



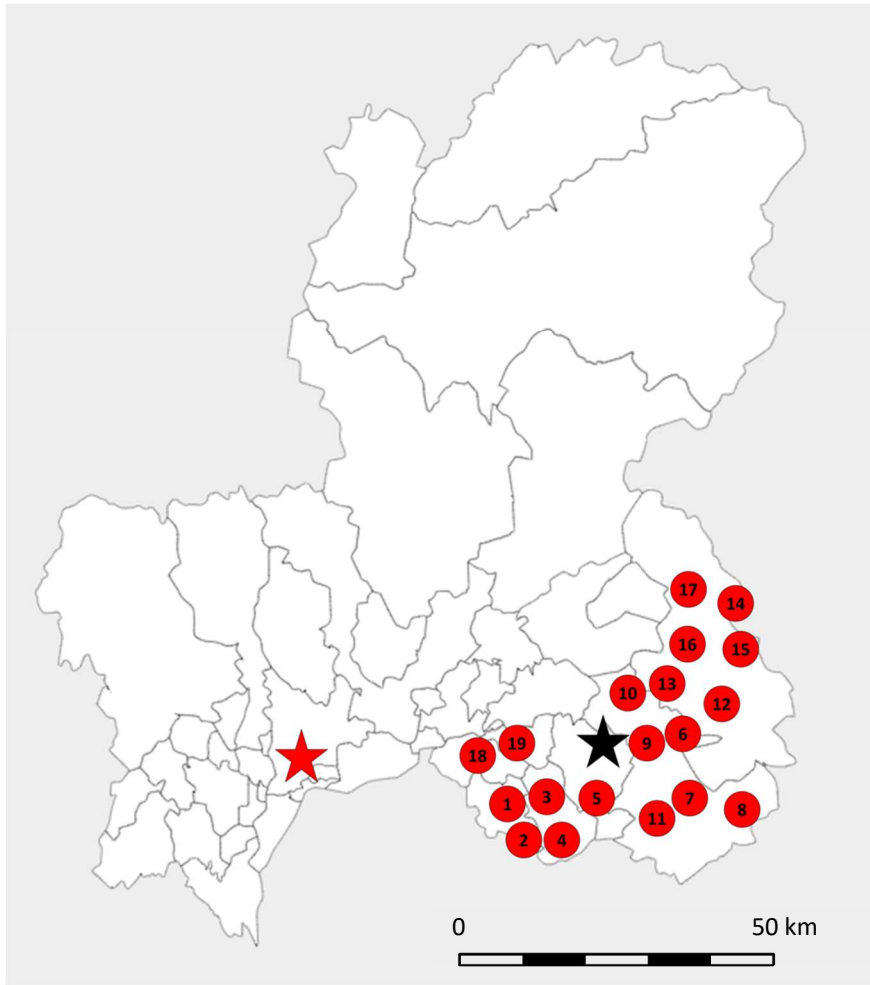
*Supplement of*

**Reconstruction of drought and long-rain chronologies since the 17th century in central Japan using intra-annual tree-ring oxygen isotope ratios and documentary records**

**Hiroto Iizuka et al.**

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5 Fig. S1 Map of Gifu Prefecture showing the location of the municipalities of the Town/City histories used in this study (red solid circles) together with the location of the sample tree (black star) and the meteorological station (red star). The numbers within the red circles link to the numbers in Table S1. We collected 20 Town/City histories, 19 of which were issued by municipalities in the vicinity of the sampling site and one by Gifu Prefecture.

