Table 7

Two generation reproductive toxicity study of BBP by oral administration in rats

Food consumption of F_0 females during gestation period; Mean±S.D. (N)

Compound	Butyl benzyl phthalate			
Dose (mg/kg)	0[a]	20	100	500
Days of gestation				
1-2	23.4 ± 3.1 (22)	23.6 ± 2.9 (20)	24.0 ± 2.1 (23)	24.2 ± 2.9 (24)
7-8	25.0 ± 3.1 (22)	24.0 ± 3.1 (20)	25.0 ± 2.6 (23)	21.6 ± 17.0 (24)
13-14	24.9 ± 3.0 (22)	24.9 ± 3.2 (20)	24.1 ± 2.2 (23)	25.9 ± 3.2 (24)
19-20	23.2 ± 3.0 (22)	23.7 ± 2.9 (20)	23.6 ± 2.9 (23)	24.7 ± 2.7 (24)

a: vehicle control, corn oil (2 mL/kg)

Table 8

Two generation reproductive toxicity study of BBP by oral administration in rats

Food consumption of F_0 females during lactation period; Mean±S.D. (N)

Compound	Butyl benzyl phthalate			
Dose (mg/kg)	0[a]	20	100	500
Days of lactation				
3-4	37.3 ± 6.3 (22)	38.2 ± 5.4 (20)	39.3 ± 5.1 (23)	36.6 ± 5.5 (24)
6-7	43.1 ± 5.2 (22)	44.7 ± 5.0 (20)	43.3 ± 3.8 (23)	41.7 ± 5.7 (24)
9-10	50.4 ± 6.2 (22)	50.1 ± 6.6 (20)	50.4 ± 4.6 (23)	47.7 ± 5.7 (24)

a: vehicle control, corn oil (2 mL/kg)

Table 9

Two generation reproductive toxicity study of BBP by oral administration in rats

Estrous cycle of F_0 females

Compound	Butyl benzyl phthalate			
Dose (mg/kg)	0[a]	20	100	500
Number of females examined	25	25	25	25
Mean length of estrous cycle in days				
Pre-treatment period; Mean±S.D.	4.0 ± 0.0	4.0 ± 0.2	4.0 ± 0.2	4.0 ± 0.0
Treatment period; Mean±S.D.	4.0 ± 0.1	4.1 ± 0.3	4.0 ± 0.1	4.1 ± 0.2
Number of animals showing each type of cycle during pre-treatment period				
4-day cycle	25	24	24	25
5-day cycle	0	1	1	0
Changes of estrous cycle after treatment				
Number of animals whose estrous cycle was not changed	24	24	24	23
Number of animals whose estrous cycle was changed	1	1	1	2
[Pre-treatment] → [Treatment]				
4-day → 5-day	0	0	0	1
4-day → 4/5-day	1	0	0	1
4-day → irregular	0	1	0	0
5-day → 4/5-day	0	0	1	0
Number of vaginal estrus during mating period				
period; Mean±S.D.	1.0 ± 0.0	1.0 ± 0.0	1.0 ± 0.2	1.1 ± 0.3

a: vehicle control, corn oil (2 mL/kg)

Table 10

Two generation reproductive toxicity study of BBP by oral administration in rats

Reproductive performance of F_0 animals

Compound	Butyl benzyl phthalate			
Dose (mg/kg)	0[a]	20	100	500
Number of pairs examined (A)	25	25	25	25
Number of pairs successful copulation (B)	24	24	24	25
Copulation index [(B/A)×100,%]	96.0	96.0	96.0	100.0
Number of pregnant females (C)	22	20	23	24
Fertility index [(B/A)×100,%]	91.7	83.3	95.8	96.0
Pairing days until copulation Mean±S.D.	2.5 ± 1.2 (24)	3.2 ± 2.6 (24)	2.6 ± 1.4 (24)	3.2 ± 1.4 (25)

a: vehicle control, corn oil (2 mL/kg)

Table 11
Two generation reproductive toxicity study of BBP by oral administration in rats
Summary of macroscopic findings in F0 males

