I `Zj RvZxq c`v`<sup>o</sup>xfZ wFUmgbi Zvij Kv

cwbZ `xfZ wFUmgb	`Zj RvZxq c`v` <sup>o</sup> xfZ wFUmgb
1. _vqmg (Thiamine) (wFUmgb ve-1)	1. tiUbj (Retinol)
2. wi tevchwfb (Riboflavin) (wFUmgb ve-2)	(wFUmgb-G)
3. cvBwi Wv b (Pyridoxine) (wFUmgb ve-6)	2. tKvtj K'ij intdij (Cholecalciferol)
4. c`vUv`ubK GimW (Pantothenic acid)	(wFUmgb-W/3)
5. ubKvUubK GimW (Nicotinic acid)	3. tUvKvtj (Tocopherol)
6. evfqmUb (Biotin)	(wFUmgb-B)
7. dij K GimW (Folic acid)	4. dvBtj vKbbk(Phylloquinone)
8. mvBqvbtvKvej `mg (Cyanocobalamin) (wFUmgb ve-12)	(wFUmgb-tK)
9. BtbvmtUvj (Inositol)	
10. tKvj b (Choline)	
11. A`imKimeK GimW (Ascorbic acid) (wFUmgb-im)	

**wFUmgbi `vkB gZev I HvZnmK cUfygKv**

wFUmgb Ame<sup>o</sup>v`ii HvZnmK NUbvejx LgB PgKc0 | Aov`k kZvaxi tkli w`tk cyone`MY gtb KitZb th GKwU myg Lv` c0` igU Dcv`vb (Proximate composition) thgb- Avgl, tn, kKv, LubR jeY Ges cwb mjbw`0 cwi gvY `vKv c0qvRb| GB wFvE`Z wevfbvDcv`v`bi cwi gvY I `YMZgv ubY`qi Rb` wevfbvMtel Yv Kvh`ig cwi Pwj Z nq| 1871 mtj c`v`im kni Aetiva Kvtj `jai Afve ciY KitZ vki Lv` Gj`temgb RvZxq Zij c`v`<sup>o</sup>kKvri Afvte vki`i Acy0Z fytZ t`Lv hvq| Gi KviY intmte ARvbn cy0 Dcv`vbtk `vqx Kiv nq| wevfbvclPxb wicvU`<sup>o</sup>t`K Rvbn hvq th, Lv` etkl Dcv`v`bi Abg`w`vzi Kvi`Y gvbtj i gta` wevfbv`vM t`Lv w`Z| 1500 mtj tRKm KwU`vi (Jacques Cartier) bvgK GKRb veAvbx DjL Kti0b th, cvBb MtQi Kwhi vbh`mi (infusion of pine needles) mrvth` `wv`<sup>o</sup>vM c0Ztiva Kiv m`e| cieZ`Z tRgm wj U (Jams Lind) 1753 mtj tj eyRvZxq dtj i i`mi mrvth` `wv`<sup>o</sup>vMi wPwKrmq mdj Zv jvf Kti b|

1500 mtj tRKm KwU`vi bvgK GKRb veAvbx DjL Kti0b th cvBb MtQi Kwhi vbh`mi mrvth` `wv`<sup>o</sup>vM c0Ztiva Kiv m`e|

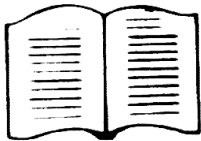
Rvcvbx tb`emvbx bmeKt` i eUw`b mgj`<sup>a</sup> `vKvi dtj Avakvstki tewi`ewi (beriberi) tivM (hv GKwU wFUmgbi AfveRv0Z tivM) Av`v`v` n`Z t`Lv thZ| 1880 mtj ZvKvK (Takaki) A`bK Mtel Yvi ci bmeKt` i Lv` Zvij Kvq cwi eZ0 Avtbb| Lv` Zvij Kvq gvsm, kvK kewR Ges `jai cwi gvY e`x`i dtj bmeKt` i `v`i`i bvUKxq DbvZ NtU| Gi ci t`K Lg Kg mL`K bmeKt` i GB tivM t`Lv hvq|

1897 mtj Eijkman bvgK GKRb WvP wPwKrmK Rvfv 0t`c Lv` Pvdj i Kev msthvRtbi gva`tg tewi`ewi tivMi Dcmg KitZ mg`<sup>nb</sup>|

cU`exi thme t`tk gvbtj i c0vb Lv` QvUvB Kiv (Polished) Pvdj thLv`b tewi`ewi tivMi c0`v`ve t`Lv hvq| 1897 mtj Eijkman bvgK GKRb WvP wPwKrmK Rvfv 0t`c Lv` Pvdj i Kev msthvRtbi gva`tg tewi`ewi tivMi Dcmg KitZ mg`<sup>nb</sup>| wZvb gjvM`K QvUvB Kiv Pvdj Lvl qv`bv gva`tg tewi`ewi tivMi c0`mgK j`vY intmte eUw` vqyc0v`ni gZ DcmM`ch`e`vY Kti b| Ab`w`tk th mg` gjvM`K A0vUvBKZ.Pvdj Lvl qv`bv ntqvQj Zv` i gta` GB tivMi tKvb j`vY t`Lv hvq| tKvb tKvb mgq QvUvBKZ.Pvdj i Kev vbh` e`envi Kti tewi`ewi tivMi DcmM`gn t`K Zv0r Avt`vM`jvf m`e ntq0|

Dcwi D<sup>3</sup> MtelYvi tcl<sup>3</sup> tclKj nwis (Pekelharing) brgK GKRb weAvbr clyiq wei x Lv<sup>3</sup> Dcr`vb e`envti i gva`tg GKw MtelYv KVR cwi Pvj br Ktib| wZub wei x Lv<sup>3</sup> Dcr`vb BujtK Lvl qvb Ges t`tLb th c<sup>3</sup>gve`vq Zivv fvj fite Lvq Ges Zvt` i tK `v`evb t`Lvq| wKs` Pri mBvn ci me`tjv Bujy gviv hvq| Bujy i Lv<sup>3</sup> h<sup>3</sup> cwibi cwi etZ<sup>3</sup> y A`ev tNvj Lvl qvtbr nq Zvtj Zivv tetP`v tK| Dcmsnvti wZub etj b th, `ja GKw AAvZ Dcr`vb AvtQ Ges Zv Lgy mvgvb` cwi gvY ntj I c<sup>3</sup>yi Rb` AZxe , i ZcY<sup>3</sup>

hyivtofi AmtevY<sup>3</sup> Ges tgtUj (Osborne and Mendel) c<sup>3</sup>Kfite Bujy i lcti GKB aitbi MtelYv Kvh<sup>3</sup>cwi Pvj br Ktib| Zivv km`vbr t`tK c<sup>3</sup>KKZ.wei x tclUub (Purified protein) Gi c<sup>3</sup>vgvb hvPvB Kti t`tLb th, h<sup>3</sup> Lv<sup>3</sup> `y msthvRb Kiv br nq Zvtj Bujy i ewx t`tg hvq, GgbwK IRtbi Ktg hvq| 1911 mtj hyivtofi gvKKjvg (McCollum) Ges Bsj`vUi ncwKbn (Hopkins) Zvt` i MtelYq GKB aitbi dj jvf Ktib| Avei 1911 mtj dvsK (Funk) Pvd<sup>3</sup>tj i Kzv t`tK `vbr`vi (Crystalline) c`v`c<sup>3</sup>K Ktib, hv Keztii eumea wqg<sup>3</sup>vn c<sup>3</sup>Ztiva Ges Dcm<sup>3</sup>tg KvhRix figKv ivtL| Zvi we<sup>3</sup>kdY t`tK t`Lv hvq th, H c`v`U<sup>3</sup>tZ gj Dcr`vb wntmte bvBtU<sup>3</sup>Rb we`gvb Ges hv m<sup>3</sup>eZ A`gvBb (Amine)| thtnZzGw Rxe<sup>3</sup>bi Rb` Acwivh<sup>3</sup>ZvB GwUv brgKiY Ktib "Vitamine" cieZ<sup>3</sup>Z GB evbvU cwi eZ<sup>3</sup> Kti "Vitamin" Kiv nq Ges Lv<sup>3</sup> cvlqv hvq Ggb GKB aitbi Dcr`vb tKv i vmvqvbK MVb e`wZt<sup>3</sup>tK wFUmgb wntmte AvL`wqZ Kiv nq|



mvi gg<sup>3</sup> gv<sup>3</sup>Qi kix<sup>3</sup>ii Rb` AZxe c<sup>3</sup>qvRbxq c<sup>3</sup>yi gta` wFUmgb Ab`Zg| wFUmgb c<sup>3</sup>Yxi kix<sup>3</sup>i `Zwi nq bv| ZvB evB<sup>3</sup>i t`tK wFUmgb gv<sup>3</sup>Qi Lve<sup>3</sup>tii mt` mieivn Kiv nq| wFUmgb ejtZ GK aitbi A`k` Re c`v`K eS<sup>3</sup>vq hv Ritei ea<sup>3</sup> I tetP`v Kvi Rb` AZxe Ri ix| wFUmgb Ave<sup>3</sup>v<sup>3</sup>i HwZnwmK NUbvejx AZ`š PgKc<sup>3</sup> | we<sup>3</sup>fb<sup>3</sup>mg<sup>3</sup>tqi we<sup>3</sup>fb<sup>3</sup>NUbv wFUmgb Ave<sup>3</sup>v<sup>3</sup>i mt` RwoZ| we<sup>3</sup>fb<sup>3</sup>aitbi tivM Av<sup>3</sup>uvš nevi ci we<sup>3</sup>fb<sup>3</sup>levi thgb- gvQ, gvsm, `y, tjeyMh<sup>3</sup>Yi gva`tg tivM t`tK gv<sup>3</sup> cvl qvi ci c<sup>3</sup>ymYZ nq th D<sup>3</sup> Lvevi `tj vtZ AAvZ Dcr`vb AvtQ, hv Lgy mvgvb` cwi gvY ntj I c<sup>3</sup>yi Rb` AZxe c<sup>3</sup>qvRb| Avi H AAvZ Dcr`vbB ntjv wFUmgb| Avei 1911 mtj dvsK (Funk) Pvd<sup>3</sup>tj i Kzv t`tK `vbr`vi (Crystalline) c`v`c<sup>3</sup>K Ktib, hv Keztii eumea wqg<sup>3</sup>vn c<sup>3</sup>Ztiva Ges Dcm<sup>3</sup>tg KvhRix figKv ivtL| Zvi we<sup>3</sup>kdY t`tK t`Lv hvq th, H c`v`U<sup>3</sup>tZ gj Dcr`vb wntmte bvBtU<sup>3</sup>Rb we`gvb Ges hv m<sup>3</sup>eZ A`gvBb (Amine)| thtnZzGw Rxe<sup>3</sup>bi Rb` Acwivh<sup>3</sup>ZvB GwUv brgKiY Ktib "Vitamine" cieZ<sup>3</sup>Z GB evbvU cwi eZ<sup>3</sup> Kti "Vitamin" Kiv nq|



