Extremely high fertility of a sedentarized Bedouin clan in south Jordan: a genealogical-demographic approach to long-term change

Shuji SUEYOSHI1*, Ryutaro OHTSUKA2

1Graduate School of International Development and Cooperation, Kibi International University, Okayama 716-8508, Japan
2National Institute for Environmental Studies, Tsukuba 305-8506, Japan

Abstract A Bedouin-origin clan with extremely high fertility in south Jordan sedentarized in a village in 1948. In this paper, based on our genealogical-demographic data collected from this clan, we elucidate the long-term demographic change that this clan has undergone. Our results highlight differences in fertility indicators among the early (1950–1969), middle (1970–1989), and late (1990–2004) periods. In particular, the total marital fertility rate (TMFR) was 4.756, 9.852, and 9.146, respectively, and the total fertility rate (TFR) was 3.589, 7.214, and 5.189, respectively. Taking age-specific indicators into account, the increase in TFR or TMFR from the early to the middle periods was attributable to increased rates of childbirth among middle-aged and older women, presumably associated with improvements in maternal nutrition and increased demand for children as agriculture labor, while the decrease in TFR from the middle to the late periods was caused by a delay in females’ age at marriage and an increase in the number of unmarried females. The fertility of this clan has been high, especially in the late period, and it is estimated that its population will double by 2030, implying the urgent necessity to reduce fertility to prevent overpopulation that threatens the people’s subsistence adaptation.

Key words: genealogical demography, population growth, Bedouin, sedentarization, south Jordan

Introduction

Pastoral nomads worldwide have been undergoing a rapid transition from nomadism to sedentarism since the early 20th century. This transition has been caused by various factors, including population increase, deterioration of pasture land, necessity of dependency on agriculture and demand for modern conveniences as well as political intervention (Shamekh, 1977; Ginguld et al., 1997; Fratkin et al., 2004). This transition has been accompanied by drastic changes in daily life. Furthermore, these lifestyle changes have affected population dynamics, or fertility and mortality. Reviewing many reports of nomadic, semi-nomadic, and sedentarized populations in north Africa and the Middle East, Meir (1987) emphasized that mortality has decreased among sedentarized groups as a result of increased accessibility to medical services, and consequently their populations have increased rapidly; however, little attention has been paid to changes in fertility and their effect on population. The basic reason of neglecting fertility may be due to the lack of historical documents among pastoral populations.

The vast arid area of the Middle East is inhabited by Arabic-speaking people who have a long history of developing nomadic pastoralism, relying on livestock animals such as goats and sheep; these people are generically known as Bedouin. Similar to many other nomadic pastoralists, the Bedouins have been experiencing a lifestyle change from nomadism to sedentarism. In Jordan, like other Arab countries, nomadic Bedouins formed a majority in the past, but their numbers have gradually decreased since many have sedentarized as a result of droughts that affected their pasture land and government policy promoting their settlement (Lewis, 1987; Bocco, 2000). Consequently, the proportion of Bedouins (which refers only to nomadic Bedouins in Jordanian government documents) in the total Jordanian population was 46% in the 1920s and decreased to 35% in the 1940s and to only 10% in the early 1990s (Yousef, 1992; Massad, 2001), suggesting that the sedentarization of Bedouins has played a significant role in the nation-level demographic change of Jordan and, perhaps, its neighboring Arab countries.

The authors have conducted human ecological and micro-demographic research in a rural area of South Ghor district, south Jordan, which has a population of predominantly sedentarized Bedouins, with some scattered nomadic Bedouins. Following a survey in 1997–1998 to elucidate current demographic patterns in relation to their biocultural adaptation (Sueyoshi and Ohtsuka, 2003, 2004), an interview survey was conducted in 2005 to reconstruct genealogies of all members of a clan (called Ashira in Arabic) of sedentarized Bedouins and to estimate its fertility and population increase rates from the time when it sedentarized. This paper has two purposes. The first is to contribute to understanding the

* Correspondence to: Shuji Sueyoshi, Graduate School of International Development and Cooperation, Kibi International University, 8 Iga-machi, Takahashi, Okayama 716-8508, Japan. E-mail: sueyoshi@kiui.ac.jp

Received 18 January 2007; accepted 7 June 2007

Published online 11 August 2007 in J-STAGE (www.jstage.jst.go.jp) DOI: 10.1537/ase.070118
long-term demographic change of Bedouins in the course of sedentarization. The second is to consider the current and future adaptation of sedentarized Bedouins, or Arab people of Bedouin origin, from an anthropological or population-ecological aspect.

