

(Bone turnover)

가

Wistar rats(7 ; n=55)
(SH; n=14) (OVX; n=41)

80 5 (OVX) 9 4 (IF, 0, 20, 40, 80mg/(kg body · d))

84 SH rats ()가 OVX

164 ()가 osteocalcine 가 (P<0.05). 164 osteocalcine deoxyypyridinoline OVX IF40 IF80 (P<0.05). IF

(osteopenia)

1.

가

(1)

(2).

(4).
(Glycine max)

(3).

가

(1).

(ipriflavone,

)

1.

가

1)

g/kg

180

210

(5).

430

100

(6,7).

25

25

10

(8-13)

18.5

(14)

(15-18).

DL-

1.5

가

¹ (Union des Caséineries), (Eurosucré), (Cerestar), (Durieux), (Bailly), (Roche), (Prolabo) DL- (Jerafrance).

가

² kg retinyl palmitate(250 IU/mg) 200 mg, cholecalciferol(400IU/mg) 312mg, DL-tocopherol acetate(0.25IU/mg) 20,000 mg, menadione 100mg, thiamine HCl 1000 mg, riboflavin 1000 mg, nicotinic acid 4500 mg, D-calcium panthothenate 3000 mg, pyridoxine HCl 1000 mg, inositol 5000 mg, folic acid 200 mg, cyanocobalamine 1.35 mg, ascorbic acid 10000 mg, p-aminobenzoic acid 5000 mg, choline chloride 75000 mg, sucrose 971.9 g

가

가

(19).

가

³ kg CaHPO₄ · 2H₂O 308 g, K₂HPO₄ 194 g, CaCO₃ 146 g, MgSO₄ · 7H₂O 109 g, NaCl 168 g, MgO 24.3 g, FeSO₄ · 7H₂O 20.9 g, ZnSO₄ · H₂O 12.1 g, MnSO₄ · H₂O 12.1 g, CuSO₄ · 5H₂O 2.4 g, NaF 1.9 g, CrK(SO₄)₂ · 12H₂O 1.2 g, (NH₄)₆Mo₇O₂₄ · 4H₂O 0.0005, CoCO₃ 0.0005, Na₂SeO₃ 0.0005g

2.

2.1

Wistar rats(n=60, 195) IN.RA

()

21

12

(OVX; n=41)

(d 0).

80

(d 80)

5

(SHi n=5; OVXi n=5)

(IN.RA;

가

1)

. 210

(299g)

(n=36; 366g)

9

4

(initial control; IC) 5

(IF)

55 chloral hydrate

0(OVX), 20(IF20), 40(IF40), 80(IF80) mg/ (kg

(80g/L in saline soln.; 0.4ml/ 100g

body · d) 84

, 164

body)

(SH; n=14)

(d 164)

(Novasoy Isoflavone compound 152-400, ADM)	SH	antibody (Biochemical Technologies)
OVX		(radioimmunoassay)
		0.01 nmol/L
		7-9%
SH		
	1	2.4 deoxypyridinoline(DPD)
		DPD
48	X	anti-DPD antibody, ¹²⁵ I-
(DEXA)	(20). 0, 40, 80,	DPD(Pyralinks-D RIA kit;Metra Biosystem)
122, 164	24	ELISA
		2 nmol/L
deoxypyridinoline(DPD)		4-6% nmol DPD/mmol creatinine
(21).	ml	(21).
200 pep-tidase inhibitory units iniprol		picric acid Jaffés
9		
(3500g, 5min, 4).		
, , osteocalcine,		DPD
-20	(22). 80	
164	(uterine	2.5
horn)		
		Perkin-Elmer 400
		Lanthanum oxide (1g/L;Carlo Erba Re-agenti)
2.2		
	(eguol)	2.6
ELISA	(23,24).	BMD X Hologic QDR-
	35, 40, 10	4500 DEXA BMD
nmol/L		(T-BMD) D-BMD M-BMD
	4.8, 5, 5%	(25). D-BMD (cortical bone)
13.1, 12.8, 13.6%		(diaphysis)
2.3 osteocalcine(OC)		, M-BMD (cancellous bone)
OC ¹²⁵ I- OC goat anti-rat		(metaphysis)
OC antibody, 2 donkey anti-goat- 2nd		2.7

(Universal Testing Machine; Instron)
3 bending test
(26).

2.8

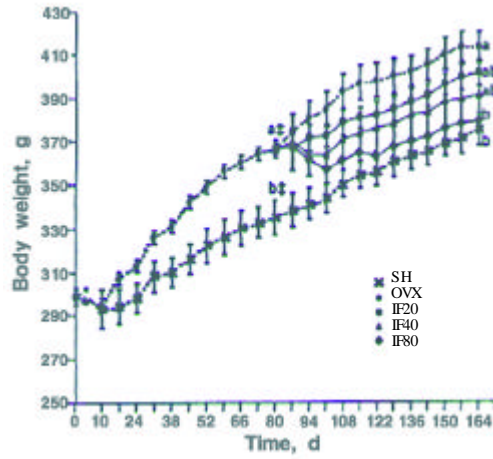
(Sigma) (27).
100 200 μm Isomet
2000(Buhler) Metaserv 2000(Buhler)
80 μm , Von Kossa silver
(AgNO₃; Sigma)
OsteoLab (Bio-
com)

(trabeculae)

2.9

\pm SE
Microsoft GraphPad InStat
가 ANOVA
Student-Newman-
Keuls
ANOVA 가
Kruskal-Wallis
test Mann-
Whitney U test
ANOVA
Student-Newman-Keuls
P<0.05

3.