срВвѐи гж њqb 4.1

мѐК Дѐѐи и сѐк ѐК ѐѐ (√) ѐ б |

- 1/ ѐRe с`v\_ѐ\_ѐK KZ aiѐbi ѐѐUмгб с\_К Kiv м=ѐ нѐqѐ0?
  - K) сѐq 10 aiѐbi
  - L) сѐq 12 aiѐbi
  - M) сѐq 15 aiѐbi
  - N) сѐq 20 aiѐbi
  
- 2/ ѐѐUмгбѐK сѐѐѐZ KZ fѐM fѐM Kiv hѐq?
  - K) ѐ fѐM
  - L) ѐZb fѐM
  - M) Pѐi fѐM
  - N) сѐѐ fѐM
  
- 3/ ѐKѐѐU ѐ`Zj RѐZѐq с`ѐ\_ѐ`ѐѐZ ѐѐUмгб?
  - K) \_ѐqмгб
  - L) еѐѐqмUб
  - M) ѐKѐѐj б
  - N) ѐi ѐUbj
  
- 4/ ѐѐѐPi ѐKѐѐUѐK ѐѐUмгб B еjѐ nq?
  - K) сѐѐj K GѐмW
  - L) A`ѐмKi ѐѐK GѐмW
  - M) ѐUѐKѐѐdij
  - N) мѐqѐѐѐѐKѐѐj ѐмгб

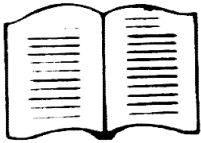
### cw 4.2 cubtZ `exfZ wFUmgbmgn



#### G cw tkłl Avcib -

- cubtZ `exfZ wFUmgbmgn ni bvg ej tZ I wj LtZ cvi teb|
- gvtQi Rb` cubtZ `exfZ wFUmgbmgn Pwv`v m`c`K`ej tZ I wj LtZ cvi teb|
- wewfbaLvt` cubtZ `exfZ wFUmgbmgn Drm m` tK`eY`v Ki tZ cvi teb|

#### cubtZ `exfZ wFUmgb



gvtQi t`tn wewfbaLvt`cuḲvi Kih`ej x m`g`v`te m` baKivi Rb` cubtZ `exfZ wFUmgbmgn AZ`š , iZ`c`Y`q` \_vqungb wi tevd`deb, cvBwi Ww b, c`v`Uvt`\_ubK GmW, ubt`KwUubK GmW, evt`qmUub, dij K GmW, mrvqvt`bt`Kvej`wgb, Bt`bvm`Uvj t`Kvij b, GmKiweK GmW BZ`w` cubtZ `exfZ wFUmgb|

#### \_vqungb

Kvtefv`Bt`WU wecv`K \_vqungb GKwU tKv`GbRvBg wnt`mte KvR Kti \_vt`K| \_vqungb`i Afite tewi`ewi ti`wM nt`Z cvti | Pij , Mg, evnj ,K`zv, mqvweb BZ`w` \_vqungb`i Drm|

#### wi tevd`deb

wi tevd`deb tKv`GbRvBg wnt`mte KvR Kti kw<sup>3</sup> i wecv`K , i Zc`Y`q` fvgKv cij b Kti \_vt`K| GuU Kvtefv`Bt`WU, Pw`Ges Avigt`li wecv`K w`qv`i Rb` c`Q`v`Rb| c`Y`xi hKZ, d`d`d`z, `jai mi, gj`Mxi w`M`gi m`v` Ask I kv`Kew`R`Z cvl`qv` hvg| Gi Afite gvt`Qi I Rb Ktg hvg Ges `j`zvg`v` t`Lv` t`q| Zv Qvov gvt`Qi d`j`Kvi Nv, t`Prt`L Qmb Ges Prgov LmL`m nt`q hvg|

#### cvBwiWw b

GuU Avigt`li wecv`K tKv`Gbv`RvBg wnt`mte , i Zc`Y`q` fvgKv cij b Kti \_vt`K| GQvovl GuU G`vigt`bv` GmW`wi cwie`ZB I c`Z`v`ct`b m`v`v`h` Kti| Gi Afite gvt`Qi Prgov d`j` hvg, `j`zvg`v` t`Lv` t`q, i<sup>3</sup> kb`Zv Ges w`q`j` Amj`av nq| B÷, kv`Kew`R, i`Kbv gvQ, wdk w`gj , w`Zj , Pij I mqvweb BZ`w` tZ cvBwi Ww b cvl`qv` hvg|

cvBwiWw tbi Afite gvt`Qi Prgov d`j` hvg, `j`zvg`v` t`Lv` t`q, i<sup>3</sup> kb`Zv Ges w`q`j` Amj`av nq|

#### c`v`Uvt`\_ubK GmW

mrvavi YZ Gt`K GmUv`Bj tKv`GbRvBg-G ejv`nq| c`v`Uvt`\_ubK GmW c`v`b` cyb `e` t`\_t`K kw<sup>3</sup> g`y` Kivi Kv`R e`e`u`Z nq| GuU d`w`U GmW, t`Kvt`j` t`o`ij I wnt`gv`M`web m`st`kd`YI fvgKv iv`Lt`Z cvti | Kvtefv`Bt`WU, Pw`Ges Avigt`li wecv`K GuU g`y` fvgKv cij b Kti| i`Kt`bv B÷, gj`Mxi w`Mg, ev`vg, M`gi K`zv, P`rt`j`i K`zv, i`Kt`bv `jai mi, f`A`v, B`j`z`o BZ`w` tZ c`v`Uvt`\_ubK GmW cvl`qv` hvg| Gi Afite gvt`Qi `j`zvg`v`, d`j`Kv d`j` hvl`qv, ev`x` Ktg hvl`qv, t`Kv`l` i`w`Kt`q hvl`qv BZ`w` Amj`av t`Lv` t`q|

#### ubt`KwUubK GmW

GuU t`Kv`l` GbRvBg wnt`mte Kvtefv`Bt`WU, Pw`Ges Avigt`li t`\_t`K kw<sup>3</sup> g`y` Kivi Kv`R mrvq`Zv Kti | GuU wecv`K w`qv`q` Bt`j` Kub `v`bv`st`i fvgKv iv`t`L| i`Kt`bv B÷, P`rt`j`i K`zv, M`gi K`zv, c`Y`xi hKZ.I d`d`d`z, g`v`sm, gj`Mxi Dv`Q`v`sk, i`Kt`bv ,o I me`j` cvZvi kv`Kew`R`Z c`P`z` cwi`gv`Y` ubt`KwUubK GmW \_vt`K| Gi Afite gvt`Qi `j`zvg`v`, Pj`v`td`j`vi Avigt`Am`, `e`j`Zv, cvK`\_j` tZ Nv Ges ea`b`n`x`b`Zv`j` `j` Kiv hvg|

i`Kt`bv B÷, P`rt`j`i K`zv, M`gi K`zv, c`Y`xi hKZ.I d`d`d`z, g`v`sm, gj`Mxi Dv`Q`v`sk, I me`j` cvZvi kv`Kew`R`Z c`P`z` cwi`gv`Y` ubt`KwUubK GmW \_vt`K|

### evtqulb

evtqulb gvtQi kixti  
PieP mstkdl Y Ges  
A'igvBtbr GimtWi qWZKi  
c'fve g<sup>3</sup> Kti |

GiU Af cwi gvtY mKj Dwt<sup>3</sup> I c'Yxi kixti cvl qv hvq | GiU jvBimb (Lysine) Gi mvt\_ h<sup>3</sup> n<sup>3</sup>q evtqimvBiUlb DrcbreKti \_vtK | c'Yxi Z\_v gvtQi Lv<sup>3</sup> b<sup>3</sup>vj x<sup>3</sup>ZI GiU DrcbentZ cvt | evtqulb tKv-GbRvBg wntmte wecvK w<sup>3</sup>uqvq v<sup>3</sup>ivrsti figKv i<sup>3</sup>vtL | evtqulb gvtQi kixti PieP mstkdl Y Ges A'igvBtbr GimtWi qWZKi c'fve g<sup>3</sup> Kti | GiU hKZ, wKWmb, B÷, `yRvZ `e, Ges wWtgi Kwtg c'Pz cwi gvtY cvl qv hvq | Gi Afvte gvtQi Prgov, tj v d<sup>3</sup>zj hvq, tckx i<sup>3</sup>wKtq hvq, q<sup>3</sup>avgv<sup>3</sup> BZ<sup>3</sup>w<sup>3</sup> t<sup>3</sup>Lv hvq |

