Hkkjrh; df"k vuqla/kku if=dk] **35**(4): 245-248 DOI: 10.18805/BKAP254

iR;{k iHkkoksa d lekuiqfrd vof'k"Vksa lfgr mipkjksa d vuØeksa l fufgr vfHkdYiuk,

fluh oxhl] lhek tXxh] ,Ynks oxhl] ek- gk:u* ,o noUn dekj

Hkk-Ñ-vu-i-&Hkkjrh; Ñf"k lkf[;dh vuqla/kku lLFkku] ilk] ub fnYyh&110 012] HkkjrA

ikIr% fnlEcj 2020 Lohdr% tuojh 2021

lkjk'k

mipkjksa dh Jf.k;ksa l fufgr vfHkdYiukvksa dk ykHkin <x l mi;ksx rc gksrk g tc Á{k.k] ,d gh Á;qfxd bdkbZ ij ckj&ckj ,d vUrjkyksa d ckn nlj vUrjkyksa ij bl Ádkj fy;s tkrs g tl fd ÁR;d vUrjkyksa ij ,d u;k mipkj vuÁ;Dr fd;k x;k gkA vr% ekMy e vof'k"V iHkkoksa dk leko'k bl idkj dh vfHkdYiukvksa dh lcl egÙoi.k fo'k"krk gksrh gA mipkjksa d vuØeksa l fufgr N% ykdfÁ; Jf.k;ksa dh vfHkdYiukvksa dk v/;;u ,d ekMy d vrxr fd;k x;k g ftle vkx c<ku oky ÁHkko mu ÁR;{k ÁHkkoksa d lekuikrh g tgk vKkr lekuiqfrd Ákpy dfYir eku &1 l \$1 rd gA bl Á;ksx fl) m/;;u dk mnn'; mu lekuiqfrd Ákpy¨ dk eku Kkr dju dk Fkk ftud fy, vfHkdYiuk l vf/kdre lpuk ÁkIr dh tk ldA

dth 'kCnk% Økl vkoj vfHkdYiuk,] ÁR;{k ÁHkko] lekuiqfrd Ákpy] vof'k"V ÁHkkoA

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Designs involving sequences of treatments with residuals proportional to direct effects

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ABSTRACT

Designs involving sequences of treatments are advantageously used when observations are taken repeatedly from same experimental unit period after period as a new treatment is applied in each period. Hence, inclusion of residual effects into the model becomes the most important feature of such designs. Six popular classes of designs involving sequences of treatments are studied under a model with carryover effects proportional to the direct effects where the unknown proportionality parameter assumed values from -1 to +1. The objective of this empirical study was to determine the value of proportionality parameter for which maximum information can be drawn from the design.

Key words: Crossover designs, Direct effects, Proportionality parameter, Residual effects.

çLrkouk

mipkjksa d vuØeksa l fufgr vfHkdYiukvksa dh lcl cMh fo'k"krk mipkjksa d vof'k"V vFkok vkx c<ku oky çHkkoksa dh mifLFkfr g rkfd ,d gh çk;kfxd bdkbZ ij fofHkUu vUrjkyksa ij ckj&ckj ç{k.k fy;s tkrs gA ; vkx c<ku oky çHkko vyx&vyx ifjek.k vkj vyx&vyx çdkj d gk ldrs gA dHkh&dHkh o ,d l vf/kd mÙkjxkeh vUrjkyksa d ckn lekIr gksrs gA dHkh&dHkh çHkko ldkjkRed gk ldrs g vkj vU; le; ij udkjkRedA yfdu vf/kdrj vkx c<ku oky çHkko ,d gh vkj gksrs g vFkok vU; mipkjksa d çR;{k çHkko d lekuikrh gksrs gA bl çdkj dh ifjfLFkfr;ksa d fy, mipkjksa d vuØeksa l fufgr vfHkdYiuk, vFkok çR;{k çHkkoksa d lekuikrh vkx c<ku oky çHkkoksa lfgr ,d ;kT; vkx c<ku oky ekMy d lkFk Økl vkoj vfHkdYiuk, (CODs) mi;Dr gA Lkekuiqfrd çkpy vKkr g vkj lekuiqfrd çkpy ij io lpuk lgk;d gksxhA lekuikr d y{k.k ij fof'k"V #fp dUæ vFkkr D,kk vkx c<ku oky lEeyu vFkok fujrj mipkjksa d e/; 0;frjd dk :iyrk g fdUr ;g i.kr% ijh{k.k dh ç—fr ij fuHkj djrk gA mnkgj.kkFk] cgr lh lkærkvk