10

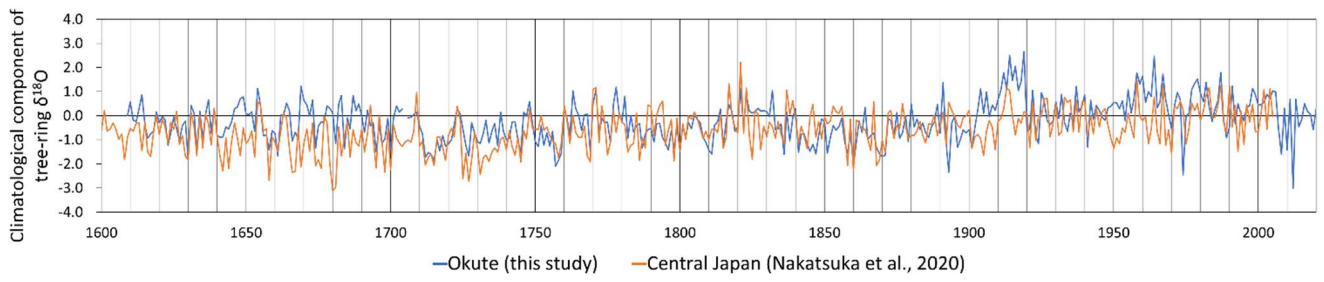
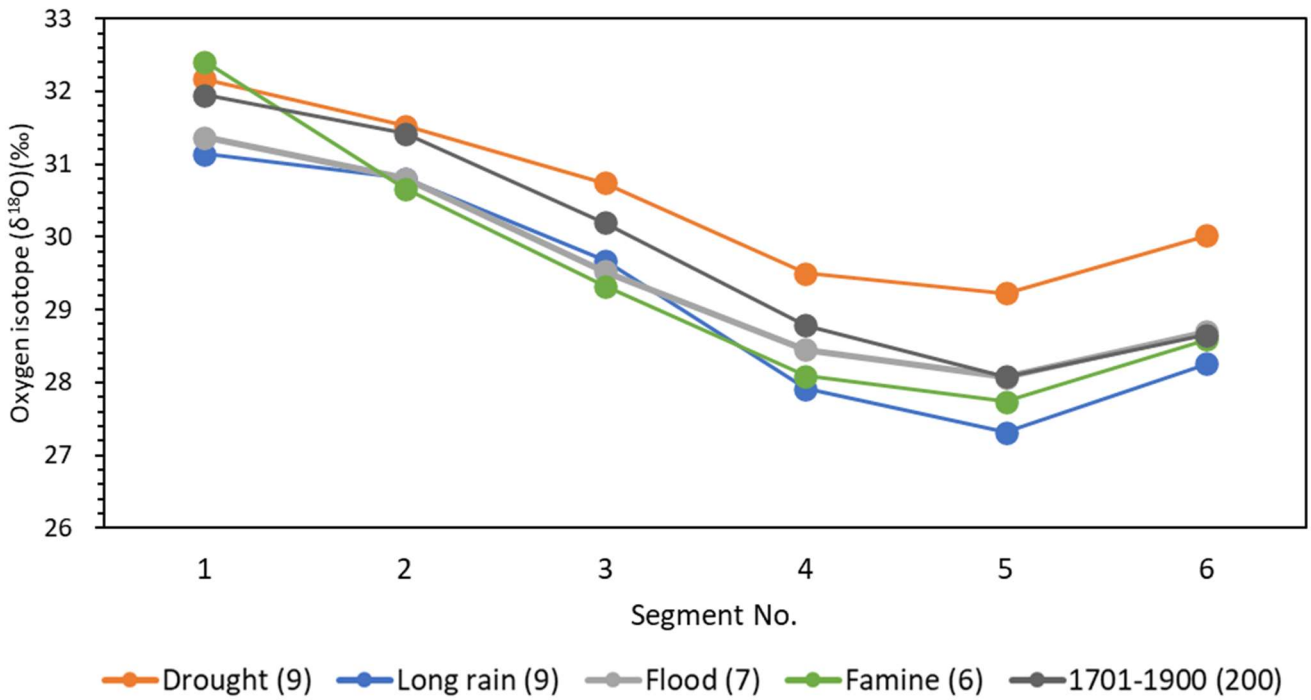


Fig. S2 Time-series graph of the climatological component of annual-averaged tree-ring  $\delta^{18}\text{O}$  of the sample tree of this study (blue line) and the central Japan master chronology (Nakatsuka et al., 2020, orange line)



15 Fig. S3 Intra-ring  $\delta^{18}\text{O}$  variation by disaster types. The mean values of  $\delta^{18}\text{O}$  for the four types of disaster years and all years for the 1701–1900 period are indicated by solid dots. Numbers in the parentheses in the legend indicate the number of years belonging to each disaster type. Years of each disaster type were extracted as years for which the disaster description is found in  $\geq 3$  titles of Town/City history.