**Subjects**

The South Ghor district is located along the eastern coast of the Dead Sea, the surface of which is 392 m below sea level, in the southern end of the agricultural band of the Jordan valley (Figure 1). The area is hot and very arid with an average annual temperature of 25.5°C and a yearly rainfall of 150 mm (Royal Jordanian Geographic Center, 1986). Administratively, the South Ghor district consists of five villages, among which Al-Safi had the largest population, numbering 19,000 in 2005. This village was co-inhabited by five clans identified as nomadic Bedouin and 12 clans identified as sedentarized Bedouin. According to the authors’ previous study for the entire sedentarized Bedouin population in this village in 1997–1998 (Sueyoshi and Ohtsuka, 2003), the total fertility rate (TFR) was extremely high (7.2) and the age-specific marital fertility rates (ASMFR) fitted well the pattern of natural fertility (Henry, 1961; Bongaarts and Potter, 1983). The study also revealed that the prevalence of modern contraceptive use was 14.3% but its effect on fertility was not obvious because its use among the most fertile age group of women was limited, and the rates of continuous contraceptive use beyond one or two years were strikingly low, in accordance with traditional Arab norms of childbearing (Sueyoshi and Ohtsuka, 2004). In addition, endogamous marriages, especially patrilateral parallel-cousin ones, prevailed; 58.1% of marriages were consanguineous (up to second cousins) (Sueyoshi and Ohtsuka, 2003).

Of the 12 clans identified as sedentarized Bedouin in Al-Safi village, Al-Shabat was selected as the subject of this study. This clan was established around 1930; its founder, named Dabur, had died but his name was still widely known. Dabur, his wife and his three sons, two of whom had a wife and children (Figure 2), settled in Al-Safi village in 1948, when the First Middle East War broke out; many other sedentarized Bedouins in this village also settled around that time. The Al-Shabat clan was suitable for this study because written genealogical charts exist (Al-Akash, 2002), even though these are too rough to be used for precise reconstruction of demographic history, and because no members, except those in one of its sub-clans, had emigrated from the village at the time the study was conducted (2005). At the time of settlement in 1948, however, almost all members of this clan were young married couples and their children, and this age structure, which seems to differ from the common pattern of sedentarized Bedouins, might have affected fertility and mortality rates for several decades after settlement.

After their settlement in 1948, the members of Al-Shabat clan promptly began cultivation of wheat and barley, although their economic dependence on husbandry of sheep and goats scarcely changed for one or two decades; the people lived in tents built within the farming area (Figure 3). Thereafter, their subsistence pattern gradually changed to more dependence on agriculture, together with a change of dwellings to adobe houses, which took place by the end of the 1960s (Figure 4). Up to the 1980s, the South Ghor district lagged behind in socioeconomic development due to the government neglect (Tall, 2000). In the late 1980s, however, many development projects were launched in this district, including construction of a road link to Amman, the national capital, a hospital, a maternal and child health (MCH) center, primary and secondary schools, a large, private chemical factory, and an irrigation system for agriculture. The villagers then began cash cropping of fruit vegetables and lived in block-made houses in a new residential area prepared by the government (Figure 5), away from the farming plots. It should also be noted that Al-Shabat women were able to obtain modern contraception free of charge at the MCH center.

Based on the above-mentioned ecological and socioeconomic histories of the Al-Shabat clan, analysis of the demographic data was made in three periods, i.e. the early period from 1950 to 1969, the middle period from 1970 to 1989, and the late period from 1990 to 2004.

The protocol of this study was explained in detail to, and approved by, a religious leader of the Al-Shabat clan, who had great authority over any matters concerning this clan, and informed consent was obtained from each participant.
Methods

Genealogical-demographic analysis, which studies genealogical information of spousal, parent-child, and sibling relations, is useful for estimating long-term changes in demographic indicators such as completed fertility, intergenerational replacement rate, and rate of population increase among anthropological populations that have no written documents (Ohtsuka, 1986, 1994; Post et al., 1997). The major possible causes of inaccuracy in genealogical-demographic data stem from failure of the informants’ memory, e.g. about parent-child and sibling relations due to ignorance of individuals who died in infancy or early childhood. Such possibilities were judged to be relatively low in the subject population because each clan or sub-clan of Bedouins has maintained its traditional patrilineal kin system, involving many related and non-related agnatic lines, and has respected its social solidarity through an idiom of descents (Hourani, 1990; Lancaster and Lancaster, 1992; Nabulsi, 1995). Nevertheless, it is still possible that some childbirths accompanied by early deaths had not been remembered by the villagers. Thus, the authors’ interviews excluded any individuals who died without child bearing, following Post et al. (1997), who pointed out that omission of such individuals, who did not contribute to reproduction, did not introduce serious biases into the estimated rate of natural increase or population growth.