### clvj K GimW

GiU mvari YZ i<sup>3</sup> KwYKv %Zwi tZ c'QvRb nq | GKiu tKv-GbRvBg wntmte GiU Kve<sup>3</sup> v<sup>3</sup>ivrsti c'Qvqv mvt\_ RwoZ \_vtK | GiU A'igvBtbr GimW mstkdl Y figKv i<sup>3</sup>vtL | GiU i<sup>3</sup>t<sup>3</sup>i M<sup>3</sup>KvR w<sup>3</sup>bqSY Kti, tKvtli AveiY msi qY Kti Ges wWg d<sup>3</sup>lv<sup>3</sup>bvi q<sup>3</sup>gZvev<sup>3</sup> Kti \_vtK | Gi Afvte i<sup>3</sup>kb<sup>3</sup>Zv, ea<sup>3</sup> nwm, f<sup>3</sup>z<sup>3</sup> cvLbv, Kvj Prgov, RoZv Ges f<sup>3</sup>z<sup>3</sup> c<sup>3</sup>mv j q<sup>3</sup> Kiv hvq | B÷, me<sup>3</sup> kvKewR, hKZ, wKWmb, gvtQi tckx I gvtQi bvorfwo<sup>3</sup>Z clvj K GimW cvl qv hvq | A<sup>3</sup>tbK c'Yxi I Dwt<sup>3</sup> GiU g<sup>3</sup> ev msh<sup>3</sup> Ae<sup>3</sup>iq cvl qv hvq |

### m<sup>3</sup>BqvtbvtKvej<sup>3</sup> wgb

c'Yxi Awgl, thgb - wdk  
wgj, gvtQi bwofwo hKZ,  
wKWmb Ges Km<sup>3</sup>BLbvi  
eR<sup>3</sup>c<sup>3</sup>vt<sup>3</sup> w<sup>3</sup>fUwgb we-12  
cvl qv hvq |

GtK w<sup>3</sup>fUwgb we-12I ejv n<sup>3</sup>q \_vtK | GiU tKveigvBW (Cobamide) tKv-GbRvBg wntmte w<sup>3</sup>bqgZ tj wnz i<sup>3</sup> KwYKv m<sup>3</sup>wtZ Ges w<sup>3</sup>q<sup>3</sup>Kvl tK<sup>3</sup> v<sup>3</sup>fmeK i<sup>3</sup>vtLZ m<sup>3</sup>vrh<sup>3</sup> Kti | GiU clvj K GimtWi mvt\_ th<sup>3</sup>S<sup>3</sup>fvte Kve<sup>3</sup> wecvK w<sup>3</sup>uqvq Ask M<sup>3</sup>hY Kti | GiU Kvtef<sup>3</sup>vBtWU Ges A'igvBtbr GimW wecvK w<sup>3</sup>uqvq figKv i<sup>3</sup>vtL | c'Yxi Awgl, thgb - wdk wgj, gvtQi bwofwo hKZ, wKWmb Ges Km<sup>3</sup>BLbvi eR<sup>3</sup>c<sup>3</sup>vt<sup>3</sup> w<sup>3</sup>fUwgb we-12 cvl qv hvq | Gi Afvte q<sup>3</sup>avgv<sup>3</sup> Lv<sup>3</sup> nRtg e<sup>3</sup>Zv, i<sup>3</sup>t<sup>3</sup>i t<sup>3</sup>kZKwKv t<sup>3</sup>f<sup>3</sup>h<sup>3</sup> v<sup>3</sup>l qv, i<sup>3</sup>kb<sup>3</sup>Zv BZ<sup>3</sup>w<sup>3</sup> DcmM<sup>3</sup> Lv hvq |

### Bt<sup>3</sup>bwmtUvj

Gi b<sup>3</sup>vr ai<sup>3</sup>ti th<sup>3</sup>M t<sup>3</sup>Lv hvq | Gt<sup>3</sup> i g<sup>3</sup>ta<sup>3</sup> gvBtqv-Bt<sup>3</sup>bwmtUvj (Myo-inositol) kixti i Kvvtgv ev K<sup>3</sup>vj, u<sup>3</sup>w<sup>3</sup>U Ges gw<sup>3</sup>t<sup>3</sup>Ki tKvtli Rb<sup>3</sup> AZ<sup>3</sup>s<sup>3</sup> i ZcY<sup>3</sup> hKZ. I Aw<sup>3</sup>g<sup>3</sup>z<sup>3</sup>vi tKvl ea<sup>3</sup>b, hKtZi Pie<sup>3</sup>v<sup>3</sup>vrstKi tY Ges RNA mstk- I tY Bt<sup>3</sup>bwmtUvj i ZcY<sup>3</sup> figKv cij b Kti | ea<sup>3</sup> nwm cvl qv, q<sup>3</sup>avgv<sup>3</sup>, cvLbv t<sup>3</sup>f<sup>3</sup>h<sup>3</sup> v<sup>3</sup>l qv, tj R Lt<sup>3</sup>m cov, i<sup>3</sup> kb<sup>3</sup>Zv, Pie<sup>3</sup>h<sup>3</sup> hKZ, g<sup>3</sup>Z<sup>3</sup>vi te<sup>3</sup>to h<sup>3</sup>l qv BZ<sup>3</sup>w<sup>3</sup> DcmM<sup>3</sup>Bt<sup>3</sup>bwmtUvtj i Afvte cwi j w<sup>3</sup>qZ nq | c'Yxi g<sup>3</sup>sm, n<sup>3</sup>o, gw<sup>3</sup>, u<sup>3</sup>w<sup>3</sup>U, hKZ, i<sup>3</sup>Kt<sup>3</sup> B÷ Ges wdk wgj Bt<sup>3</sup>bwmtUvj cvl qv hvq |

### tKwj b

gvtQi ea<sup>3</sup> I Lv<sup>3</sup> M<sup>3</sup>h<sup>3</sup>Yi  
Rb<sup>3</sup> tKwj b AZ<sup>3</sup>s<sup>3</sup>  
c'QvRbxq w<sup>3</sup>fUwgb |

gvtQi ea<sup>3</sup> I Lv<sup>3</sup> M<sup>3</sup>h<sup>3</sup>Yi Rb<sup>3</sup> tKwj b AZ<sup>3</sup>s<sup>3</sup> c'QvRbxq w<sup>3</sup>fUwgb | dmt<sup>3</sup>dmj w<sup>3</sup>W I G<sup>3</sup>v<sup>3</sup>tmUvBj tKwj b Gi i ZcY<sup>3</sup>Dcr<sup>3</sup>v<sup>3</sup> wntmte GiU tKvtli Kvvtgv i q<sup>3</sup>Yvte q<sup>3</sup>Y I w<sup>3</sup>q<sup>3</sup> Ab<sup>3</sup>v<sup>3</sup>z t<sup>3</sup>c'Y Kti \_vtK | GiU t<sup>3</sup>g<sup>3</sup> I b<sup>3</sup>v<sup>3</sup>Bb mstkdl Y m<sup>3</sup>vrh<sup>3</sup> Kti | dmt<sup>3</sup>dmj w<sup>3</sup>W wntmte tKwj b m<sup>3</sup>vr kixti Pie<sup>3</sup>enb Kti \_vtK | c'Yxi hKZ, d<sup>3</sup>z<sup>3</sup>d<sup>3</sup>, w<sup>3</sup>sw<sup>3</sup>, wdk wgj, m<sup>3</sup>q<sup>3</sup>web, m<sup>3</sup>g<sup>3</sup>Yxi e<sup>3</sup>R BZ<sup>3</sup>w<sup>3</sup> tZ c'Pz cwi gvtY tKwj b cvl qv hvq | tKwj t<sup>3</sup>bi Afvte gvtQi ea<sup>3</sup> nwm, Blr nj<sup>3</sup> is Gi hKZ, wKWmb Ges Lv<sup>3</sup> b<sup>3</sup>vj x<sup>3</sup>Z i<sup>3</sup> Rtg h<sup>3</sup>l qv, i<sup>3</sup>kb<sup>3</sup>Zv, t<sup>3</sup>PvL eo n<sup>3</sup>q h<sup>3</sup>l qv, kixti i s<sup>3</sup> d<sup>3</sup>vKvtk n<sup>3</sup>q h<sup>3</sup>l qv I g<sup>3</sup>Z<sup>3</sup>vi te<sup>3</sup>to h<sup>3</sup>l qv BZ<sup>3</sup>w<sup>3</sup> mg<sup>3</sup>m<sup>3</sup> t<sup>3</sup>Lv t<sup>3</sup>q |

### A<sup>3</sup>vmKiveK GimW (w<sup>3</sup>fUwgb-w)

w<sup>3</sup>fUwgb-w GKiu AZ<sup>3</sup>s<sup>3</sup> i ZcY<sup>3</sup>w<sup>3</sup>fUwgb | GiU kixti i we<sup>3</sup>fb<sup>3</sup>Kj vi g<sup>3</sup>ta<sup>3</sup> mg<sup>3</sup>sq<sup>3</sup> m<sup>3</sup>ab Kti | G Q<sup>3</sup>ov i<sup>3</sup> KwYKv, n<sup>3</sup>to<sup>3</sup> tKvl Ges q<sup>3</sup>Z v<sup>3</sup>tb<sup>3</sup>i tKvtli mg<sup>3</sup>sq<sup>3</sup> m<sup>3</sup>at<sup>3</sup>bl c'Z<sup>3</sup> q<sup>3</sup> figKv cij b







**Drm t** iK dmtDU, nvtoi PY<sup>©</sup>wdk ugj, gjmMi i<sup>3</sup>, gjmMi iKtbn ueov, Pvtj i Kzv, Mtgi Kzv BZ<sup>™</sup> t<sub>†</sub>K dmdim cvl qv hvq|