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[1]Hkk-Ñ-vu-i-&dUnh; lenh ekfRL;dh vuqla/kku lLFkku] dkfPp&682 018] djy] HkkjrA

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ij tl dh feBkl irk dju d fy, mPp lkærk oky tl l igy okyk ehBk tl de lkærk Lrj l igy okyk ogh tl de rhork okyk yx ldrk gA cgr lh çk;kfxd ifjfLFkfr;k e ,d mipkj d vkx c<ku oky çHkko dh ;kT; çHkko gku dh dYiuk dh tkrh g tk fd mipkj d rjr vFkok çR;{k çHkko d lekuikrh gA lekuikr d y{k.k ij fof'k"V #fp dUæ vFkkr D;k vkx c<ku oky lfEeyu vFkok fujrj mipkjk d e/; 0;frjd dk :Ik yrk g fdUr ;g i.kr% ijh{k.k dh ç—fr ij fuHkj djrk gA

fdlh ;kT; vkx c<ku oky ekMy d lkFk mipkjk d vuØek l fufgr vfHkdYiuk, tc vkx c<ku oky çHkko] ,d vKkr lekuikfrd çkpy lfgr çR;{k çHkkok d lekuikrh gk rk ml bu ifjfLFkfr;k e mi;kx fd;k tkrk g (dEIVu bR;kfn] 2001)A dEIVu bR;kfn] (2001) d dN ifj.kkek dk cy ,o duV (2006) }kjk 0;kidrk çnku gÃA ckl ,o LVQdu (2007) rFkk ckl ,o M (2009) u blh ;kT; ekMy dk mi;kx fd;k vkj Øk lvkoj vfHkdYiukvk dh b"Vrerk dk v/;;u rc fd;k tc çFke Øe vkx c<ku oky çHkko mipkjk d çR;{k çHkko d lekuikrh g vkj ;g ekur g, fd lekuikfrdrk fu;rkd Kkr gA oxhl bR;kfn (2013) u [k.kM vfHkdYiukvk dk v/;;u rc fd;k tc lgoklh çHkko Lofl) :Ik l mipkjk d çR;{k çHkko d lekuikrh gA

bl v/;;u e mipkjk d vudek l fufgr N% ykdfi; Jf.k;k dh vfHkdYiukvk dk v/;;u ,d ekMy d vrxr fd;k x;k g ftle vkx c<ku oky ÁHkko mu iR;{k d ÁHkkok d lekuikrh g tgk vKkr lekuikfrd Ákpy dfYir eku &1 l $1 rd gA bl Á;kx fl) v/;;u dk mnn'; mu lekuikfrd Ákpy¨ dk eku Kkr dju dk Fkk ftud fy, vfHkdYiuk l vf/kdre lpuk ikIr dh tk ldA

ekMy

;g ekur g, fd çFke vo'k"k fn; x, g] n çk;kfxd bdkÃ ,o p vUrjkyk e v mipkjk d vuØek l fufgr vfHkdYiukvk gr fuEufyf[kr ;kT; fLFkj çHkko ekMy fy;k tk ldrk gA

$$\mathbf{y} = \boldsymbol{\mu} + \mathbf{T}\boldsymbol{\tau} + \mathbf{R}\boldsymbol{\rho} + \mathbf{P}\boldsymbol{\pi} + \mathbf{S}\boldsymbol{\psi} + \boldsymbol{\varepsilon}, \quad (1)$$

tgk **y**, lk;of{kr vufØ;kvk dk ,d np×1 lfn'k g] $\boldsymbol{\pi}$] vUrjkyk dk p×1 lfn"k g] $\boldsymbol{\tau}$] çR;{k mipkjk dk v×1 lfn'k g] $\boldsymbol{\rho}$] vo'k"kk dk v×1 lfn"k g] $\boldsymbol{\psi}$] vuØek@ bdkb;k dk n×1 lfn'k g vkj $\boldsymbol{\mu}$ ek/;k dk np×1 lfn'k gA **P**, ç{k.kk cuke vUrjkyk dk np×p vfHkdYiuk vk0;g g] **T**, ç{k.kk cuke çR;{k mipkjk dk np×v vfHkdYiuk vk0;g g] **R**] ç{k.kk cuke mipkj vo'k"kk dk np×v vfHkdYiuk vk0;g g] **S**, ç{k.k cuke ijh{k.k bdkÃ;k dk np×n vfHkdYiuk vk0;g g ,o