Group	0 mg/kg		20 mg/kg		100 mg/kg		500 mg/kg	
Grade	−	+	−	+	−	+	−	+
(Liver)	[25]		[25]		[25]		[25]	
Yellowish	23	2	25	0	24	1	25	0
Area, dark	25	0	25	0	24	1	25	0
(Testis)	[25]		[25]		[25]		[25]	
Small	24	1	24	1	25	0	25	0
(Epididymis)	[25]		[25]		[25]		[25]	
Small	24	1	24	1	25	0	25	0
Nodule, white, fat tissue	24	1	25	0	25	0	25	0
(Kidney)	[25]		[25]		[25]		[25]	
Cyst, right side	24	1	25	0	25	0	24	1
Recessed area, cortex	25	0	24	1	24	1	25	0
(Lung)	[25]		[25]		[25]		[25]	
Spot, gray	25	0	25	0	25	0	25	0
Area, dark, right lobe	25	0	24	1	25	0	25	0
(Thymus)	[25]		[25]		[25]		[25]	
Small	25	0	21	4	23	2	24	1
(Thyroid gland)	[25]		[25]		[25]		[25]	
Enlargement	25	0	25	0	25	0	24	1

−, Negative; +, Positive
[ ], Number of animals examined

Table 12
Two generation reproductive toxicity study of BBP by oral administration in rats
Summary of macroscopic findings in F0 females

Group	0 mg/kg		20 mg/kg		100 mg/kg		500 mg/kg	
Grade	−	+	−	+	−	+	−	+
(Liver)	[25]		[25]		[25]		[25]	
Enlargement	25	0	25	0	25	0	24	1
Diaphragmatic nodule	24	1	25	0	25	0	25	0
Area, pale	24	1	25	0	25	0	25	0
(Thymus)	[25]		[25]		[25]		[25]	
Small	23	2	24	1	23	2	22	3
(Ovary)	[25]		[25]		[25]		[25]	
Small	25	0	24	1	25	0	25	0
(Uterus)	[25]		[25]		[25]		[25]	
Dilatation, lumen	25	0	25	0	25	0	23	2
(Pituitary gland)	[25]		[25]		[25]		[25]	
Enlargement	25	0	24	1	25	0	25	0
(Kidney)	[25]		[25]		[25]		[25]	
Recessed area, left side	25	0	24	1	25	0	25	0
Area, pale, cortex	25	0	25	0	24	1	25	0
(Lung)	[25]		[25]		[25]		[25]	
Area, dark	25	0	25	0	24	1	25	0
(Skin)	[25]		[25]		[25]		[25]	
Alopecia	25	0	25	0	24	1	25	0
(Stomach)	[25]		[25]		[25]		[25]	
Area/spot, dark, mucosa, glandular stomach	25	0	25	0	24	1	25	0
(Mammary gland)	[25]		[25]		[25]		[25]	
Mass	25	0	25	0	25	0	24	1

−, Negative; +, Positive
[ ], Number of animals examined

Table 13

Two generation reproductive toxicity study of BBP by oral administration in rats

Organ weight of F_0 males; Mean±S.D. (N)