**g<sup>™</sup>Mtbnkqvg**

Giu ciavb ciavb Kvr, tjv ntjv ubaifc -

g<sup>™</sup>Mtbnkqvg nvtoi MVb, Zi Yw<sup>™</sup> Ges wPswoi tLvm MVtbi Rb<sup>™</sup> GKiu AwZ c<sup>™</sup>qvRbxq LibR Dcv<sup>™</sup>vb|

- Giu nvtoi MVb, Zi Yw<sup>™</sup> Ges wPswoi tLvm MVtbi Rb<sup>™</sup> GKiu AwZ c<sup>™</sup>qvRbxq LibR Dcv<sup>™</sup>vb|
- g<sup>™</sup>Mtbnkqvg AtbK<sub>3</sub> tjv GbRvBtgi m<sup>™</sup>uqK| thgb - KvBtR (Kinase), ugD<sup>™</sup>tRm&(Mutases) BZ<sup>™</sup> |
- Giu tKvl ga<sup>™</sup>w<sup>™</sup>Z A<sup>™</sup>qv<sup>™</sup>iK fvimv<sup>™</sup>Zv i<sup>™</sup>qv Ges K<sup>™</sup>te<sup>™</sup>v<sup>™</sup>WU, Awgl I Pie<sup>™</sup> uecvK<sup>™</sup>uqv<sup>™</sup> i ZcY<sup>™</sup>f<sup>™</sup>gKv i<sup>™</sup>vL|

**Drm t** gism Ges nvo PY<sup>©</sup>, Pvtj i Kzv, mh<sup>™</sup>xi exR, wZj, wPswoi gism, KvKiovi PY<sup>©</sup>, gjmMi iKbn ueov BZ<sup>™</sup> t<sub>†</sub>Z c<sup>™</sup>z<sup>™</sup> cwi gvY g<sup>™</sup>Mtbnkqvg cvl qv hvq|

**tmw<sup>™</sup>qvg, cUukqvg I tKwib**

G wZbwU LibR Dcv<sup>™</sup>vb gv<sup>™</sup>Qi kix<sup>™</sup>i Zij c<sup>™</sup>v<sup>™</sup> Ges big K<sup>™</sup>vi g<sup>™</sup>a<sup>™</sup> v<sup>™</sup>tK| tmw<sup>™</sup>qvg I tKwib i<sup>™</sup>agv<sup>™</sup> kix<sup>™</sup>i Zij c<sup>™</sup>v<sup>™</sup> P<sup>™</sup> g<sup>™</sup>a<sup>™</sup> x<sup>™</sup>fZ v<sup>™</sup>tK| G Dcv<sup>™</sup>vb, tjv Awf<sup>™</sup>kbxq Pvc ubq<sup>™</sup>S<sup>™</sup>Y K<sup>™</sup>i v<sup>™</sup>tK| Giv c<sup>™</sup>mbi uecvK<sup>™</sup>uqv<sup>™</sup> f<sup>™</sup>gKv i<sup>™</sup>vL Ges kix<sup>™</sup>i A<sup>™</sup>qv<sup>™</sup>i<sup>™</sup>xq fvimv<sup>™</sup> i<sup>™</sup>qv K<sup>™</sup>i v<sup>™</sup>tK|

**Drm t** Nb grm<sup>™</sup> x<sup>™</sup>Y, wPswoi PY<sup>©</sup>, m<sup>™</sup>v<sup>™</sup> v<sup>™</sup>wdk ugj, B<sup>™</sup>z<sup>™</sup> iKtbn o, mq<sup>™</sup>ieb ugj, Pvtj i Kzv BZ<sup>™</sup> t<sub>†</sub>Z c<sup>™</sup>z<sup>™</sup> cwi gvY G Dcv<sup>™</sup>vb, tjv cvl qv hvq|

**m<sup>™</sup>j dvi**

m<sup>™</sup>j dvti i ciavb ciavb Kvr, tjv ubaifc

- Giu AtbK<sub>3</sub> tjv ciavb A<sup>™</sup>gv<sup>™</sup>Btbn G<sup>™</sup>mtWi (ugw<sup>™</sup> I ubb, wmmwU<sup>™</sup>b) i ZcY<sup>™</sup> Dcv<sup>™</sup>vb|
- m<sup>™</sup>j tDU w<sup>™</sup>mt<sup>™</sup>te Giu e<sup>™</sup>u<sup>™</sup> Re c<sup>™</sup>v<sup>™</sup> P<sup>™</sup> Dcv<sup>™</sup>vb|
- AtbK<sub>3</sub> tjv gL<sup>™</sup> GbRvBtgi tKv-GbRvBg Ges M<sup>™</sup>gv<sup>™</sup>qb Ges Z<sup>™</sup>v<sup>™</sup> i Kv<sup>™</sup>R<sup>™</sup>vi Z<sup>™</sup>v g<sup>™</sup> m<sup>™</sup>j dvti i Gi I ci ubf<sup>™</sup>P<sup>™</sup>k<sup>™</sup>j |
- Giu gv<sup>™</sup>Qi kix<sup>™</sup>i i<sup>™</sup>el<sup>™</sup>uqv<sup>™</sup> c<sup>™</sup>ZeU<sup>™</sup>K w<sup>™</sup>mt<sup>™</sup>te Kvr K<sup>™</sup>i |

**Drm t** wdk ugj, gjmMi wVg Ges cvL<sup>™</sup>i cvL<sup>™</sup>br w<sup>™</sup> t<sup>™</sup>q %Z<sup>™</sup>w<sup>™</sup> w<sup>™</sup>d<sup>™</sup> vi ug<sup>™</sup>tj c<sup>™</sup>z<sup>™</sup> cwi gvY m<sup>™</sup>j dvi v<sup>™</sup>tK|

**tM<sup>™</sup>S<sup>™</sup> Dcv<sup>™</sup> vbmgn**

**tj Šn**

tj Šni ciavb ciavb Kvr ubaifc -

- Giu w<sup>™</sup>tg<sup>™</sup>v<sup>™</sup>M<sup>™</sup> w<sup>™</sup>et<sup>™</sup>bi AwZ c<sup>™</sup>qvRbxq Dcv<sup>™</sup>vb|
- Giu AtbK GbRvBtgi Rb<sup>™</sup> c<sup>™</sup>qvRbxq Dcv<sup>™</sup>vb| thgb - m<sup>™</sup>v<sup>™</sup>B<sup>™</sup>t<sup>™</sup>u<sup>™</sup>u<sup>™</sup>g K<sup>™</sup>v<sup>™</sup>U<sup>™</sup>t<sup>™</sup>j R BZ<sup>™</sup> |
- Giu kix<sup>™</sup>i i<sup>™</sup>w<sup>™</sup>f<sup>™</sup>b<sup>™</sup>e A<sup>™</sup>st<sup>™</sup> Aw<sup>™</sup> t<sup>™</sup>Rb Ges B<sup>™</sup>t<sup>™</sup>J K<sup>™</sup>Ub<sup>™</sup> v<sup>™</sup>br<sup>™</sup>Š<sup>™</sup>i i K<sup>™</sup>v<sup>™</sup>R<sup>™</sup>i Rb<sup>™</sup> c<sup>™</sup>qvR<sup>™</sup>b|

Drm t i<sup>3</sup>, bwi tKj PY<sup>o</sup> gysm I Aw' PY<sup>o</sup> Kvkiov PY<sup>o</sup> Pttj i Kgn, gjmMi i Ktbr meov BZ'w' I cvl qv hvq|

**Kcvi**

Kcvti i cãvb cãvb `Re mupv vbtP cõ È ntjv -

- GwU GKwU ,i ZcY<sup>o</sup>Dcv`vb vntmte Rvib meRvib GbRvBg cõwZtZ fvgKv ivtL|
- GwU tj Štni mecvKwupvq msukõ t\_tK vntgvMmeb mstkd Y Kti i<sup>3</sup> KwYKv %Zwi I iYvteY Kti \_vtK|
- Kcvi tgj vnb %Zwi tZ fvgKv ivtL etj Atpk mekym Kti b| GQovl GwU nvo MVtb I wevfbk jv MVtb mrvnh` Kti \_vtK|

Nb gvQi `èY, Bqjz i Ktbr o, Zjvi exR, Kvkiov PY<sup>o</sup> mqweb wj Ges gjmMi i Ktbr meovq Kcvi cvl qv hvq|

Drm t Nb gvQi `èY, Bqjz i Ktbr o, Zjvi exR, Kvkiov PY<sup>o</sup> mqweb wj Ges gjmMi i Ktbr meovq Kcvi cvl qv hvq|

**g'vsmvbR**

g'vsmvbRi `Re mupv vbtP t`qv ntjv -

- GwU kixti GbRvBtgi mupvK/DtERK vntmte Kvr Kti \_vtK| G GbRvBg ,tjv dmtDU `vbršti mrvnh` Kti| GwU wekl Kti mrvBUK GmW Pp, qvixq dmdvtUR GKs tnt. vKvBtBR RvZixq GbRvBgtK mupv Kitz fvgKv ivtL|
- GwU cvBi tFU Kven<sup>o</sup> tj tRi ,i ZcY<sup>o</sup>Dcv`vb|
- Atpk ,tjv GbRvBtgi Dcv`vb vntmte g'vsmvbR nivoi MVtb, i<sup>3</sup> KwYKv cõMv<sup>o</sup>tb, kKvvi mecvKwupvq Ges gvQi cRbb Ptp mekl fvgKv cvj b Kti|

**wR¼**

wR¼ gvQi Rb` AwZ cõqvRbxq tMSY LvbR c`\_v` Gi `Re mupv vbtP mstjtc vbaifc t

wR¼ 80 wLi Awk avZe GbRvBtgi ,i ZcY<sup>o</sup> Dcv`vb|

- GwU 80 wLi Awk avZe GbRvBtgi (metalloenzyme) ,i ZcY<sup>o</sup>Dcv`vb|
- GwU eü GbRvBtgi tKv-d'v±i vntmte Kvr Kti \_vtK| G ,tjv gta` AvwRtBR I Btvtj R Ab`Zg|
- wR¼ GKwU mupv Dcv`vb vntmte Pve<sup>o</sup>Awgl I kKvvi mecvKwupvq gly` fvgKv cvj b Kti \_vtK|
- GwU nigtvbi mvt\_ fvgKv ivtL etj tKn tKn gtb Kti b|
- GwU qjZ`vb i KvZ BwZevPK fvgKv ivtL|