$\boldsymbol{\varepsilon} = (\varepsilon_1,..., \varepsilon_{np})'$, $E(\boldsymbol{\varepsilon}) = \mathbf{O}$ vkSj $E(\boldsymbol{\varepsilon}\boldsymbol{\varepsilon}') = \sigma^2 I$

lfgr ;kÍfPNd =fV;k dk np×1 lfn'k gA

vc bl io /kkj.kk d vUrxr fd vo'k"k çR;{k çHkkok d lekuikrh g] ekMy bl Ádkj lf{kIr g¨ tkrk G

$$\mathbf{y} = \boldsymbol{\mu} + \mathbf{T}\boldsymbol{\tau} + \mathbf{R}\boldsymbol{\lambda}\boldsymbol{\tau} + \mathbf{P}\boldsymbol{\pi} + \mathbf{S}\boldsymbol{\psi} + \boldsymbol{\varepsilon}$$

$$= \boldsymbol{\mu} + (\mathbf{T} + \mathbf{R}\boldsymbol{\lambda})\boldsymbol{\tau} + \mathbf{P}\boldsymbol{\pi} + \mathbf{S}\boldsymbol{\psi} + \boldsymbol{\varepsilon} \quad (2)$$

tgk λ lekuikfrd Ákpy gA $0 < \lambda < 1$ gr io mipkj d iHkko dk vkf'kd leko'k g tcfd $-1 < \lambda < 0$ gr vof'k"V ÁHkko] 0;frjd iHkko dk :i y yrk gA ;fn $\lambda = 0$ g rk dkb vof'k"V ÁHkko ugh jgrk gA ekMy ¼2½ dh e[; J"Vrk ;g g fd ble vkdyu d fy, de Ákpy gA

lekuikfrdrk Ákpy dk vkdyu

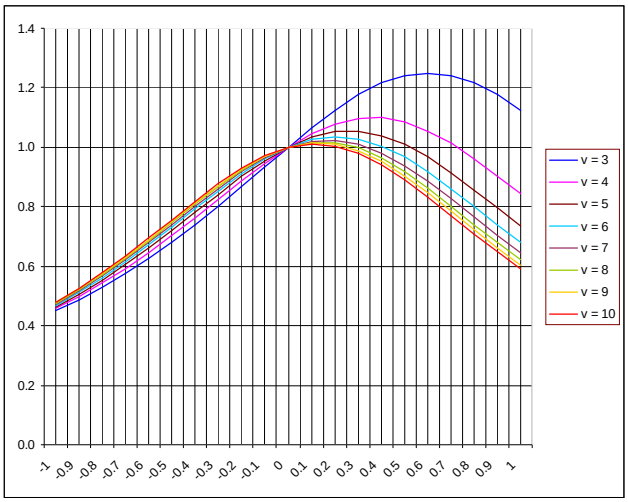
mipkjk d vuØek l fufgr vfHkdYiuk, ftue] vo'k"k ÁHkko] ÁR;{k ÁHkkok d lekuikrh g] dh x.kukvk gr i)fr dk vfUre :i fn;k x;k gA lekuikfrd Ákpy d fofHkUu ekuk d fy, lekU;r% 0 l &1 vFkok 1 d e/; cnyr g,] ÁR;{k ÁHkkok d ldkjkRed ;k udkjkRed vlj ij fuHkj djr g, ;kT; vkx c<kr iHkko ekMy d vrxr] tcfd vkx c<kr iHkko mud ÁR;{k ÁHkkok d lekuikrh g] cgr lh vfHkdYiukvk d in'ku dk v/;;u vuHko fl) fof/k l fd;k x;k gA ;g nh xb ifjfLFkfr d fy, ,d mi;Dr vfHkdYiuk d p;u dju e i;kDrk dh lgk;rk djxkA

bl foU;kl d vUrxr cgr lh lrfyr vfHkdYiukvk d in'ku d v/;;u dju d fy, lefpr ,l,,l dVk ¼y[kd d ikl miyC/k½ dk fodkl fd;k x;k gA lekuikfrd ikpyk d fofHkUu eku¨ d vUrxr ÁFke Øe vo'k"k ÁHkkok t¨ fd ÁR;{k ÁHkkok d lekuikrh g] dh mifLFkfr e mipkj¨ d vuØek l fufgr io&vUrjky ,o vfrfjDr vUrjky vfHkdYiukvk d in'ku d v/;;u gr iu% ,l,,l dV fy[k x, gA CODs [fofy;El (1948) }kjk fofy;El ox vfHkdYiuk,] 'kek (1981) }kjk fn; x, CODs vfrfjDr- vUrjky fofy;El ox vfHkdYiuk,] io- vUrjky fofy;El ox vfHkdYiuk, cyke ¼1968½ }kjk fn; x, ijLij vk;rh; yfVu ox (MOLs) mi;kx djr g, CODs ,o f}- vUrjky CODs]