Compound		Butyl benzyl phthalate			
Dose (mg/kg)		0[a]	20	100	500
Terminal body weight	(g)	593.2 ± 55.8 (25)	584.0 ± 52.6 (25)	593.2 ± 52.6 (25)	550.3 ± 50.0 * (25)
Brain	(g)	2.07 ± 0.08[b] (25)	2.07 ± 0.09 (25)	2.08 ± 0.08 (25)	2.09 ± 0.10 (25)
		0.35 ± 0.03[c]	0.36 ± 0.03	0.35 ± 0.03	0.38 ± 0.04 **
Heart	(g)	1.50 ± 0.11 (25)	1.46 ± 0.10 (25)	1.49 ± 0.14 (25)	1.43 ± 0.13 (25)
		0.25 ± 0.03	0.25 ± 0.02	0.25 ± 0.02	0.26 ± 0.02
Lung	(g)	1.41 ± 0.11 (25)	1.44 ± 0.11 (25)	1.43 ± 0.08 (25)	1.40 ± 0.13 (25)
		0.24 ± 0.02	0.25 ± 0.02	0.24 ± 0.01	0.26 ± 0.02 *
Liver	(g)	19.08 ± 2.52 (25)	18.58 ± 1.97 (25)	19.27 ± 1.93 (25)	21.21 ± 2.52 **(25)
		3.22 ± 0.30	3.19 ± 0.24	3.25 ± 0.19	3.85 ± 0.27 **
Spleen	(g)	0.85 ± 0.12 (25)	0.92 ± 0.13 (25)	0.88 ± 0.12 (25)	0.84 ± 0.10 (25)
		0.14 ± 0.02	0.16 ± 0.02	0.15 ± 0.02	0.15 ± 0.02
Kidneys	(g)	3.35 ± 0.40 (25)	3.26 ± 0.29 (25)	3.43 ± 0.33 (25)	3.58 ± 0.29 * (25)
		0.57 ± 0.07	0.56 ± 0.05	0.58 ± 0.05	0.65 ± 0.06 **
Adrenal glands	(mg)	47.1 ± 6.1 (25)	48.4 ± 6.1 (25)	49.0 ± 5.7 (25)	48.1 ± 7.0 (24)
		8.0 ± 1.1	8.3 ± 1.1	8.3 ± 1.3	8.8 ± 1.0
Thymus	(mg)	251.9 ± 60.9 (25)	222.4 ± 65.2 (25)	214.0 ± 35.3 (24)	226.1 ± 68.5 (25)
		42.5 ± 10.0	38.5 ± 12.2	36.5 ± 7.2	41.2 ± 11.8
Testes	(g)	3.23 ± 0.58 (25)	3.19 ± 0.55 (25)	3.33 ± 0.34 (25)	3.15 ± 0.28 (25)
		0.55 ± 0.10	0.55 ± 0.10	0.56 ± 0.05	0.58 ± 0.09
Epididymides	(g)	1.31 ± 0.21 (25)	1.28 ± 0.15 (25)	1.32 ± 0.09 (25)	1.27 ± 0.10 (25)
		0.22 ± 0.04	0.22 ± 0.03	0.22 ± 0.02	0.23 ± 0.03
Ventral prostate	(g)	0.68 ± 0.17 (25)	0.70 ± 0.17 (25)	0.73 ± 0.16 (25)	0.69 ± 0.19 (25)
		0.12 ± 0.03	0.12 ± 0.03	0.12 ± 0.03	0.13 ± 0.04
Seminal vesicle	(g)	2.10 ± 0.25 (25)	2.06 ± 0.33 (24)	2.06 ± 0.33 (24)	2.03 ± 0.28 (25)
		0.36 ± 0.06	0.36 ± 0.07	0.35 ± 0.07	0.37 ± 0.06
Prostate and seminal vesicle	(g)	3.29 ± 0.31 (25)	3.33 ± 0.44 (24)	3.23 ± 0.36 (24)	3.14 ± 0.44 (25)
		0.56 ± 0.09	0.57 ± 0.09	0.55 ± 0.09	0.58 ± 0.10
Thyroid glands	(mg)	20.5 ± 4.8 (25)	21.0 ± 5.3 (25)	22.0 ± 4.3 (25)	20.5 ± 4.0 (25)
		3.5 ± 0.9	3.6 ± 1.0	3.7 ± 0.8	3.8 ± 1.0
Pituitary gland	(mg)	11.6 ± 1.6 (25)	11.9 ± 1.7 (25)	11.4 ± 1.4 (25)	11.3 ± 1.5 (25)
		2.0 ± 0.3	2.0 ± 0.3	1.9 ± 0.3	2.1 ± 0.3

a: vehicle control, corn oil (2 mL/kg)
b: absolute weight
c: relative weight (mg per 100g body weight)
*: significant difference from control, $p<0.05$
**: significant difference from control, $p<0.01$

Table 14

Two generation reproductive toxicity study of BBP by oral administration in rats

Organ weight of F_0 females on day 22 of lactation; Mean±S.D. (N)