20 Table S1 List of Town/City histories used in this study.

No.	Title	North longitude	East latitude	Year of publication
1	Tajimi City history	35° 20'	137° 08'	1980
2	Kasahara Town history	35° 18'	137° 10'	1993
3	Toki City history	35° 21'	137° 11'	1971
4	Tumaki Village history	35° 19'	137° 11'	1931
5	Mizunami City history	35° 22'	137° 15'	1974
6	Ena City history	35° 27'	137° 25'	1989
7	Iwamura Town history	35° 22'	137° 26'	1961
8	Kamiyahagi Town history	35° 18'	137° 30'	2008
9	Takenami Town history	35° 27'	137° 20'	1993
10	Nakanoho Town history	35° 31'	137° 18'	1968
11	Yamaoka Town history	35° 21'	137° 23'	1984
12	Nakatsugawa City history	35° 29'	137° 30'	1988
13	Hirukawa Village history	35° 31'	137° 23'	1974
14	Kawakami Village history	35° 37'	137° 30'	1983
15	Sakashita Town history	35° 34'	137° 32'	2005
16	Fukuoka Town history	35° 34'	137° 27'	1992
17	Tukechi Town history	35° 40'	137° 26'	1974
18	Kani City history	35° 26'	137° 04'	2010
19	Mitake Town history	35° 26'	137° 08'	1992
20	Gifu Prefecture disaster history	35° 26'	136° 46'	1996

Table S2 Total number of disaster descriptions in a total of twenty titles of Town/City history in the Tono area for each of eight disaster types for each year in 1601–1900.

25

	Long rain	Drought	Flood	Heavy rain	Poor harvest	Famine	Heavy wind	Insect damage
1601	0	0	0	0	0	0	0	0
1602	0	0	0	0	0	0	0	0
1603	0	0	0	0	0	0	0	0
1604	0	0	0	0	0	0	0	0
1605	0	0	0	0	0	0	0	0
1606	0	0	0	0	0	0	0	0
1607	0	0	0	0	0	0	0	0
1608	0	0	1	0	0	0	0	0
1609	0	0	0	0	0	0	0	0
1610	0	0	2	0	0	0	0	0
1611	0	0	0	0	0	0	0	0
1612	0	0	0	0	0	0	0	0
1613	0	0	0	0	0	0	0	0
1614	0	0	1	0	0	0	0	0
1615	0	0	0	0	1	1	0	0
1616	0	0	0	0	0	0	0	0
1617	0	0	1	0	1	0	0	0
1618	0	0	0	0	0	0	0	0
1619	0	0	0	0	0	0	0	0
1620	1	0	0	0	0	1	0	0
1621	0	0	0	0	0	0	0	0
1622	0	0	0	0	1	0	0	0
1623	0	0	0	0	0	0	0	0
1624	0	0	0	0	0	0	0	0
1625	0	0	0	0	0	0	0	0
1626	0	0	0	0	0	0	0	0
1627	0	1	0	0	0	0	0	0
1628	0	0	0	0	0	0	0	0
1629	0	0	2	0	0	0	0	0
1630	0	0	0	0	0	1	0	0
1631	0	0	0	0	0	1	0	0
1632	0	0	0	0	0	0	0	0
1633	0	0	0	0	0	0	0	0
1634	0	0	0	0	0	0	0	0
1635	0	0	0	0	0	0	0	0
1636	0	0	0	0	0	0	0	0
1637	0	0	0	0	0	0	0	0
1638	0	0	1	0	0	0	0	0
1639	0	0	0	0	0	0	0	0
1640	0	0	0	0	1	1	0	0
1641	0	5	0	0	0	1	0	0
1642	1	0	0	0	2	6	0	0
1643	0	0	0	0	0	0	0	0
1644	0	0	0	0	0	0	0	0
1645	0	0	0	0	0	0	0	0
1646	0	0	0	0	0	0	0	0
1647	0	0	0	0	0	0	0	0
1648	0	0	1	1	0	0	0	0
1649	0	0	0	0	0	0	0	0
1650	0	0	5	0	0	0	0	0
1651	0	0	0	0	0	0	0	0
1652	0	0	0	0	0	0	0	0
1653	0	0	0	0	0	0	0	0
1654	0	0	0	0	0	0	0	0
1655	0	0	0	0	0	0	0	0
1656	0	0	1	0	0	0	0	0