1. SH(), OVX(), IF20, IF40, IF80(20, 40, 80 mg/(kg body · d))

\pm SE, n=9(0 80 OVX가 n=36).
SH OVX 0 80
, P<0.0001. † SH , OVX , IF20
80 164
P<0.001.; 80 164
가 가 , P<0.05.

3.1
† a
0 80 a SH^{ab} OVX^a
가 (d 80; P<0.0001) 1c
(d 80) SH OVX
d (P<0.05, 1). 80 164
SH OVX 가
(P<0.001), SH
(P<0.05). IF20
80 164
가 164
, IF80 SH 가
OVX 가
(P<0.05). , IF20 IF40
SH OVX 가
(IC)

2. 가

	g/100g body
SHi	0.27 ± 0.02 ^a
OVXi	0.05 ± 0.01 ^b
SH	0.38 ± 0.04 ^a
OVX	0.08 ± 0.01 ^b
IF20	0.10 ± 0.01 ^b
IF40	0.06 ± 0.01 ^b
IF80	0.11 ± 0.01 ^b

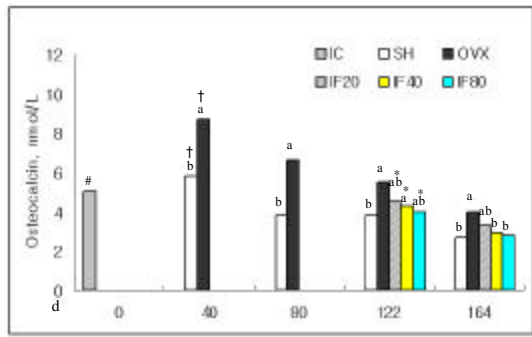
¹ ±SE, n=5, 9, 가, P<0.001

² SHi((sham-operated), d=80), OVXi((ovariectomized), d=80), OVX(, d=164), IF20(20 mg/(kg body · d), d=164), IF40(40 mg/(kg body · d), d=164), IF80(80 mg/(kg body · d), d=164)

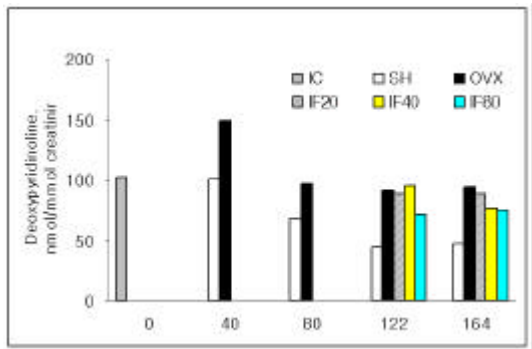
(fat mass) (lean mass)
가 28 ± 1, 69 ± 1g / 100g body (IC)
가
(14.2 ± 2, 83 ± 2g/100g body, P<0.001)

3.2 SH OVX 80 164 가 (2). 164 (IF) OVX 가 .

3.3 164 IF20 가



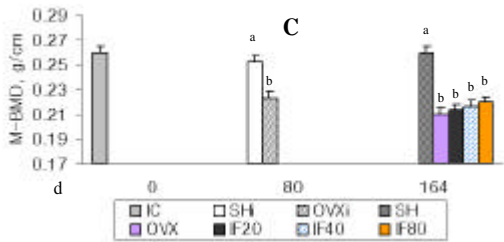
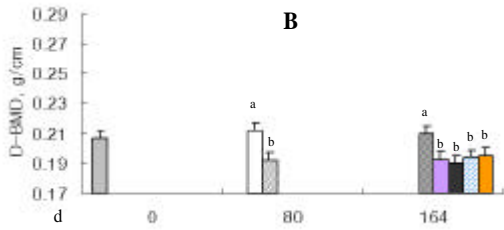
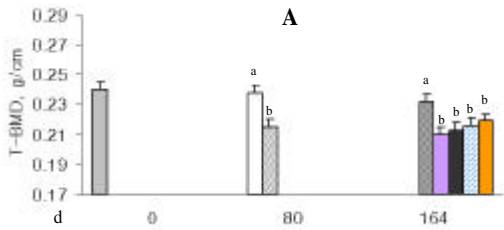
2. IC(), SH(), OVX(), IF20, IF40, IF80(20, 40, 80 mg/(kg body · d)) osteocalcin ±SE, n=9(IC n=5, 40 80 OVX n=36). * 80, 122, 164 SH . P<0.05,[‡] 40 osteocalcin SH 80, 122, 164 OVX 80 , P<0.05, 122 osteocalcin 164 , P<0.05 ; 가 가 , P<0.05.