Compound		Butyl benzyl phthalate			
Dose (mg/kg)		0[a]	20	100	500
Terminal body weight	(g)	353.9 ± 25.3 (22)	348.0 ± 18.2 (20)	352.0 ± 15.6 (23)	356.8 ± 21.3 (24)
Brain	(g)	1.89 ± 0.06 (22)	1.87 ± 0.06 (20)	1.86 ± 0.08 (23)	1.88 ± 0.08 (24)
		0.54 ± 0.04	0.54 ± 0.03	0.53 ± 0.03	0.53 ± 0.04
Heart	(g)	1.13 ± 0.11 (22)	1.12 ± 0.09 (20)	1.12 ± 0.08 (23)	1.12 ± 0.07 (24)
		0.32 ± 0.02	0.32 ± 0.02	0.32 ± 0.02	0.32 ± 0.02
Lung	(g)	1.18 ± 0.09 (22)	1.16 ± 0.10 (20)	1.15 ± 0.08 (23)	1.14 ± 0.08 (24)
		0.33 ± 0.02	0.34 ± 0.03	0.33 ± 0.02	0.32 ± 0.02
Liver	(g)	14.91 ± 1.14 (22)	15.04 ± 1.46 (20)	15.14 ± 1.48 (23)	15.74 ± 1.29 (24)
		4.22 ± 0.31	4.32 ± 0.29	4.30 ± 0.37	4.41 ± 0.29
Spleen	(g)	0.68 ± 0.08 (22)	0.67 ± 0.09 (20)	0.69 ± 0.10 (23)	0.67 ± 0.10 (24)
		0.19 ± 0.02	0.19 ± 0.02	0.20 ± 0.03	0.19 ± 0.03
Kidneys	(g)	2.21 ± 0.23 (22)	2.28 ± 0.25 (20)	2.36 ± 0.15 * (23)	2.37 ± 0.19 * (24)
		0.62 ± 0.05	0.65 ± 0.06	0.67 ± 0.03 **	0.66 ± 0.04 *
Adrenal glands	(mg)	65.8 ± 7.0 (22)	65.5 ± 6.9 (20)	69.1 ± 7.8 (23)	66.7 ± 7.8 (24)
		18.6 ± 1.8	18.9 ± 2.3	19.7 ± 2.5	18.7 ± 2.3
Thymus	(mg)	212.9 ± 59.3 (22)	190.6 ± 55.0 (20)	216.7 ± 66.2 (23)	199.2 ± 63.9 (24)
		60.3 ± 16.9	54.9 ± 16.3	61.4 ± 17.9	56.1 ± 19.4
Ovary	(mg)	103.0 ± 9.2 (22)	103.2 ± 10.9 (20)	99.1 ± 15.4 (23)	92.1 ± 13.0 * (24)
		29.2 ± 3.1	29.7 ± 3.3	28.2 ± 4.7	25.9 ± 3.9 *
Uterus	(g)	0.40 ± 0.11 (22)	0.37 ± 0.13 (20)	0.44 ± 0.09 (23)	0.47 ± 0.19 (24)
		0.11 ± 0.03	0.11 ± 0.04	0.13 ± 0.03	0.13 ± 0.05
Thyroid glands	(mg)	15.5 ± 3.4 (22)	17.4 ± 2.5 (20)	15.6 ± 3.3 (23)	16.8 ± 3.0 (24)
		4.4 ± 1.0	5.0 ± 0.6	4.4 ± 0.9	4.7 ± 1.0
Pituitary gland	(mg)	15.3 ± 2.1 (22)	15.1 ± 2.1 (20)	15.4 ± 2.2 (23)	14.8 ± 2.0 (24)
		4.4 ± 0.7	4.4 ± 0.6	4.4 ± 0.6	4.2 ± 0.7

a: vehicle control, corn oil (2 mL/kg)
b: absolute weight
c: relative weight (mg per 100g body weight)
*: significant difference from control, $p<0.05$
**: significant difference from control, $p<0.01$

Table 15
Two generation reproductive toxicity study of BBP by oral administration in rats
Summary of histopathological findings in F0 male

Group / Grade	0 mg/kg −	±	+	++	+++	Pos.	20 mg/kg −	±	+	++	+++	Pos.	100 mg/kg −	±	+	++	+++	Pos.	500 mg/kg −	±	+	++	+++	Pos.
(Testis)	[10]						[0]						[0]						[10]					
Atrophy, seminiferous tubule, bilateral	9	1	0	0	0	1													10	0	0	0	0	0
(Epididymis)	[10]						[0]						[0]						[10]					
Cell debris, lumen, bilateral	9	1	0	0	0	1													10	0	0	0	0	0
(Prostate)	[10]						[0]						[0]						[10]					
Cellular infiltration, lymphocyte, interstitium	6	3	1	0	0	4													6	3	1	0	0	4
Cellular infiltration, lymphocyte /neutrophil, epithelium	9	1	0	0	0	1													9	1	0	0	0	1
(Seminal vesicle & coagulating gland)	[10]						[0]						[0]						[10]					
No remarkable change																								
(Liver)	[10]						[0]						[0]						[10]					
Fatty change, periportal	7	0	1	2	0	3													10	0	0	0	0	0
(Kidney)	[10]						[0]						[0]						[10]					
Eosinophilic body	3	3	3	1	0	7													5	2	2	1	0	5
Basophilic tubule, cortex	2	7	1	0	0	8													2	7	1	0	0	8
Cast, cortex/medulla	8	1	1	0	0	2													6	4	0	0	0	4
Cyst, medulla	9	1	0	0	0	1													10	0	0	0	0	0
Degeneration, vacuolar, with hyalin droplet, proximal tubular epithelium	9	0	1	0	0	1													10	0	0	0	0	0
Mineralization	7	3	0	0	0	3													10	0	0	0	0	0
(Mammary gland)	[8]						[0]						[0]						[9]					
No remarkable change																								
(Thyroid gland)	[10]						[0]						[0]						[10]					
No remarkable change																								
(Parathyroid gland)	[8]						[0]						[0]						[10]					
No remarkable change																								
(Pituitary gland)	[10]						[0]						[0]						[10]					
No remarkable change																								
(Adrenal gland)	[10]						[0]						[0]						[10]					
No remarkable change																								
(Lung)	[1]						[0]						[0]						[0]					
Mineralization, artery	0	1	0	0	0	1																		