1657	0	0	0	0	0	0	0	0
1658	0	0	0	0	0	0	0	0
1659	0	0	0	0	0	0	0	0
1660	0	0	1	0	0	0	0	0
1661	0	0	1	0	0	0	0	0
1662	0	0	0	0	0	0	0	0
1663	0	4	0	0	0	1	0	0
1664	0	0	0	0	0	0	0	0
1665	1	0	2	0	0	0	0	0
1666	0	0	1	0	0	0	0	0
1667	0	0	0	0	0	0	0	0
1668	0	1	1	0	0	0	0	0
1669	0	0	0	0	0	0	0	0
1670	0	0	0	0	0	0	0	0
1671	0	0	0	0	0	0	0	0
1672	0	0	0	0	0	0	0	0
1673	0	0	0	0	0	1	0	0
1674	0	1	1	0	1	1	0	0
1675	1	0	0	0	1	5	0	0
1676	0	0	0	1	0	0	0	0
1677	0	0	0	0	0	0	0	0
1678	0	0	2	0	0	0	0	0
1679	0	0	0	0	0	0	0	0
1680	1	0	2	1	0	0	0	3
1681	0	0	0	0	1	2	0	0
1682	0	0	0	0	0	1	0	0
1683	0	0	0	0	0	0	0	0
1684	0	1	0	0	0	0	0	0
1685	0	0	1	0	0	0	0	0
1686	0	0	0	0	0	0	0	0
1687	0	0	3	0	0	0	0	0
1688	0	0	0	0	0	0	0	0
1689	0	0	2	0	0	0	0	0
1690	0	0	0	0	0	0	0	0
1691	0	0	1	0	1	1	0	0
1692	0	0	1	0	0	0	0	0
1693	0	1	0	0	0	0	0	0
1694	0	0	0	0	0	0	0	0
1695	0	0	0	0	0	0	0	0
1696	0	0	0	0	0	0	0	0
1697	0	0	0	0	0	0	0	0
1698	0	0	1	0	0	0	0	0
1699	0	0	1	0	0	0	0	0
1700	1	0	0	0	0	0	0	0
1701	0	0	1	0	0	0	0	0
1702	0	0	0	0	0	0	0	0
1703	0	0	0	0	1	0	0	0
1704	0	0	0	0	0	0	0	0
1705	0	0	0	0	0	0	0	0
1706	0	0	0	0	0	0	0	0
1707	0	0	0	0	0	0	0	0
1708	0	0	0	0	0	0	0	0
1709	0	1	0	0	0	0	0	0
1710	0	1	0	0	0	0	0	0
1711	0	0	0	0	0	0	0	0
1712	0	0	0	0	0	0	0	0
1713	0	0	4	0	0	0	0	0
1714	0	0	0	0	0	0	0	0
1715	0	0	2	0	0	0	0	0
1716	0	0	2	0	1	0	0	0
1717	0	0	0	0	0	0	0	0
1718	0	2	0	0	0	0	0	0