Drm t gjmMi n'Pwi i i Ktbr Lvevi, K'vbwWw B÷, i Ktbr gvQi `èY, wdk wj, gjmMi i Ktbr meov, Mtgi Kzv, mhglx exR Øriv `Zwi Lv` BZ'w' tZ cõž cwi gvY wR¼ cvl qv hvq|

**tKvevè**

tKvevèi `Re mupv vbtP cõ È ntjv -

- GiU mVbqvfbvKvevj "vrgb (vrfUvrgb ve-12) Gi GKwX Acwi nih<sup>©</sup>Ask wntmte i<sup>3</sup>KwYKv MVtb Ges wqšKvfi i i qYvte qYfY fvgKv cij b Kfi |
- GiU wewfbæGbRvBg c0vZtZ DfERK mμqK wntmte KvR Kfi \_vK etj tKn tKn wckjm Kfi \_vKb|

Drm t bvi tKtj i kwn, wZwm, wdk wvj, ZžvexR Ges mqwefb tKvevè cvl qv hvq|

**Avtqmw**

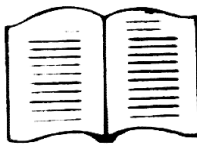
Avtqmw \_vqitqW nitgvfb \_vqi w b I UtB-AvtqvWv \_vqfiweb Gi GKwU Acwi nih<sup>©</sup> Dcv`vb|

- GiU wecvK μqv wqšfY fvgKv cij b Kfi \_vK|
- Gi Afite gvQI I Ab`vb` c0Yxi Mj MÜ tivM t`Lv hvq|

Drm t mvari YZ mvgv`K gvQ I Ab`vb` Lv` `fe` cPž cwi gvY Avtqmw \_vK| mgj`f `kevj, Ab`vb` Dv`c Ges wPsw I KvKari kixfi cPž Avtqmw \_vK|



**Ablyj b (Activity)t** wewfbæi tbi tMSY LubR Dcv`vbmgtni Drm, t j v wj Lly|



**mvi gg<sup>©</sup>** c0Yxi t`tni wewfbæKv h<sup>©</sup>m v`tbi Rb` thme A%Re i vμqv bK Dcv`vb AZ`vš c0qvRb Zv` i tK LubR Dcv`vb ejv nq| c0q 20 ai tbi A%Re c`v`er LubR Dcv`vb wewfbæc0Yx gvQ I wPswi Rb` c0qvRb| LubR Dcv`vb, t j v gvQI kixfi i GbRvBg, nitgi v b Ges Awgtli `Re AYNUK ev Biocatalyst wntmte KvR Kfi | LubR Dcv`vb gvQI Awfkèb c0qvri Rb`I LqB c0qvRb| LubR Dcv`vb tK mvari YZ gly` Dcv`vb I tMSY Dcv`vb -G` 0vrtM fM Kiv hvq| c0Z tKwR gvQI Lverti th mKj LubR Dcv`v tbi cwi gvY 100 M0g ev Gi Awak tm mKj LubR Dcv`vb tK gly` Dcv`vb etj | K`vj wmqvg, dmdim, g`vM t b wmqvg, tmwvqvg, cUwkvqvg, tKwib, m j dvi G, t j v n t Q gly` Dcv`vb| gvQI c0Z wK t j v M0g Lverti th mKj LubR Dcv`v tbi cwi gvY 100 M0gi Kg tm mKj LubR Dcv`vb tK tMSY Dcv`vb etj | t j šn, Kcvi g`v s MwbR, wR¼, tKvevè Ges Avtqmw b- G, t j v n t Q tMSY Dcv`vb|



### срВѐи гж њqb 4.3

#### мѠК Дѐти и сѠк ѠК ѠѠ (√) Ѡ б |

- 1/ гѠQi нѠ MVѠb ѠКѠ&ЛѠbR Dcr` Ѡb мѠнѠh` KѠi?  
 % AvѠqmѠb  
 ѠR¼  
 & K`Ѡj ѠmqѠg I dmd i Ѡm  
 мѠj dѠi
  
- 2/ ѠнѠгѠѠMѠнѠѠbi сѠqѠRbѠq Ask ѠКѠ&ЛѠbR Dcr` Ѡb?  
 % AvѠi Y  
 мѠj dѠi  
 & ѠR¼  
 KcѠi
  
- 3/ гѠQ I гѠbѠj i Mj MŪ ti ѠM nq ѠКѠ&ЛѠbR Dcr` ѠѠbi AfѠѠe?  
 % ѠKѠi b  
 AvѠqmѠb  
 & сUѠmqѠg  
 ѠdѠi b
  
- 4/ сѠnbѠZ гѠѠQi Ѡ`Ѡni j eѠYi fѠi мѠg` i ѠѠѠq ѠКѠ&Ѡj Ѡ AvѠK fѠgKѠi i ѠѠL?  
 % ѠmѠѠWqѠg I ѠKѠi b  
 AvѠi b I ѠR¼  
 & AvѠqmѠb I ѠdѠi b  
 KcѠi I мѠj dѠi

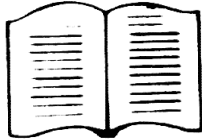
### cW 4.4 Awgl, Pie<sup>©</sup>kK<sup>®</sup> I LibR Gi msÁv Ges cKvi<sup>˘</sup>f<sup>˘</sup>

#### G cW tk<sup>†</sup>l Av<sup>c</sup>ib -



- Awgl RvZxq Lv<sup>˘</sup> Kx Ges Gi cKvi<sup>˘</sup>f<sup>˘</sup> m<sup>˘</sup> tK<sup>®</sup>ej tZ I wj LtZ cvi<sup>˘</sup>teb|
- gv<sup>†</sup>Qi Rb<sup>˘</sup> AZ<sup>˘</sup>vek<sup>˘</sup>Kxq A<sup>˘</sup>vgvB<sup>†</sup>bv GimW/mgn Kx Kx Zv wPw<sup>†</sup>YZ Ki<sup>†</sup>Z cvi<sup>˘</sup>teb|
- d<sup>˘</sup>wU Gim<sup>†</sup>Wi cKvi<sup>˘</sup>f<sup>˘</sup> Ges AZ<sup>˘</sup>vek<sup>˘</sup>Kxq d<sup>˘</sup>wU Gim<sup>†</sup>Wi bvg ej tZ I wj LtZ cvi<sup>˘</sup>teb|
- kK<sup>®</sup> Lv<sup>˘</sup> t<sup>˘</sup>i tk<sup>†</sup>w<sup>†</sup>ieb<sup>˘</sup>vm ej tZ I wj LtZ cvi<sup>˘</sup>teb|

#### Awgl ev t<sup>c</sup>Üb (Protein)



Awgl DP Av<sup>†</sup>veK IRb wek<sup>ó</sup> GK ai<sup>†</sup>bi RuUj <sup>˘</sup>Re thSM hv we<sup>†</sup>fb<sup>˘</sup>ai<sup>†</sup>bi A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>Wi mg<sup>†</sup>stq M<sup>†</sup>WZ| c<sup>†</sup>Yx<sup>˘</sup> t<sup>˘</sup>ni g<sup>†</sup>sm<sup>†</sup>t<sup>†</sup>ckx, Af<sup>˘</sup>šixY A<sup>†</sup>zmgn, gMR, kvqyGes Z<sup>†</sup>Ki te<sup>†</sup>ki f<sup>†</sup>wMB Awgl Øv<sup>†</sup>v M<sup>†</sup>WZ|

**M<sup>†</sup>wbK Dc<sup>†</sup>v<sup>†</sup> b t** kK<sup>®</sup> I Pie<sup>®</sup> b<sup>˘</sup>vq Awgl<sup>†</sup>l Kve<sup>†</sup>, nuB<sup>†</sup>W<sup>†</sup>t<sup>†</sup>Rb I Aw<sup>†</sup> t<sup>†</sup>Rb we<sup>˘</sup> g<sup>†</sup>v| Z<sup>†</sup>vQvov Awgl<sup>†</sup>l c<sup>†</sup>q 16% bvB<sup>†</sup>U<sup>†</sup>t<sup>†</sup>Rb <sup>˘</sup>v<sup>†</sup>t<sup>†</sup>K Ges t<sup>†</sup>Kv<sup>†</sup> t<sup>†</sup>Kv<sup>†</sup> Awgl<sup>†</sup>l d<sup>†</sup>md<sup>†</sup>vm Ges m<sup>†</sup>j d<sup>†</sup>vi <sup>˘</sup>v<sup>†</sup>t<sup>†</sup>K|

Awgl m<sup>†</sup>aviYZ A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>Wi mg<sup>†</sup>stq M<sup>†</sup>WZ hv ci<sup>˘</sup> t<sup>†</sup>i m<sup>†</sup>nZ t<sup>†</sup>ccU<sup>†</sup>vBW e<sup>†</sup>Üb Øv<sup>†</sup>v Ave<sup>˘</sup> <sup>˘</sup>v<sup>†</sup>t<sup>†</sup>K|