−, Negative; ±, Very slight; +, Slight; ++, Moderate; +++, Severe; Pos., Total of positive grade
[ ], Number of animals examined

Table 16
Two generation reproductive toxicity study of BBP by oral administration in rats
Summary of histopathological findings in F0 female

Group / Grade	0 mg/kg						20 mg/kg						100 mg/kg						500 mg/kg					
	−	±	+	++	+++	Pos.	−	±	+	++	+++	Pos.	−	±	+	++	+++	Pos.	−	±	+	++	+++	Pos.
(Ovary)	[10]						[0]						[0]						[10]					
Increase, atresia, follicle	9	0	1	0	0	1													9	0	1	0	0	1
Follicular cyst	10	0	0	0	0	0													9	0	1	0	0	1
(Uterus)	[10]						[0]						[0]						[10]					
No remarkable change																								
(Vagina)	[10]						[0]						[0]						[10]					
No remarkable change																								
(Liver)	[10]						[0]						[0]						[10]					
Fibrosis, capsule & subcapsule, diaphragmatic nodule	9	0	1	0	0	1													10	0	0	0	0	0
Granulation, subcapsule, focal	9	0	1	0	0	1													10	0	0	0	0	0
(Kidney)	[10]						[0]						[0]						[10]					
Basophilic tubule, cortex	8	2	0	0	0	2													5	4	1	0	0	5
Fibrosis, focal, subcapsule	9	1	0	0	0	1													10	0	0	0	0	0
(Mammary gland)	[10]						[0]						[0]						[10]					
Adenoma	tumor= 0																		tumor= 1					
Atrophy, with cell debris, lumen, focal	9	0	1	0	0	1													10	0	0	0	0	0
Cellular infiltration, neutrophil	9	1	0	0	0	1													9	0	0	1	0	1
(Thyroid gland)	[10]						[0]						[0]						[10]					
Ectopic thymus	10	0	0	0	0	0													9	0	1	0	0	1
(Parathyroid gland)	[9]						[0]						[0]						[9]					
No remarkable change																								
(Pituitary gland)	[10]						[0]						[0]						[10]					
No remarkable change																								
(Adrenal gland)	[10]						[0]						[0]						[10]					
No remarkable change																								
(Thymus)	[2]						[0]						[0]						[0]					
No remarkable change																								

−, Negative; ±, Very slight; +, Slight; ++, Moderate; +++, Severe; Pos., Total of positive grade
[ ], Number of animals examined

Table 17

Two generation reproductive toxicity study of BBP by oral administration in rats

Epididymal sperm findings in F_0 males at 23 weeks of age; Mean±S.D. (N)

Compound	Butyl benzyl phthalate			
Dose (mg/kg)	0[a]	20	100	500
% of motile	96 ± 5 (24)	94 ± 5 (24)	94 ± 6 (25)	95 ± 4 (25)
% of progressive	83 ± 7 (24)	80 ± 10 (24)	78 ± 11 (25)	81 ± 6 (25)
Sperm counts[b]	1790.2 ± 505.3 (24)	1790.2 ± 467.3 (24)	1700.3 ± 328.5 (24)	1758.8 ± 476.2 (25)

a: vehicle control, corn oil (2 mL/kg)

b: number of sperm per caudal epidymis weight ($x10^6$/g)

Table 18

Two generation reproductive toxicity study of BBP by oral administration in rats

Serum concentrations of testosterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH), thyroid-stimulating hormone (TSH), triiodothyronine (T3), thyroxine (T4) in F_0 males; Mean±S.D. (N)