3. IC(), SH(), OVX(), IF20, IF40, IF80(20, 40, 80 mg/(kg body · d)) deoxypyridinoline ±SE, n=9(IC n=5, 40 80 OVX n=36). * 80, 122, 164 SH . P<0.005,[‡] 40 DPD SH 80, 122, 164 OVX 80 , P<0.01, * 122 DPD 164 , P<0.05 ; 가 가 , P<0.05.

IF40 IF80 (P<0.0001)
 IF40 IF80 가 (3).

0.08 ± 0.01, 0.09 ± 0.01
 0.05 ± 0.01 μmol/L (P<0.0001).



4. IC(), SHi(), SH(), OVXi(), OVX(), IF20, IF40, IF80(20, 40, 80 mg/ (kg body · d)) (BMD)

A (T-BMD); B (B-BMD); C (M-BMD). ±SE, n=5 9; 가 가 , P<0.005(A), P<0.05(B), P<0.001(C).

3.4 osteocalcine

OC SH
 OVX (2). , IF20
 IF40 OC 122 SH
 가 , IF OVX
 OC 가
 122 164 OC
 OVX SH 가 IF
 OC 가
 164 IF
 OC SH 가
 OVX 가 IF20

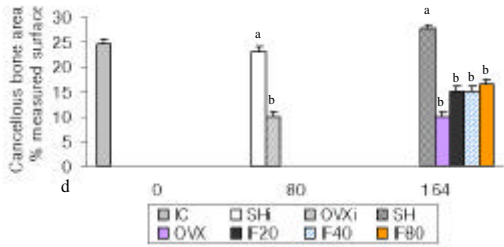
3.5 deoxypyridinoline

DPD SH OVX
 (3). 122
 DPD SH
 IF , IF80 DPD
 OVX (P<0.05).
 164 DPD OVX ,
 IF SH , IF40
 122 164 DPD
 164 IF40 IF80 OVX
 DPD (P<0.05,
 IF20).

3.6

가 (2.58 ± 0.07(0), 2.53 ± 0.03(80), 2.61 ± 0.01(122), 2.47 ± 0.01 (164)mmol/L).
 가 (2.6 ± 0.2(0), 3.1 ± 0.2 (80), 2.8 ± 0.2(122), 3.9 ± 0.2(164)mg/day).

3.7 (BMD)



5. IC(), SHi(), OVXi(), SH(), OVX(), IF20, IF40, IF80(20, 40, 80 mg/(kg body · d))

±SE, n=5 9; 가 가 , P<0.05.

BMD (IC), SHi , SH 가 , SH OVX IF 80 164 (4). , 164 IF BMD OVX

3.8 가 , 37.1±0.1mm, 3.62±0.04mm, 115±2 N

3.9 가 IC , SHi , SH 가 , SH OVX IF 80 164

(5). , 164 IF OVX (trabecular number) (1.6±0.1 trabeculae/mm) (3.2±0.2 trabeculae/mm) (P<0.0001). (613±36 μm) (242±19 μm) (P<0.0001). IC, SHi, SH 가 , SHi (77±3μm) OVXi (65±3μm) 164 가 (84±2μm).

4. 가 (osteopenia) (8-13). 35 100 (IF IF) (19). , 가 가

가 7 80 84 IF

(M-BMD) (D-BMD) , (2)가 (distal femur mataphysis;)

(femoral diaphysis; (g/100g dry bone)
 D-BMD (SH, OVX, Arjmandi (19)
 D-BMD (M-BMD, (5),
 M-BMD (5). (turnover)가 (23).
 (trabecular) (turnover)가 (23).
 가 IF20 osteocalcine OVX
 SHi OVXi 164 가 164
 SH OVX IF SH osteocalcine
 가 osteocalcine
 가 IF 122 164
 SH OVX
 DPD OC 가 (2). DPD
 (2, 3) IF SH
 (turnover)가 가 , IF80 DPD 122 164
 (genistin diadzin 164 (3). IF40 122
) 25 2.5µg/g body · d 65 , 164
 OVX
 IF40 DPD
 Arjmandi 가
 (19) , 가
 (4). Arjmandi (19)

	(µmol/L)	(µmol/L)	(µmol/L)
IF 20	0.73 ± 0.06 ^a	0.72 ± 0.09 ^b	0.95 ± 0.12 ^b
IF 40	1.32 ± 0.16 ^c	1.38 ± 0.11 ^c	1.50 ± 0.19 ^c
IF 80	1.39 ± 0.29 ^c	1.62 ± 0.22 ^c	1.93 ± 0.30 ^c

¹ ± SE, n=9, 가 가 , P,0.001
² IF20(20 mg/ (kg body · d)), IF40(40 mg/ (kg body · d)
), IF80(80 mg/ (kg body · d))

(genistin diadzin) 25 2.5µg/g
body · d
가

IF20

가 OVX

SH

IF20

< : J. Nutr., 131, 723-728, 2001>

5.

164

IF20

IF40

가

가

가

IF40

IF80

가

가가

(3).

10-13

가

가

IF80

가

(

1). OVX

SH

가

,

164

SH

가

(2).

, 65

25 µg/(g body · d)

(19).

가

, IF40

IF80

가

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