dk fofHkUu Jf.k;k e mipkjk dh fofHkUu l[;kvk (v) gr lekuikfrd çkpy d fofHkUu ekuk ¼λ] –1 l 1 rd d eku ydj½ d vrxr mipkjk d çR;{k çHkko l lcf/kr 0;frjdk d çlj.kk dh x.kuk dh xÃ gA Tkc $\lambda = 0$ g] vo'k"k çHkko vuifLFkr gA λ dk b"Vre eku Kkr dju d fy, ge mipkjk dh çfrÑfr;k (r) dh leku l[;k, yr g, vk;rh; vfHkdYiukvk d lki{k bu 0;frjdk d vkdyu gr lpuk dh x.kuk djr gA

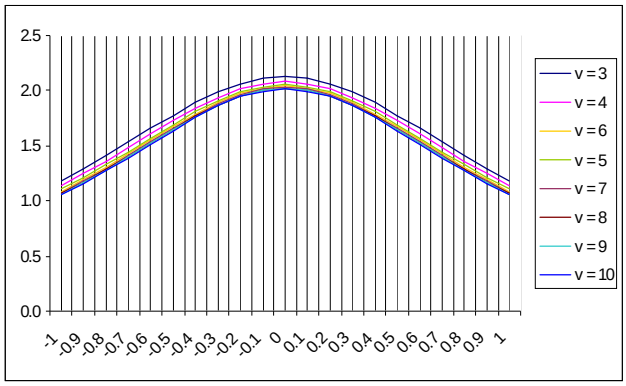
$$\text{Lkpuk} = \left(\frac{r}{2}\right) \times$$ ¼çR;{k çHkko 0;frjdk dk ek/;e çlj.k)

lekuikfrd çkpy ¼λ] –1 l + 1 rd d eku ydj) d fofHkUu ekuk ,o mipkjk (v) dh fofHkUu l[;kvk gr bl lpuk dh x.kuk Hkh dh xÃ gA ifj.kkek dk Li"V dju d fy, v d fofHkUu ekuk d fy, x.kuk dh xb lpuk dk lekuikfrd çkpy λ d fofHkUu ekuk d fo#) vkyf[kr (plotted) fd;k x;k vkj 1&6 fp=k e fn;k x;k gA çk;kfxd ijkl d vnj yxHkx lHkh v gr ftl λ d fy, lokf/kd lpuk çkIr dh xb] ml lekuikfrd çkpy dk lefpr eku fy;k x;k vkj ml gh vfHkdYiukvk dh ml J.kh d fy, fy;k x;k A



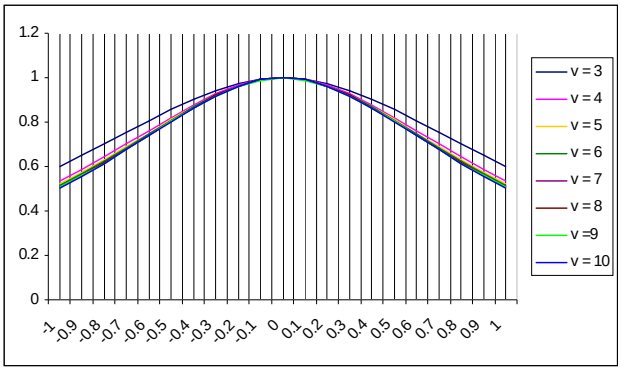
fp= 1% fofy;El (1949) ox vfHkdYiuk% lpuk cuke fofHkUu v gr λ

mijkDr l ;g n[kk x;k g fd tl & tl v c<rk g lekuikfrd çkpy dk eku 0-6 l 0-1 rd ifjofrr gkrk gA



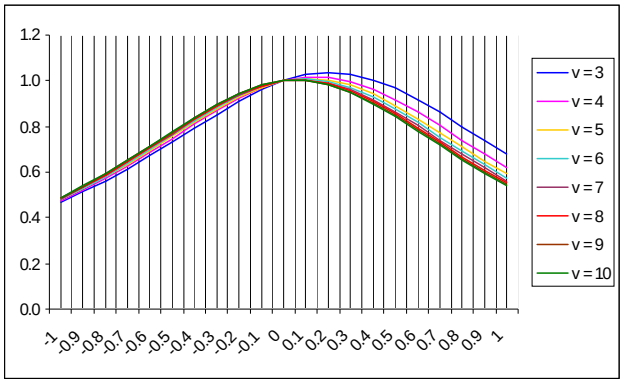
fp= 2% vfrfjDr- vUrjky fofy;El ox vfHkdYiuk% lpuk cuke fofHkUu v gr λ