Compound	Butyl benzyl phthalate			
Dose (mg/kg)	0[a]	20	100	500
Testosterone (ng/mL)	3.5 ± 1.6 (25)	3.6 ± 1.9 (25)	2.7 ± 1.3 (25)	1.9 ± 1.1 **(25)
LH (ng/mL)	11.5 ± 5.1 (25)	8.3 ± 2.2 * (25)	8.8 ± 2.1 (25)	10.7 ± 3.9 (25)
FSH (ng/mL)	161 ± 50 (25)	167 ± 37 (25)	197 ± 55 **(25)	192 ± 33 **(25)
TSH (ng/mL)	14.8 ± 3.1 (25)	13.4 ± 2.3 (25)	13.0 ± 2.3 * (25)	13.3 ± 2.0 (25)
T3 (ng/mL)	0.9 ± 0.2 (25)	0.9 ± 0.2 (25)	0.9 ± 0.2 (25)	0.8 ± 0.1 **(24)
T4 (ng/mL)	71 ± 10 (25)	71 ± 11 (25)	68 ± 12 (25)	56 ± 9 **(25)

a: vehicle control, corn oil (2 mL/kg)
*: significant difference from control, $p<0.05$
**: significant difference from control, $p<0.01$

Table 19

Two generation reproductive toxicity study of BBP by oral administration in rats

Serum concentrations of prolactin (PRL), luteinizing hormone (LH), follicle-stimulating hormone (FSH), thyroid-stimulating hormone (TSH), triiodothyronine (T3), thyroxine (T4), estradiol in F_0 females; Mean±S.D. (N)

Compound		Butyl benzyl phthalate			
Dose (mg/kg)		0[a]	20	100	500
PRL	(ng/mL)	47.0 ± 30.0 (22)	90.0 ± 126.9 (20)	64.7 ± 97.5 (24)	82.6 ± 79.8 * (24)
LH	(ng/mL)	9.2 ± 2.0 (22)	9.0 ± 3.3 (20)	9.6 ± 3.2 (24)	16.4 ± 31.4 (24)
FSH	(ng/mL)	287 ± 81 (22)	275 ± 83 (20)	252 ± 91 (24)	290 ± 98 (24)
TSH	(ng/mL)	17.4 ± 2.8 (22)	19.5 ± 2.3 * (20)	17.5 ± 5.8 (24)	18.5 ± 3.6 (24)
T3	(ng/mL)	0.8 ± 0.1 (22)	0.9 ± 0.2 (20)	0.9 ± 0.2 (24)	0.9 ± 0.2 (24)
T4	(ng/mL)	56 ± 13 (22)	53 ± 8 (20)	47 ± 7 (24)	44 ± 10 **(24)
Estradiol	(pg/mL)	17.4 ± 10.9 (8)	11.7 ± 7.8 (5)	10.5 ± 5.5 (8)	22.5 ± 13.1 (9)

a: vehicle control, corn oil (2 mL/kg)
*: significant difference from control, $p<0.05$
**: significant difference from control, $p<0.01$

Table 20

Two generation reproductive toxicity study of BBP by oral administration in rats

Development F_1 offspring up to weaning; Mean±S.D. (N)

Compound	Butyl benzyl phthalate			
Dose (mg/kg)	0[a]	20	100	500
Gestation period; days	21.9 ± 0.3 (22)	22.0 ± 0.0 (20)	21.7 ± 0.4 (23)	22.0 ± 0.2 (24)
Implantations	14.3 ± 3.1 (22)	15.1 ± 2.1 (20)	15.9 ± 1.6 (23)	15.2 ± 2.5 (24)
Delivery index; dam A)	100.0	100.0	100.0	100.0
Day 0				
Fetuses delivered	13.3 ± 3.3 (22)	14.0 ± 2.4 (20)	15.1 ± 1.6 (23)	14.3 ± 2.6 (24)
Delivery index; fetuses B)	93.0 ± 8.9 (22)	92.8 ± 9.6 (20)	95.4 ± 5.7 (23)	94.0 ± 6.7 (24)
Live newborns	13.1 ± 3.3 (22)	13.9 ± 2.6 (20)	14.9 ± 1.7 (23)	14.0 ± 2.5 (24)
Birth index C)	91.3 ± 9.4 (22)	91.9 ± 10.0 (20)	93.8 ± 7.4 (23)	92.7 ± 6.8 (24)
Viability index D)	98.2 ± 4.1 (22)	99.0 ± 2.9 (20)	98.2 ± 3.8 (23)	98.6 ± 2.8 (24)
Day 4				
Live offspring	13.1 ± 3.3 (22)	13.7 ± 2.6 (20)	14.8 ± 1.7 (23)	13.5 ± 2.4 (24)
Viability index E)	100.0 ± 0.0 (22)	99.0 ± 2.6 (20)	99.5 ± 1.7 (23)	96.7 ± 4.8 **(24)
Offspring after culling	7.8 ± 0.9 (22)	8.0 ± 0.0 (20)	8.0 ± 0.0 (23)	7.9 ± 0.4 (24)
Males	3.9 ± 0.9	3.8 ± 0.9	4.1 ± 0.3	4.0 ± 0.2
Females	3.9 ± 0.8	4.2 ± 0.9	3.9 ± 0.3	4.0 ± 0.5
Day 21				
Live offspring	7.7 ± 0.9 (22)	8.0 ± 0.0 (20)	8.0 ± 0.0 (23)	7.9 ± 0.4 (24)
Males	3.9 ± 0.9	3.8 ± 0.9	4.1 ± 0.3	4.0 ± 0.2
Females	3.9 ± 0.8	4.2 ± 0.9	3.9 ± 0.3	4.0 ± 0.5
Weaning index F)	99.4 ± 2.7 (22)	100.0 ± 0.0 (20)	100.0 ± 0.0 (23)	100.0 ± 0.0 (24)