1719	0	0	0	0	0	0	0	0
1720	0	0	0	0	0	0	0	0
1721	0	0	0	0	0	0	0	0
1722	0	0	0	0	0	0	0	0
1723	0	0	1	1	0	0	0	0
1724	0	1	1	0	0	0	0	0
1725	0	1	1	0	0	0	0	0
1726	0	0	0	0	0	0	0	0
1727	0	0	0	0	0	0	0	0
1728	1	0	0	0	2	0	0	0
1729	0	0	0	0	0	0	0	0
1730	0	0	0	0	1	0	0	0
1731	0	0	2	0	1	1	0	0
1732	1	0	0	0	1	2	0	2
1733	0	0	0	1	0	2	0	0
1734	0	0	0	0	0	0	0	0
1735	0	0	0	0	0	0	0	0
1736	0	0	1	0	0	0	0	0
1737	0	0	0	0	0	0	0	0
1738	1	0	0	0	0	0	0	0
1739	0	0	0	0	0	0	0	0
1740	0	0	0	0	0	0	1	0
1741	0	0	1	0	0	0	0	0
1742	0	0	1	0	0	0	0	0
1743	0	0	0	0	0	0	0	0
1744	0	1	0	0	0	0	0	0
1745	0	1	0	0	1	0	0	0
1746	0	0	0	0	0	0	0	0
1747	0	1	0	0	0	0	0	0
1748	0	0	0	0	0	0	0	0
1749	0	0	0	0	0	0	0	0
1750	0	0	0	0	1	0	0	0
1751	0	0	2	1	0	0	0	0
1752	0	0	0	1	0	0	0	0
1753	0	0	1	0	0	0	0	0
1754	0	0	1	0	0	0	0	0
1755	0	0	0	0	0	0	0	0
1756	0	0	1	0	0	0	0	0
1757	0	0	4	2	0	0	0	0
1758	0	2	0	1	1	0	0	0
1759	0	0	0	0	0	1	0	0
1760	0	0	0	0	0	0	0	0
1761	0	1	0	0	0	0	0	0
1762	0	2	0	0	0	1	0	0
1763	0	0	0	1	0	0	0	0
1764	0	0	0	0	0	0	0	0
1765	0	2	2	0	0	1	1	0
1766	0	0	1	0	0	0	0	0
1767	0	2	1	0	0	0	0	0
1768	0	2	0	0	0	0	0	0
1769	0	0	0	0	0	1	0	0
1770	0	8	0	0	0	1	0	0
1771	0	3	0	0	0	0	0	0
1772	0	1	0	0	1	0	0	0
1773	0	0	0	0	0	0	0	0
1774	0	0	0	0	0	0	0	0
1775	0	0	1	0	1	0	0	0
1776	0	1	1	0	0	0	0	0
1777	0	0	0	0	0	0	0	0
1778	0	1	0	0	0	0	0	0
1779	0	0	2	0	0	0	0	0
1780	0	1	0	0	0	0	0	0



1781	3	0	0	0	0	0	0	0
1782	5	0	0	1	0	0	0	0
1783	3	0	0	0	2	2	0	0
1784	0	1	1	0	3	5	0	0
1785	0	2	0	0	0	0	0	0
1786	8	0	1	0	6	3	1	0
1787	3	0	0	1	6	2	0	0
1788	0	0	0	0	2	0	0	0
1789	2	0	2	0	2	0	0	0
1790	0	4	1	0	0	0	0	0
1791	0	1	0	0	1	0	0	0
1792	1	0	1	1	0	0	1	0
1793	0	1	0	1	0	0	0	0
1794	0	4	1	0	0	0	0	0
1795	0	0	0	1	0	0	0	0
1796	0	0	0	0	1	0	0	0
1797	0	4	0	0	0	0	0	0
1798	0	0	3	1	0	1	0	0
1799	0	1	0	0	0	0	0	0
1800	3	0	0	0	0	0	0	0
1801	0	0	0	0	0	0	0	0
1802	0	0	0	0	0	0	1	0
1803	0	0	0	0	0	0	0	0
1804	0	0	2	0	0	0	0	0
1805	0	3	0	0	0	0	0	0
1806	0	0	0	0	1	0	0	0
1807	0	0	0	0	1	0	2	1
1808	1	0	1	1	0	0	0	0
1809	0	1	0	0	0	0	0	0
1810	0	0	0	0	0	0	0	0
1811	0	0	0	0	0	0	0	0
1812	0	0	0	0	0	0	0	0
1813	0	1	0	0	0	0	0	0
1814	0	1	0	1	0	1	0	0
1815	0	0	2	0	0	0	0	0
1816	0	0	0	1	1	0	0	0
1817	0	2	0	0	0	0	0	1
1818	0	4	0	0	0	0	0	0
1819	0	0	0	0	0	0	0	0
1820	0	0	0	0	0	0	0	0
1821	0	2	0	0	1	0	1	0
1822	0	1	1	2	0	0	0	0
1823	0	1	0	1	0	0	1	0
1824	0	0	0	0	0	0	0	0
1825	1	0	0	0	2	0	0	3
1826	0	0	0	1	0	0	0	0
1827	0	1	0	0	0	0	0	0
1828	0	0	0	1	0	0	0	0
1829	1	0	0	0	0	0	0	0
1830	0	0	0	0	0	1	0	0
1831	0	0	0	0	1	0	0	0
1832	0	4	0	0	4	2	0	0
1833	2	1	0	0	2	4	0	1
1834	0	0	0	0	2	3	0	0
1835	2	0	1	0	3	1	0	0
1836	5	0	0	0	6	7	1	3
1837	0	1	2	0	0	3	6	0
1838	0	1	0	0	1	0	0	0
1839	0	1	0	0	1	0	0	1
1840	0	1	0	1	0	0	0	0
1841	0	1	1	0	2	1	0	1
1842	0	0	1	0	0	0	0	0