**M<sup>†</sup>v<sup>†</sup> K<sup>†</sup>w<sup>†</sup>t<sup>†</sup>gv t** Awgl m<sup>†</sup>aviYZ A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>Wi mg<sup>†</sup>stq M<sup>†</sup>WZ hv ci<sup>˘</sup> t<sup>†</sup>i m<sup>†</sup>nZ t<sup>†</sup>ccU<sup>†</sup>vBW e<sup>†</sup>Üb Øv<sup>†</sup>v Ave<sup>˘</sup> <sup>˘</sup>v<sup>†</sup>t<sup>†</sup>K| we<sup>†</sup>fb<sup>˘</sup>e<sup>†</sup>D<sup>†</sup>rm t<sup>†</sup> t<sup>†</sup>K c<sup>†</sup>ÜB Awgl<sup>†</sup>l A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>Wi M<sup>†</sup>v<sup>†</sup> w<sup>†</sup>fb<sup>˘</sup>z<sup>†</sup>i n<sup>†</sup>tq <sup>˘</sup>v<sup>†</sup>t<sup>†</sup>K| Awgl<sup>†</sup>l M<sup>†</sup>v<sup>†</sup> kK<sup>®</sup> ev Pie<sup>®</sup> b<sup>˘</sup>vq Aw<sup>†</sup>fb<sup>˘</sup>e<sup>†</sup>GKK, thgb- M<sup>†</sup>g<sup>†</sup>KvR, d<sup>˘</sup>wU Gim<sup>†</sup>W BZ<sup>˘</sup>w<sup>˘</sup> Øv<sup>†</sup>v M<sup>†</sup>WZ bv n<sup>†</sup>tq we<sup>†</sup>fb<sup>˘</sup>ai<sup>†</sup>bi c<sup>†</sup>q 100 wU tg<sup>†</sup>šij K GKK (A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>W) Øv<sup>†</sup>v M<sup>†</sup>WZ n<sup>†</sup>tZ cvi<sup>˘</sup>teb|

th mg<sup>˘</sup> A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>W c<sup>†</sup>Yx t<sup>˘</sup> t<sup>†</sup>n w<sup>†</sup>b<sup>†</sup>R w<sup>†</sup>b<sup>†</sup>R m<sup>†</sup>st<sup>†</sup>k- w<sup>†</sup>Z n<sup>†</sup>tZ cvi<sup>˘</sup>teb, ew<sup>†</sup>ni t<sup>†</sup>t<sup>†</sup>K Lve<sup>†</sup>t<sup>†</sup>i g<sup>†</sup>va<sup>†</sup>tg mie<sup>†</sup>ivn Ki<sup>†</sup>Z nq Z<sup>†</sup>v<sup>†</sup> i<sup>†</sup>t<sup>†</sup>K AZ<sup>˘</sup>vek<sup>˘</sup>Kxq A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>W etj|

**tk<sup>†</sup>w<sup>†</sup>ieb<sup>˘</sup>vm t** 20wU Av<sup>˘</sup> k<sup>©</sup>A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>W<sup>†</sup>K AZ<sup>˘</sup>vek<sup>˘</sup>Kxq (essential) Ges AbZ<sup>˘</sup>vek<sup>˘</sup>Kxq (non-essential), G <sup>˘</sup>B<sup>˘</sup> f<sup>†</sup>v<sup>†</sup>t<sup>†</sup>M f<sup>†</sup>wM Kiv nq| th mKj A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>W c<sup>†</sup>Yx t<sup>˘</sup> t<sup>†</sup>n w<sup>†</sup>b<sup>†</sup>R w<sup>†</sup>b<sup>†</sup>R m<sup>†</sup>st<sup>†</sup>k- w<sup>†</sup>Z n<sup>†</sup>tZ cvi<sup>˘</sup>teb Z<sup>†</sup>v<sup>†</sup> i<sup>†</sup>t<sup>†</sup>K AbZ<sup>˘</sup>vek<sup>˘</sup>Kxq A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>W etj| Avi th mg<sup>˘</sup> A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>W c<sup>†</sup>Yx t<sup>˘</sup> t<sup>†</sup>n w<sup>†</sup>b<sup>†</sup>R w<sup>†</sup>b<sup>†</sup>R m<sup>†</sup>st<sup>†</sup>k<sup>†</sup>w<sup>†</sup>Z n<sup>†</sup>tZ cvi<sup>˘</sup>teb, ew<sup>†</sup>ni t<sup>†</sup>t<sup>†</sup>K Lve<sup>†</sup>t<sup>†</sup>i g<sup>†</sup>va<sup>†</sup>tg mie<sup>†</sup>ivn Ki<sup>†</sup>Z nq Z<sup>†</sup>v<sup>†</sup> i<sup>†</sup>t<sup>†</sup>K AZ<sup>˘</sup>vek<sup>˘</sup>Kxq A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>W etj| m<sup>†</sup>vi w<sup>†</sup>Y 12 G gv<sup>†</sup>Qi Rb<sup>˘</sup> AZ<sup>˘</sup>vek<sup>˘</sup>Kxq I AbZ<sup>˘</sup>vek<sup>˘</sup>Kxq A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>W mg<sup>†</sup>t<sup>†</sup>ni Z<sup>†</sup>w<sup>†</sup>j Kv c<sup>†</sup>Ü<sup>˘</sup> E<sup>˘</sup> n<sup>†</sup>tj v -

m<sup>†</sup>vi w<sup>†</sup>Y 12 t gv<sup>†</sup>Qi AZ<sup>˘</sup>vek<sup>˘</sup>Kxq I AbZ<sup>˘</sup>vek<sup>˘</sup>Kxq A<sup>˘</sup>vgvB<sup>†</sup>bv Gim<sup>†</sup>W mg<sup>†</sup>t<sup>†</sup>ni Z<sup>†</sup>w<sup>†</sup>j Kv

AZ <sup>˘</sup> vek <sup>˘</sup> Kxq	AbZ <sup>˘</sup> vek <sup>˘</sup> Kxq
w <sup>†</sup> gv <sup>†</sup> l w <sup>†</sup> bb (Methionine)	G <sup>†</sup> mc <sup>†</sup> vi w <sup>†</sup> UK Gim <sup>†</sup> W (Aspartic acid)
Av <sup>†</sup> i w <sup>†</sup> Rw <sup>†</sup> bb (Arginine)	G <sup>†</sup> mc <sup>˘</sup> vi w <sup>†</sup> Rb (Asparagine)
w <sup>†</sup> 1 w <sup>†</sup> bb (Threonine)	w <sup>†</sup> mm <sup>†</sup> w <sup>†</sup> Üb (Cysteine)
w <sup>†</sup> Ü <sup>†</sup> t <sup>†</sup> U <sup>†</sup> v <sup>†</sup> db (Tryptophan)	M <sup>†</sup> g <sup>†</sup> w <sup>†</sup> g <sup>†</sup> K Gim <sup>†</sup> W (Glutamic acid)
F <sup>˘</sup> w <sup>†</sup> j b (Valine)	M <sup>†</sup> Ü <sup>†</sup> w <sup>†</sup> g <sup>†</sup> b (Glutamine)
Av <sup>†</sup> B <sup>†</sup> t <sup>†</sup> m <sup>†</sup> v- w <sup>†</sup> j D <sup>†</sup> w <sup>†</sup> mb (Iso-leucine)	M <sup>†</sup> g <sup>†</sup> B <sup>†</sup> w <sup>†</sup> mb (Glycine)
w <sup>†</sup> j D <sup>†</sup> w <sup>†</sup> mb (Leucine)	t <sup>†</sup> c <sup>†</sup> h <sup>†</sup> w <sup>†</sup> b (Proline)
w <sup>†</sup> clbvB <sup>†</sup> j G <sup>†</sup> j w <sup>†</sup> bb (Phenylalanine)	w <sup>†</sup> w <sup>†</sup> i b (Serine)
w <sup>†</sup> w <sup>†</sup> ÷ w <sup>†</sup> Wb (Histidine)	U <sup>†</sup> v <sup>†</sup> B <sup>†</sup> i w <sup>†</sup> mb (Tyrosine)
j vB <sup>†</sup> w <sup>†</sup> mb (Lysine)	

Z<sup>†</sup>vQvov <sup>˘</sup>e<sup>†</sup>YxqZv, Av<sup>†</sup>Kw<sup>†</sup>Z Ges i<sup>†</sup>vmvq<sup>†</sup>ubK M<sup>†</sup>v<sup>†</sup>t<sup>†</sup>bi I ci w<sup>†</sup>f<sup>†</sup>ü<sup>˘</sup> K<sup>†</sup>t<sup>†</sup>i Awgl<sup>†</sup>t<sup>†</sup>K w<sup>†</sup>Z<sup>†</sup>buU c<sup>†</sup>äv<sup>†</sup>b f<sup>†</sup>v<sup>†</sup>t<sup>†</sup>M f<sup>†</sup>wM Kiv h<sup>†</sup>q|

1. **আক RvZiq Awgl t** th mKj Awgl mvariY GbrRvBg Øivv cwi cvP<sup>o</sup> nq bv Zv<sup>o</sup> i<sup>o</sup> K Avk RvZiq Awgl etj | Avk RvZiq Awgl ,tj v mvariYZ j <sup>o</sup> ZŠRvZiq <sup>o</sup> Ktj m<sup>o</sup> 4Z <sup>o</sup> K | <sup>o</sup> P Avk RvZiq Awgl i D<sup>o</sup> vni Y t<sup>o</sup> I qv ntj v t tKij v<sup>o</sup> Rb (Collagen), thvRK Kj v (Connective tissue), tKi mUb (Keratene), Pž, bL BZ<sup>o</sup> v<sup>o</sup> Awgl |

২. **গ্লোবিউলার (Globular) Awgl t** mKj cKvi GbRvBg, GwU<sup>o</sup> Rb Ges ni<sup>o</sup> gvb GB tc<sup>o</sup> U<sup>o</sup> bi AŠ<sup>o</sup> | <sup>o</sup> èbxqZvi I ci v<sup>o</sup> K<sup>o</sup> i tM- meDj vi Awgl tK <sup>o</sup> f<sup>o</sup> M f<sup>o</sup> M Kiv hvq -