The authors’ interview survey of more than 30 Al-Shabat members, including its head and religious leader, was made over six weeks from August to September 2005. For each living or dead member of this clan, his/her full name, consisting of the first (his/her own name), the second (father’s name), the third (grandfather’s name), and the last (clan’s name), was collected to verify his/her relationships with...
other kin group members. Then, each person’s dates (in years) of not only birth and death but also, if any, marriage(s), in-migration(s) and out-migration(s) were identified. The interview survey was conducted repeatedly until all data, including the dates of events, became consistent. Using all the data, the genealogical charts of the whole clan members covering five or six generations back were reconstructed (see Figure 2 for the three oldest generations).

The calculation of the annual rate of population increase \( (r) \) was based on the number of persons who lived at the beginning and the end of the early, middle, or late period, using the following equation:

\[
r = \frac{1}{t} \ln \left( \frac{N_2}{N_1} \right),
\]

where \( N_1 \) is the population size at the beginning of each period, \( N_2 \) is the population size at the end, and \( t \) is the time span (in years) of that period.

Using the number of childbirths (excluding individuals who died without bearing children) of the subject females aged 15–49 years in every 1 year period, the authors calculated two fertility indicators: the 5-year-interval ‘age-specific marital fertility rate’ (ASMFR) and the 5-year-interval ‘age-specific fertility rate’ (ASFR). It is noted that due to the exclusion of individuals who died without bearing children, the ASMFR and ASFR in this study differ from the common use of these terms, so that they are called, respectively, the effective age-specific marital fertility rate (E-ASMFR) and the effective age-specific fertility rate (E-ASFR). It should also be noted that, due to the small sample size, fertility indicators were pooled for 20 years of the early (from 1950 to 1969) and middle (from 1970 to 1989) periods and for 15 years of the late (from 1990 to 2004) period; as a result, the number of person-years of any 5-year age group of the subject females, except 30–34 and higher age groups in the early period, exceeded 35, the minimum number recognized to provide statistically acceptable ASMFR (Handwerker, 1988).

Results

Figure 6 shows the population growth of the Al-Shabat clan from its establishment in 1930 up to 2005; the population number in each year was obtained by adding births and in-migrants and subtracting deaths and out-migrants. The growth curve did not fit the exponential equation but rather the polynominal equation \( (R^2 = 0.996) \), implying that this group’s growth pattern deviated from that of natural fertility. In other words, the population growth of the Al-Shabat clan slowed down in later years for some reason, e.g. decrease of fertility or increase of out-migration.

Table 1 presents the population change of the Al-Shabat clan from its establishment in 1930 to 2005. The line shows the fitted polynominal equation \( (R^2 = 0.996) \).
clan in each of the three periods, by birth, death, in-migration, and out-migration. There are three major observations. First, the number of births markedly exceeded that of deaths in any period. Second, the number of in-migrants was larger than that of out-migrants, although the difference was much smaller than that between births and deaths. Third, the annual rate of population increase gradually declined from 0.054 in the early period to 0.050 in the middle period and then to 0.044 in the late period, corresponding to, respectively, 12.8, 13.9, and 15.8 years of doubling time.

Table 2 shows the E-ASMFR, the age-specific proportion of females married \(m(a)\) and the E-ASFR for the three periods; also shown are the effective total marital fertility rate \(E\)-TMFR as the sum of E-ASMFRs, the effective total fertility rate \(E\)-TFR as the sum of E-ASFRs, and the index of marriage \(C_m\), i.e. \(E\)-TFR/\(E\)-TMFR, which indicates the role of the proximate determinant of marriage on fertility (Bongaarts and Potter, 1983). These indicators varied considerably among the three periods, summarized as follows. First, the E-ASMFR declined age-dependently from the 15–19 to the 30–34 years age group and was zero in higher age groups in the early period, in contrast to the persistently high levels between the 15–19 and 30–34 (or 35–39) years age groups and more than zero up to the 45–49 years age group in the middle and late periods; consequently, the E-TMFR was only 4.8 in the early period but more than 9 in other two periods. Second, \(m(a)\) increased from 15–19 to 25–29 years age group and reached 1 in the 30–34 years age group in the early and middle periods, with higher levels in the former, but this indicator in the late period was much lower in any age groups and reached 1 only in the 45–49 years age group. Third, the E-TFR increased from the early to the middle period and then decreased to the late period. Fourth, \(C_m\) was considerably higher in the early and middle periods than in the late period.