1843	0	0	0	0	0	0	1	0
1844	0	1	0	0	0	0	0	0
1845	0	0	0	0	0	0	0	0
1846	0	0	0	0	0	0	0	0
1847	0	0	0	0	0	0	0	0
1848	0	1	2	0	0	0	0	0
1849	0	0	0	0	0	0	0	0
1850	0	0	3	0	1	1	2	0
1851	0	2	1	1	0	0	0	0
1852	0	2	0	1	0	0	0	0
1853	0	5	0	0	0	0	0	0
1854	0	0	3	0	1	1	0	0
1855	1	1	3	1	1	0	1	0
1856	0	2	0	3	1	0	0	0
1857	0	0	2	1	0	0	0	0
1858	0	0	1	0	0	0	0	1
1859	0	0	0	0	0	0	0	0
1860	3	0	2	0	2	0	2	0
1861	0	1	1	0	0	1	0	0
1862	0	0	1	0	0	0	0	0
1863	0	1	0	0	0	0	0	0
1864	0	0	1	1	0	0	0	0
1865	2	0	3	1	1	0	0	0
1866	3	1	1	0	3	1	1	0
1867	0	1	0	0	0	1	0	0
1868	1	0	1	0	1	0	0	0
1869	0	0	1	0	1	1	0	0
1870	0	0	1	0	0	0	1	0
1871	0	0	0	0	0	0	1	0
1872	0	0	0	0	0	0	0	0
1873	0	0	0	0	0	0	0	0
1874	0	0	0	0	0	0	0	0
1875	0	0	0	0	0	0	0	0
1876	0	0	0	0	0	0	0	0
1877	0	0	0	0	0	0	0	0
1878	0	0	0	0	0	0	0	0
1879	0	0	1	0	0	0	0	0
1880	0	0	0	0	0	0	0	0
1881	0	1	0	0	0	0	0	0
1882	0	0	1	0	0	0	0	0
1883	0	0	0	0	0	0	0	0
1884	0	0	2	0	0	0	0	0
1885	0	0	0	0	0	0	0	0
1886	0	0	0	0	0	0	0	0
1887	0	0	0	0	0	0	0	0
1888	0	0	0	0	0	0	0	0
1889	0	0	0	0	0	0	0	0
1890	0	0	0	0	0	0	0	0
1891	0	0	1	0	0	0	0	0
1892	0	0	1	0	0	0	0	0
1893	0	0	1	0	0	0	0	0
1894	0	0	0	0	0	0	0	0
1895	0	0	0	0	0	0	0	0
1896	0	0	1	1	0	0	0	0
1897	0	0	1	0	0	0	0	0
1898	0	0	1	0	0	0	0	0
1899	0	0	0	0	0	0	0	0
1900	0	0	0	0	0	0	0	0

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30 Table S3 Mean numbers of days and the mean precipitation of Baiu duration for drought/long-rain years extracted by disaster records in the Town/City histories together with the number of disaster years extracted (n) and the significance level (p-value) of the difference between the mean values for disaster years and all years in the analyzed period.

Number of disaster descriptions	The mean number of days (37, 1751–1900)				The mean precipitation (mm) (351, 1701–1900)			
	≥ 1	≥ 2	≥ 3	≥ 4	≥ 1	≥ 2	≥ 3	≥ 4
Drought	35 (n=49) (p>0.05)	32 (n=20) (p>0.05)	27 (n=9) (p<0.01)	27 (n=7) (p<0.05)	315 (n=57) (p>0.05)	265 (n=21) (p<0.05)	193 (n=9) (p<0.001)	193 (n=7) (p<0.01)
Long rain	42 (n=19) (p>0.05)	45 (n=13) (p<0.05)	48 (n=9) (p<0.001)	51 (n=3) (p<0.05)	475 (n=22) (p<0.01)	473 (n=13) (p<0.01)	492 (n=9) (p<0.01)	645 (n=3) (p<0.05)