



Figure S1. Group size affected neurochemical mRNA expression in the brains of male Brandt's voles in a brain-region-specific manner (no significant differences in post hoc tests). Figure S1a) The mRNA expression of *Htr1a* in the Arc area was significantly different among the three groups, but the multiple comparison was not significantly different. Figure S1b) The mRNA expression of *GnRH* in the MeA area was different among the three groups, but did not reveal a significant difference between the three groups post hoc. The mRNA expression of *GnRH* in the Arc area was significantly different among the three groups, but did not reveal significant difference between the three groups post hoc. Figure S1c) The mRNA expression of *Rfrp* in the MeA area was significantly different among the three groups, but did not reveal a significant difference between the three groups post hoc.

Table S1. The final sample size in the three groups

Group	Replicate code	Number of Males	Number of Females	Total number
Small-sized group	1	1	1	2
	2	1	1	2
	3	1	1	2
	4	1	1	2
	5	1	1	2
	6	1	1	2
	7	1	1	2
	8	1	1	2
	9	1	1	2
	10	1	1	2
	11	1	1	2
	12	1	1	2
Medium-sized group	1	1	1	2
	2	2	2	4
	3	3	1	4
	4	4	0	4
	5	3	1	4
	6	2	2	4
Large-sized group	1	2	3	5
	2	1	1	2
	3	4	3	7

Table S2. Impacts of group size on mRNA expression of Brandt's voles (No significance)

Brain area	Gene	$F_{2,19}$	P
DMH	<i>POMC</i>	3.264	0.089
	<i>OT</i>	0.211	0.812
	<i>Esr1</i>	1.657	0.217
	<i>Kiss1</i>	0.563	0.613
AHA	<i>POMC</i>	0.133	0.876
	<i>OT</i>	1.170	0.332
	<i>Esr1</i>	0.374	0.693
	<i>Kiss1</i>	0.943	0.407
MeA	<i>POMC</i>	1.238	0.312
	<i>OT</i>	0.264	0.771
	<i>Esr1</i>	1.535	0.241
	<i>Kiss1</i>	0.749	0.507
MPOA	<i>POMC</i>	0.135	0.876
	<i>OT</i>	0.485	0.632
	<i>Esr1</i>	0.949	0.405
	<i>Kiss1</i>	1.546	0.263
Arc	<i>POMC</i>	1.158	0.335
	<i>OT</i>	0.277	0.761
	<i>Esr1</i>	0.377	0.695

	<i>Kiss1</i>	2.364	0.121
PVN	<i>POMC</i>	1.822	0.189
	<i>OT</i>	0.342	0.718
	<i>Esr1</i>	1.451	0.259
	<i>Kiss1</i>	1.570	0.234

Table S3. The Spearman correlation between the final group size and mRNA expression of all genes in male brains, and the relationship between the final density and mRNA expression of all genes in male brains.

Genes	Final group size	Final Density
<i>CRH</i>	NS	Arc + ($r=0.545$, $P=0.011$)
<i>POMC</i>	NS	NS
<i>AVP</i>	NS	MeA + ($r=0.471$, $P=0.031$)
<i>OT</i>	NS	NS
<i>Htr1a</i>	Arc - ($r=-0.574$, $P=0.007$)	NS
<i>GnRH</i>	MeA + ($r=0.596$, $P=0.004$)	NS
<i>Kiss1</i>	NS	MPOA - ($r=-0.457$, $P=0.037$)
<i>Rfrp</i>	MeA + ($r=0.590$, $P=0.005$)	MPOA - ($r=-0.597$, $P=0.004$)
<i>Ar</i>	DMH - ($r=-0.438$, $P=0.047$)	DMH + ($r=0.565$, $P=0.008$)
	MeA + ($r=0.481$, $P=0.027$)	
<i>Esr1</i>	NS	NS

NS means there is no significance.