Table 3 shows the mean age at first marriage among the male and female subjects in the three periods. The age at marriage increased from the early period (20.6 for the male and 16.7 for the female) to the middle period (23.1 for the male and 19.2 for the female), and to the late period (27.4 for the male and 22.6 for the female), though the between-sex difference of 4–5 years remained similar for all periods.

### Discussion

#### Reliability of data

The exclusion of individuals who died without bearing

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<tr>
<td>15–19</td>
<td>0.362 (47)</td>
<td>0.349 (43)</td>
<td>0.325 (40)</td>
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<td>20–24</td>
<td>0.323 (65)</td>
<td>0.426 (68)</td>
<td>0.338 (145)</td>
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<td>25–29</td>
<td>0.179 (39)</td>
<td>0.345 (87)</td>
<td>0.364 (176)</td>
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<td>30–34</td>
<td>0.087 (23)</td>
<td>0.347 (98)</td>
<td>0.286 (119)</td>
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<td>35–39</td>
<td>0.000 (21)</td>
<td>0.241 (87)</td>
<td>0.273 (88)</td>
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<td>40–44</td>
<td>0.000 (15)</td>
<td>0.169 (77)</td>
<td>0.176 (74)</td>
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<td>45–49</td>
<td>0.000 (20)</td>
<td>0.093 (43)</td>
<td>0.068 (73)</td>
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\[ E\)-TMFR = (\Xi [E-ASMFR] \cdot 5) \]

\[ E\)-TFR = (\Xi [E-ASFR] \cdot 5) \]

\[ C_m = \sum m(a) \cdot [E-ASMFR] / \sum [E-ASMFR] = [E-TFR] / [E-TMFR]. \]

The accumulated marital periods of all subjects (person-years) are shown in parentheses.

| Index of marriage, \(C_m = \sum m(a) \cdot [E-ASMFR]/[E-ASFR] = [E-TFR]/[E-TMFR]. \)

### Table 3. Mean age at first marriage in the three periods

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<td>Male</td>
<td>12</td>
<td>14</td>
<td>52</td>
</tr>
<tr>
<td>Female</td>
<td>15</td>
<td>17</td>
<td>54</td>
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\[ ^1 \text{Five polygynous males were excluded in cases of their marriage to a second wife.} \]
children, who were mostly infants or young children, guaranteed the reliability of the data obtained because of the omission of uncertain and less-certain births and deaths. However, this exclusion should have caused fewer counts of not only deaths but also births than there actually were, leading to an underestimation of the fertility indicators, E-ASMFR, E-ASFR, E-TMFR, and E-TFR; theoretically, the higher the child mortality, the larger the deviation from reality. Our discussion begins with an examination about the possible effects of the neglected births, even though in an indirect manner.

The fertility level disclosed in this study, especially the highest E-TFR (7.214) and E-TMFR (0.982) in the middle period, was compared with the reported high values in the world. According to De Jong (1972), the eight nations with the highest TFR in 1955–1960 were Sudan, Brunei, Iraq, Honduras, Guinea, Pakistan, Guatemala, and Togo, and their TFRs averaged 6.860 (range 6.156–7.496). For TFRM, Joseph (2004) reported that a very high value was observed in a sedentarized Bedouin population in the Bekaa Valley, Lebanon; this group’s TMFR, 9.56, is lower than the E-TMFR of the present study population in the middle period, 9.852. Furthermore, our E-TMFR (of 9.852) is almost comparable to the TMFR of 9.99 reported for the Hutterites in 1964–1950, who are well known to have had the highest fertility in the world (Eaton and Mayer, 1953). These comparisons strongly suggest that there is only a small possibility that the number of child deaths in the Al-Shabat clan was large enough to underestimate the fertility.

Taking into account the historical fact that the provision of medical services, which is the major contributor to reducing mortality, began during the end of the middle period in the study area, it is natural to judge that the marked increase of fertility, exemplified by E-ASMFR, from the early to the middle period was due not to the decrease in child deaths but to the increase in fertility itself. In other words, the neglected births and deaths due to excluding those individuals who died without bearing children might not have resulted in serious underestimation. Thus, the following discussion will be made based on the supposition that the fertility indicators of the subject population, i.e. E-ASMFR, E-ASFR, E-TMFR and E-TFR, basically substituted the usual corresponding indicators, i.e. ASMFR, ASFR, TMFR and TFR.