A): Delivery index; dams = (no. of dams having live newborns / no. of pregnant females) x 100
B): Delivery index; fetuses = (no. of fetuses delivered / no. of implantations) x 100
C): Birth index = (no. of live newborns / no. of implantatios) x 100
D): Viability index; Day 0 = (no. of live newborns / no. of offspring delivered) x 100
E): Viability index; Day 4 = (no. of live offspring on day 4 / no. of offspring on day 0) x 100
F): Weaning index = (no. of live offspring at weaning / no. of live offspring on day 4) x 100
a: vehicle control, corn oil (2 mL/kg)
**:Significant difference from control, $p<0.01$

Table 21

Two generation reproductive toxicity study of BBP by oral administration in rats

Body weight of F_1 offspring up to weaning; Mean±S.D. (Litter)

Compound	Butyl benzyl phthalate			
Dose (mg/kg)	0[a]	20	100	500
Day 0				
Male	6.8 ± 0.5 (22)	6.8 ± 0.4 (20)	6.4 ± 0.4 * (23)	6.3 ± 0.4 **(24)
Female	6.4 ± 0.5 (22)	6.5 ± 0.4 (20)	6.0 ± 0.3 **(23)	6.0 ± 0.4 **(24)
Day 4 (After culling)				
Male	10.9 ± 1.5 (22)	11.2 ± 1.3 (20)	10.4 ± 1.1 (23)	10.2 ± 1.4 (24)
Female	10.4 ± 1.4 (22)	10.7 ± 1.2 (20)	9.8 ± 0.9 (23)	9.8 ± 1.3 (24)
Day 7				
Male	18.1 ± 1.8 (22)	18.4 ± 1.4 (20)	17.6 ± 1.4 (23)	17.1 ± 1.7 (24)
Female	17.4 ± 1.9 (22)	17.6 ± 1.4 (20)	16.5 ± 1.1 (23)	16.3 ± 1.7 (24)
Day 14				
Male	36.6 ± 2.7 (22)	36.7 ± 2.1 (20)	36.1 ± 2.3 (23)	33.8 ± 2.7 **(24)
Female	35.4 ± 2.5 (22)	35.6 ± 2.1 (20)	34.3 ± 2.0 (23)	32.7 ± 2.4 **(24)
Day 21				
Male	59.0 ± 4.3 (22)	59.8 ± 3.1 (20)	58.7 ± 4.1 (23)	54.9 ± 4.5 **(24)
Female	56.6 ± 3.2 (22)	57.1 ± 2.9 (20)	55.6 ± 3.7 (23)	52.4 ± 4.0 **(24)

a: vehicle control, corn oil (2 mL/kg)

*: significant difference from control, $p<0.05$

**: significant difference from control, $p<0.01$

Table 22

Two generation reproductive toxicity study of BBP by oral administration in rats

Anogenital distance of F_1 pups at birth; Mean±S.D. (Litter)