K) Gj eygb ev c<sup>o</sup> b<sup>o</sup> t<sup>o</sup> Z <sup>o</sup> èbxq Awgl - th mg<sup>o</sup> Awgl c<sup>o</sup> b<sup>o</sup> t<sup>o</sup> Z <sup>o</sup> èxfZ nq Zv<sup>o</sup> i<sup>o</sup> K Gj eygb etj | mWg, <sup>o</sup> g, i<sup>o</sup> 3 Ges <sup>o</sup> v<sup>o</sup> f<sup>o</sup> b<sup>o</sup> D<sup>o</sup> v<sup>o</sup> t<sup>o</sup> c<sup>o</sup> U<sup>o</sup> bi Awgl - Gj eygb<sup>o</sup> bi D<sup>o</sup> vni Y |

L) tM<sup>o</sup> meDij b ev c<sup>o</sup> b<sup>o</sup> t<sup>o</sup> Z A<sup>o</sup> èbxq Awgl - th mg<sup>o</sup> Awgl j eY <sup>o</sup> è<sup>o</sup> Y <sup>o</sup> èxfZ nq, Zv<sup>o</sup> i<sup>o</sup> K tM<sup>o</sup> meDij b etj | thgb- km<sup>o</sup> ex<sup>o</sup> R RgvKZ. tc<sup>o</sup> U<sup>o</sup> bi Ask <sup>o</sup> v<sup>o</sup> t<sup>o</sup> K |

3. **KbR<sup>o</sup> t<sup>o</sup> U<sup>o</sup> W ev msh<sup>o</sup> Awgl t** th mg<sup>o</sup> Awgl mvariYZ Ab<sup>o</sup> tKvb D<sup>o</sup> cv<sup>o</sup> v<sup>o</sup> t<sup>o</sup> bi ev thŠ<sup>o</sup> Mi m<sup>o</sup> t<sup>o</sup> h<sup>o</sup> <sup>o</sup> v<sup>o</sup> t<sup>o</sup> K Zv<sup>o</sup> i<sup>o</sup> K KbR<sup>o</sup> t<sup>o</sup> U<sup>o</sup> W Awgl etj | thgb-

- <sup>o</sup> v<sup>o</sup> t<sup>o</sup> cv<sup>o</sup> t<sup>o</sup> c<sup>o</sup> U<sup>o</sup> bi
- <sup>o</sup> v<sup>o</sup> D<sup>o</sup> v<sup>o</sup> K<sup>o</sup> t<sup>o</sup> c<sup>o</sup> U<sup>o</sup> bi
- <sup>o</sup> v<sup>o</sup> t<sup>o</sup> g<sup>o</sup> v<sup>o</sup> t<sup>o</sup> M<sup>o</sup> v<sup>o</sup> e<sup>o</sup> b |

**vj ucW ev Pve<sup>o</sup>**

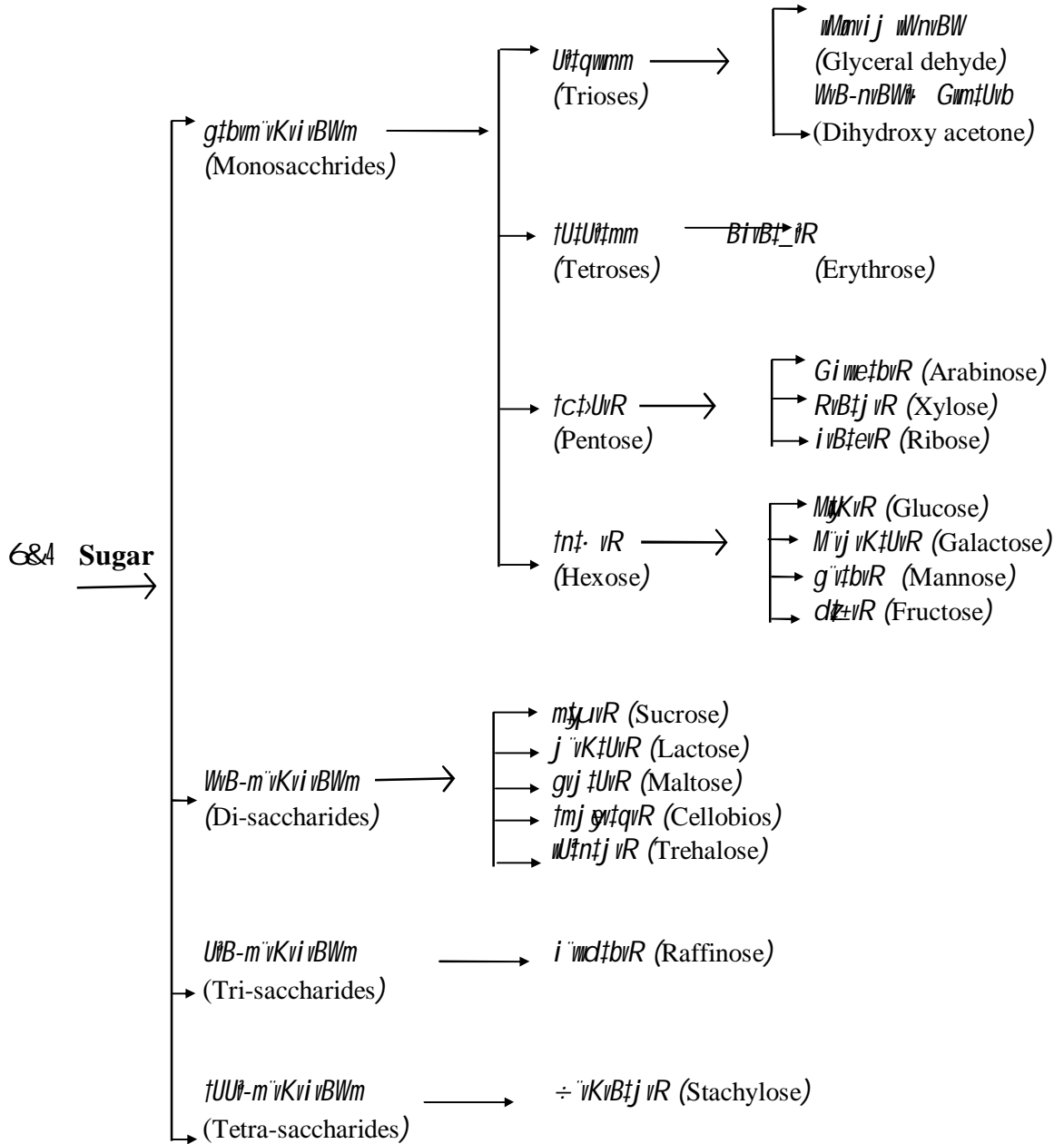
vj ucW GK ai<sup>o</sup> t<sup>o</sup> bi <sup>o</sup> Re AY<sup>o</sup> hv Kve<sup>o</sup> ci g<sup>o</sup> v<sup>o</sup> Y<sup>o</sup> v<sup>o</sup> K<sup>o</sup> j mg<sup>o</sup> Š<sup>o</sup> t<sup>o</sup> q M<sup>o</sup> v<sup>o</sup> Z |

grm<sup>o</sup> c<sup>o</sup> v<sup>o</sup> v<sup>o</sup> e<sup>o</sup> v<sup>o</sup> t<sup>o</sup> b Pve<sup>o</sup> ev <sup>o</sup> Z<sup>o</sup> j Ges vj ucW mg<sup>o</sup> v<sup>o</sup> R<sup>o</sup> k<sup>o</sup> a<sup>o</sup> v<sup>o</sup> t<sup>o</sup> m<sup>o</sup> t<sup>o</sup> e<sup>o</sup> e<sup>o</sup> v<sup>o</sup> Z nq | vj ucW GK ai<sup>o</sup> t<sup>o</sup> bi <sup>o</sup> Re AY<sup>o</sup> hv Kve<sup>o</sup> ci g<sup>o</sup> v<sup>o</sup> Y<sup>o</sup> v<sup>o</sup> K<sup>o</sup> j mg<sup>o</sup> Š<sup>o</sup> t<sup>o</sup> q M<sup>o</sup> v<sup>o</sup> Z | vj ucW <sup>o</sup> v<sup>o</sup> f<sup>o</sup> b<sup>o</sup> e<sup>o</sup> c<sup>o</sup> Ø<sup>o</sup> v<sup>o</sup> I D<sup>o</sup> v<sup>o</sup> t<sup>o</sup> i<sup>o</sup> K j v<sup>o</sup> q cv<sup>o</sup> l qv hvq hv mvariYZ c<sup>o</sup> b<sup>o</sup> t<sup>o</sup> Z A<sup>o</sup> èY<sup>o</sup> q; <sup>o</sup> v<sup>o</sup> KŠ<sup>o</sup> <sup>o</sup> v<sup>o</sup> f<sup>o</sup> b<sup>o</sup> e<sup>o</sup> Re <sup>o</sup> v<sup>o</sup> e<sup>o</sup> K thgb - B<sup>o</sup> v<sup>o</sup> i, G<sup>o</sup> v<sup>o</sup> t<sup>o</sup> U<sup>o</sup> v<sup>o</sup> b, tK<sup>o</sup> v<sup>o</sup> i vdg<sup>o</sup> BZ<sup>o</sup> v<sup>o</sup> t<sup>o</sup> Z <sup>o</sup> èY<sup>o</sup> q |





சுப்புகள் கருவிகள்









Rb GB AwglġK e'envi Kġi | dtj gvtQi ep̄ e'vnZ nq | wj ucW AZ'vek'Kxq d'vU GmġWi Drm wntmte Kvr Kġi, hv gvtQi ep̄ I tKvl ZġKi ALŪZv i ġlv Kġi | Lv'' %Zwi i chġy³ i w'K t\_ġK wj ucW Lv''ġK tġukġbi w'fZi w'ġq mntR šei nl qvi Rb'' ucw Qj Kvi x c'v\_ wntmte Kvr Kġi | ZvQvor wj ucW, av I ajv'fve Kugġq Lv''i 'f' ep̄ Kġi |