bl ekey e ;g n[kk x;k g fd vf/kdre lpuk ml ekey e g tc $l = 0$ gA



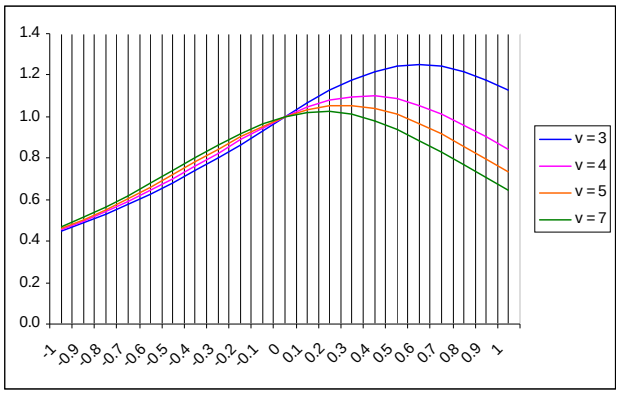
fp= 3% io &vUrjky fofy;El ox vfHkdYiuk% lpuk cuke fofHkUu v gr λ

bl ekey e Hkh ;gh n[kk x;k g fd lokf/kd lpuk ml ekey e g tc $\lambda = 0$ gA

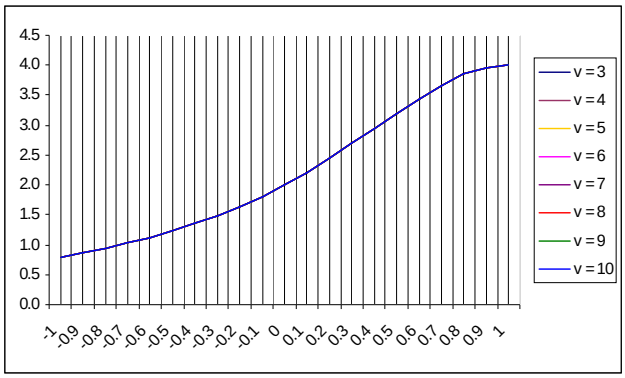


fp= 4% 'kek (1981) vfHkdYiuk% lpuk cuke fofHkUu v gr λ

mijkDr e ;g n[kk x;k g fd tl&tl v c<rk g lekuikfrd çkpy dk eku 0-1 l 0-2 rd ifjofrr gkrk gA



fp= 5% MOLS dk mi;kx djr g, COD% lpuk cuke fofHkUu v gr λ mijkDr l n[kk x;k g fd t l&t l v c<rk g lekuikfrd çkpy dk eku 0-6 l 0-2 rd ifjofrr gkrk gA



fp= 6% cyke (1988) vfHkdYiuk% lpuk cuke fofHkUu v gr λ mijkDr l n[kk x;k g fd lHkh v gr lekuikfrd çkpy dk eku 1 gA

fu"d"k

mipkjk d vuØek l fufgr vfHkdYiukvk dh lk'k&ik"k.k ijh{k.kk] yEch&vof/k —f"k ijh{k.kk ,o lk'kfpfdRlk vk"kf/k ijh{k.kk e vuç;kx dh cgr vf/kd lHkkouk, gA ijh{k.k bdkÃ;k dh miyC/krk e deh d dkj.k] mipkjk dk ,d bdkÃ ij le; d cnyr vUrjkyk ij vuç;Dr fd;k tk ldrk gA D;kfd ç{k.k ,d gh ijh{k.k bdkÃ ij ckj&ckj fy; tkr g blfy, bu ijh{k.kk ij vkx c<ku oky çHkkok d vlj dh mi{kk ugh dh tk ldrh gA mipkjk d vuØek l fufgr N% ykdfÁ; Jf.k;k dh vfHkdYiukvk dk v/;;u ,d ekMy d vrxr fd;k x;k g ftle vkx c<ku oky ÁHkko mu ÁR;{k ÁHkkok d lekuikrh g tgk vKkr lekuikfrd Ákpy dfYir eku &1 l $1 rd gA bl Á;kx fl) m/;;u dk mnn';mu lekuikfrd Ákpy¨ dk eku Kkr dju dk Fkk ftud fy, vfHkdYiuk l vf/kdre lpuk ÁkIr dh tk ldA λ d ml eku dk ft ld fy, vf/kdre lpuk çkIr dh xÃ g] lekuikfrdrk çkpy dk lefpr eku fy;k tkrk g vkj ml vfHkdYiukvk dh fof'k"V J.kh d fy, ekuk tkrk gA

lnHk

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