Compound	Butyl benzyl phthalate			
Dose (mg/kg)	0[a]	20	100	500
Male				
Anogenital distance (mm)	2.6 ± 0.2 (22)	2.6 ± 0.2 (20)	2.5 ± 0.1 (23)	2.4 ± 0.3 **(24)
Body weight (g)	6.7 ± 0.5 (22)	6.8 ± 0.5 (20)	6.4 ± 0.4 * (23)	6.3 ± 0.4 **(24)
Female				
Anogenital distance (mm)	1.2 ± 0.1 (22)	1.1 ± 0.1 (20)	1.2 ± 0.1 (23)	1.2 ± 0.1 * (24)
Body weight (g)	6.3 ± 0.5 (22)	6.4 ± 0.4 (20)	6.0 ± 0.4 * (23)	5.9 ± 0.4 **(24)

a: vehicle control, corn oil (2 mL/kg)
*: significant difference from control, $p<0.05$
**: significant difference from control, $p<0.01$

Table 23

Two generation reproductive toxicity study of BBP by oral administration in rats

Behavioral and physical development F_1 males offspring; Mean±S.D. (Litter)

Compound	Butyl benzyl phthalate			
Dose (mg/kg)	0[a]	20	100	500
Behavioral development (days)				
Righting reflex	3.3 ± 1.1 (19)	3.2 ± 0.9 (19)	3.8 ± 1.4 (23)	2.8 ± 0.8 (24)
Cliff drop aversion response	6.3 ± 1.2 (19)	6.2 ± 0.8 (19)	7.9 ± 1.0 **(23)	6.6 ± 0.9 (24)
Negative geotaxis	12.4 ± 1.1 (19)	11.6 ± 1.0 (19)	12.8 ± 1.3 (23)	12.7 ± 1.3 (24)
Physical development (days)				
Upper tooth eruption	10.2 ± 0.7 (19)	9.7 ± 0.7 (19)	9.9 ± 0.7 (23)	9.5 ± 1.0 **(24)
Ear opening	13.2 ± 0.7 (19)	12.3 ± 0.4 **(19)	12.5 ± 0.6 **(23)	12.8 ± 0.6 (24)
Eyelid opening	15.0 ± 0.8 (19)	14.3 ± 0.5 **(19)	14.9 ± 0.6 (23)	14.6 ± 0.7 (24)

a: vehicle control, corn oil (2 mL/kg)

**: significant difference from control, $p<0.01$

Table 24

Two generation reproductive toxicity study of BBP by oral administration in rats

Behavioral and physical development F_1 females offspring; Mean±S.D. (Litter)

Compound	Butyl benzyl phthalate			
Dose (mg/kg)	0[a]	20	100	500
Behavioral development (days)				
Righting reflex	4.0 ± 1.3 (21)	3.8 ± 1.0 (19)	4.1 ± 1.4 (23)	3.2 ± 0.9 (23)
Cliff drop aversion response	6.8 ± 1.2 (21)	6.3 ± 0.8 (19)	7.5 ± 1.2 (23)	6.6 ± 0.9 (23)
Negative geotaxis	12.4 ± 1.1 (21)	11.7 ± 1.0 (19)	12.6 ± 1.1 (23)	12.7 ± 1.1 (23)
Physical development (days)				
Upper tooth eruption	10.0 ± 0.9 (21)	9.7 ± 0.8 (19)	9.9 ± 0.8 (23)	9.5 ± 0.9 (23)
Ear opening	13.0 ± 0.9 (21)	12.3 ± 0.5 **(19)	12.4 ± 0.7 **(23)	12.7 ± 0.6 (23)
Eyelid opening	14.7 ± 0.8 (21)	14.2 ± 0.5 * (19)	14.8 ± 0.7 (23)	14.6 ± 0.6 (23)

a: vehicle control, corn oil (2 mL/kg)

*: significant difference from control, $p<0.05$

**: significant difference from control, $p<0.01$

Table 25

Two generation reproductive toxicity study of BBP by oral administration in rats

Morphological observations of F_1 live pups at birth

Compound	Butyl benzyl phthalate			
Dose (mg/kg)	0[a]	20	100	500
Number of live pups examined	288	277	342	337
External abnormalities				
Number of pups	0	0	1	0
Types and number				
Anasarca	0	0	1	0

a: vehicle control, corn oil (2 mL/kg)

Table 26

Two generation reproductive toxicity study of BBP by oral administration in rats

Morphological observations of F_1 dead pups during lactation period

Compound	Butyl benzyl phthalate			
Dose (mg/kg)	0[a]	20	100	500
Number of dead pups[b]	6	5	8	17
Number of dead pups collected	5	3	6	7
External abnormalities				
Number of pups	0	0	0	0
Visceral abnormalities				
Number of pups	0	0	0	0

a: vehicle control, corn oil (2 mL/kg)
b: including missing pups