Lv'' AZ'waK wj ucW \_vKġj gvtQi ep̄ Ges Lv''i KvhRwi Zvi I ci weifc cġve cġo | hw' Lv''i wj ucġW tenk cwi gvtY Am''³ d'vU GmW \_vġK Ges tKvb GwU-Aw' ġWbU e'envi br Kiv nq Zġe Zv gvtQi ep̄ Ges 'ġ''i I ci ġlvZKi cġve tdtj | KviY evZvġmi ms' ġkGB Am''³ d'vU GmW Aw' ġRġbi mġ\_ wep'qv Kġi Ges GB wj ucġWi 'RweK gvb Kugġq t'q | ZvB Lv'' wj ucġWi gvġv mġvK ivLv cġqvRb | gvtQi Lv'' wZb aiġbi AZ'vek'Kxq d'vU GmġWi cġqvRb nq; G, ġjv nġjv wj ġbvġj K GmW, wj ġbvġj vbK GmW Ges Gi vġKġWvbK GmW | G mKj d'vU GmW wġ-eŪbhġ Ges j ep̄ wKġj wekŏ nġq \_vġK | mvi wY 14 G weifbægvġQi wj ucW Ges AZ'vek'Kxq d'vU GmġWi Pwn`v t'Lvġbr nġj v |

cixġlvq t'Lv tMġQ th, Lv'' AZ'waK wj ucW \_vKġj gvtQi ep̄ Ges Lv''i KvhRwi Zvi I ci weifc cġve cġo | hw' Lv''i wj ucġW tenk cwi gvtY Am''³ d'vU GmW \_vġK Ges tKvb GwU-Aw' ġWbU e'envi br Kiv nq Zġe Zv gvtQi ep̄ Ges 'ġ''i I ci ġlvZKi cġve tdtj | KviY evZvġmi ms' ġkGB Am''³ d'vU GmW Aw' ġRġbi mġ\_ wep'qv Kġi Ges GB wj ucġWi 'RweK gvb Kugġq t'q | ZvB Lv'' wj ucġWi gvġv mġvK ivLv cġqvRb | gvtQi Lv'' wZb aiġbi AZ'vek'Kxq d'vU GmġWi cġqvRb nq; G, ġjv nġjv wj ġbvġj K GmW, wj ġbvġj vbK GmW Ges Gi vġKġWvbK GmW | G mKj d'vU GmW wġ-eŪbhġ Ges j ep̄ wKġj wekŏ nġq \_vġK | mvi wY 14 G weifbægvġQi wj ucW Ges AZ'vek'Kxq d'vU GmġWi Pwn`v t'Lvġbr nġj v |

mvi wY 14 t' gvtQi Lv'' wj ucW Ges AZ'vek'Kxq d'vU GmġWi Pwn`v (%)

gvQ	wj ucW	wj ġbvġj K GmW	wj ġbvġj vbK GmW
Kvc®	5-10	1	1
K'vUwġk	8-10	-	0.5
tZj wġqv	8-10	1	-
Mj`v wPswO	5-8	1	1
evM`v wPswO	5-8	-	1

**kKġv ev Kġe wBġW**

kKġv Lv'' kw³ mi ei vn Kġi GB kw³ Awgl Ges wj ucW t\_ġK cvl qv hvq | Lv'' hw' kKġv Ges wj ucġWi gvġv cwi gZ cwi gvtY \_vġK, Zġe Lv''i Awgl gvtQi ep̄ i Rb'' cwi cYġġte e'euZ nġZ cvġi | hv tnvK, kKġv nġj v Lv'' kw³ i mnRj f' Ges m`v Drm hv me aiġbi km'' vbr Ges `Zj extR cvl qv hvq | cwbġZ `vqx (stable) Kwġg Lv'' %Zwi ġZ kKġv evBŪvi wntmte Kvr Kġi | thgb- ōvP®(starch), Gj wRġbU (alginate), Mvg (gum) BZ'w' | ZvQvor tKvb tKvb kKġv Lv''i 'f' ep̄ Kġi Ges %Zwi Lv''i awj KYv (dustiness) Kgvq | thgb - wPŪv, o (molasses) |

cixġlvq t'Lv tMġQ, VvŪv cwi bi ivġġm gvtQ, thgb- m'vgġb (Salmon) Lv''i AwZwi³ kKġv t'ġni ep̄ Kugġq t'q, hKġZ M- vBġKvġRġbi gvġv emwġq t'q Ges gvtQi gZġ chġ nġZ cvġi | cġlvšġi Dŏ cwi bi gvQ, thgb - Kvc®K'vUwġk, tZj wġqv BZ'w', Lv'' Awġk kKġv mn'' KiġZ cvġi Ges GB kKġvġK kw³ wntmte e'envi Kġi | GgbwK AwZwi³ kKġv t'ġn Pw'e ev wj ucW wntmte Rgv ivLġZ cvġi | mvi wY 15 G weifbægvġQi weifbæeqġm kKġvi Pwn`vi cwi gvY t'Lvġbr nġj v |

mvi wY 15 t' gvtQi Lv'' weifbæeqġm kKġvi Pwn`v

gvQ	kKġvi Pwn`v (%)		
	ġcubv	Avġj x ġcubv	cY®eq`c
BiŪqvġ Ges PvbġR Kvc	25	25	25
K'vUwġk	25-30	25-30	25-30
wPswO	25	25	25

**LubR j eYi Pwn`v**

grtQi Lvt` LubR j eYi cwi gvY ubYq KóKi | KviY gvQ Lvt`i LubR j eY Qivl cQqvRtb cwb t`tK LubR j eY MhY Ki tZ cvti | ZvB Lvt` LubR j eYi Pwn`v ubfP Ki te cwb tZ H ubw 8 Dcv`vbi NbZ; Ges Lvt` eZg`vb gvIvi I ci | ZvB wUwgtbi b`vq LubR j eYi Pwn`v ubYq I MtelYvMteti ubqmsZ Ae`vq cwi tKwaZ Lvt` Lvl qvtbvi gva`tg ubYq Kiv ntq \_vtK| Ab`vb` LubR j eYi gta` Lvt` K`vj umqvg I dmdivtmi Pwn`v Rvnbqv tbqv grtQi Lv` %Zwi i Rb` wtkl fvt` i ZcYp mvi wY 16 G KvcRvZxq grtQi Lvt` K`vj umqvg I dmdivtmi Pwn`vi cwi gvY t` lqv ntj v|

mvi wY 16 t KvcRvZxq grtQi Lvt` K`vj umqvg I dmdim Gi Pwn`v

LubR j eY	Pwn`v (%)		
	t`cubv	Av`vj x t`cubv	cY`eq`c
K`vj umqvg	0.8-1.5	0.5-1.5	0.8-1.5
dmdim	0.6-1.0	0.5-1.0	0.6-1.0

Lv` %Zwi i wvfbæDcKi tY wvfbægvI`vq LubR j eY w`gvb \_vtK etj Lvt` Gt`i Afve ciY ntq hvq| ZeyKwI`g Lvt`i Rb` wvfbæj eYi wgy (premix) e`envi Kiv nq| G ai tbi wgy Lvt` 1-2% nvti e`envi Kiv th tZ cvti | mvi wY 17 G Dö cwb i grtQi Lvt` e`eüZ nq Ggb GKw LubR j eY wgy t`i bgy t` Lvtbv ntj v -

mvi wY 17 t Lvt` e`envt`i i Rb` LubR j eY wgy t`i bgy

LubR j eY	cwi gvY (Mg/k t j vMg)
K`vj umqvg At`f-dm tDU (Calcium Orthophosphate) CaHPO4.2H2O	727.7775
g`vMtbwumqvg mvj tDU (Magnesium Sulphate) MgSO4.7H2O	127.5000
tmvWvqvg tKvi vBW (Sodium Chloride) NaCl	050.0000
Avqib mvj tDU (Iron Sulphate) FeSO4.7H2O	025.0000
Avqib mvj tDU (Iron Sulphate) FeSO4.7H2O	005.5000
wRsK mvj tDU (Zinc Sulphate) ZnSO4.7H2	002.5375
g`v`vmbR mvj tDU (Manganese Sulphate) MnSO4.4H2O	000.7850
Kcvi mvj tDU (Copper Sulphate) CuSO4.5H2O	000.4775
tKievè mvj tDU (Cobalt Sulphate) CoSO4.7H2O	000.2950
K`vj umqvg AvtqvWU (Cobalt Iodate) CaIO3.6H2O	000.1275
t`vungK tKvi vBW (Cromic Chloride) CrCl3.6H2O	



**mvi gg**®. ubneo ev Avav ubneo Pti i Rb` gvQ tK KwI`g Lvevi t`qv cQqvRb, ZvB Lv` Zwi i cte`grtQi Avngl, wj wW, kKp I LubR j eYi Pwn`vi cwi gvY Rvbn`i Kvi, wvfbæeqtmi grtQi Avngl, Pve` kKp I LubR j eYi Pwn`vi cwi gvY wvfbæ Aí eqtm grtQi Avngl i Pwn`v Z`bgj Kfite teuk | KviY tQvU Ae`vq grtQi wcvKxq Kvh`ejx` aZZi nq, grtQi Lvt` wj wW wcvKxq kw<sup>3</sup> i Drm wntmte KivR Kti | Lvt` AZ`waK wj wW \_vK t j grtQi ewx Ges Lvt`i KivRvni Zvi Dci wvfc cfve cto | Lvt`i AvZwi<sup>3</sup> kKp t`tni ewx Kwgtq t`q, hK tZ Mb tKv tR tbi gvI v ewotq t`q | Lv` Zwi i wvfbæDcKi tY wvfbægvI`vq LubR w`gvb \_vtK etj Lvt` Gt`i Afve ciY ntq hvq|