Changes from the early to the middle period

Changes in the fertility indicators from the early to the middle period can be summarized as follows. First, both the E-TMFR and E-TFR doubled, which is consistent with the slight change in 

changes, although the females’ mean age at first marriage increased from 16.7 to 19.2 years. Second, broken down into age groups (reflected in E-ASMFR), only the 15–19 year age group had similar fertility levels in both periods; other age groups had markedly lower levels in the early period, i.e. three-fourths for the 20–24 year age group, half for the 25–29 year age group, one-fourth for the 30–34 year age group, and nil for the higher age groups. Since the E-ASMFR in the middle period fitted the pattern of natural fertility (Henry, 1961; Bongaarts and Potter, 1983), our discussion will focus on the conditions leading to reduced childbirth in the early period and the relaxing of such conditions in the middle period.

Malnutrition has been recognized, in general, as a major biological factor in reduced fertility, especially by delaying the age at menarche (Bongaarts, 1980, Wood, 1994). Several studies of Bedouin groups disclosed improvements in dietary intake as well as in living and hygiene conditions as the principal consequences of lifestyle change from nomadism to sedentarism (Forman et al., 1995; Fraser et al., 1998; Beverley and Henderson, 2003). Improvement of maternal nutritional status might have occurred in the study population, although its evidence has not been obtained in this study.

As a cultural factor conditioning fertility among traditional Arab populations, cessation of childbirth of females from the time when their children began childbirth has been mentioned (Varea, 1993). If this cultural norm were true in the study population, it is possible that the low fertility of the middle-aged and older women in the early period followed the traditional pattern and that this regulation weakened in the middle period. Another well-known cultural factor responsible for an increase in childbirth, especially in agrarian societies, is increased demand for children as labor (Caldwell, 1982; Shah and Nathanson, 2004). In contrast, there has been no finding about the demand of a large number of children among nomadic Bedouin societies, although a preference for male children to work as animal herders has been reported (Peters, 1990). In the Al-Shabat clan, who increased their dependency on agriculture, the need for a large labor force might have triggered an increase in fertility during the middle period. In conclusion, the marked increase in fertility from the early to the middle period was caused by the increased number of births by middle-aged and older women owing to the change in their cultural norms, perhaps in tandem with improved nutritional status and an increased demand for children agricultural labor.

It is also necessary to discuss the inconsistency of the rates of fertility and population increase between the early and middle periods. The E-TFR in the former, i.e. 3.589, was almost half that of the latter, i.e. 7.214, despite the similar rates of population increase, i.e. 0.054 in the former and 0.050 in the latter. This apparent discrepancy is due to the different age compositions between the two periods; in the early period, the number of person-years of three highly fertile (15–19, 20–24, and 25–29 year) age groups accounted for 65.7% of the total person-years of the women aged 15–49 years (151/230) while the corresponding proportion in the middle period was only 39.4% (198/503).

Changes from the middle to the late period

In Arab societies with Muslim traditions, marriage is recognized as a basic function of reproductive success (Fargues, 1989), and females’ early marriage, lack of freedom in the decision of marriage, low education level, and subordinate status in the family are considered to be closely related to the high fertility observed (Nagi, 1984; Obermeyer, 1992). More generally, early and universal marriage has been observed in most pre-modernized societies, leading to high fertility (Wood, 1994). These features, i.e. high nuptiality and high fertility, were observed especially in the middle period in the subject group. It is thus recognized that the
Arab norms of high nuptiality and high fertility were realized not in the nomadic period of Bedouins but after several decades of sedentarization.

From the middle to the late period, it was clear that E-TMFR scarcely changed but Cm and E-TFR markedly declined, implying that the females’ older age at marriage or the increase in unmarried females of younger age played major roles in reducing the E-TFR. These changes were largely triggered by governments and non-governmental organizations, which aimed to enhance women’s rights in Arab countries, including Jordan (Kohli and Al-Omaim, 1990; Horne, 1992; Obermeyer, 1992).

**Effects of sedentarization**

According to Meir’s (1987) meta-analysis of data from various nomadic and ex-nomadic populations, their rate of natural increase (crude birth rate minus crude death rate) ranged from 0.007 to 0.030 in the nomadic stage and from 0.022 to 0.057 in the sedentarized stage. This wide range in both stages is judged to have come mostly from the difference in the stage of sedentarization. An important finding of the present study was a drastic change in demographic parameters within only 55 years, from the early to the late period. This study also revealed that the increase in fertility played a significant role in increasing the population, especially in the early period, which is inconsistent with Meir’s (1987) hypothesis that an increase in the rate of population increase in sedentary nomadic populations is caused by a decrease in mortality as a result of increased accessibility to medical services. Although more studies are needed, it may be concluded that change of fertility is a significant contributor to population increase among sedentarized ex-pastoral populations.

**The current and future problems**

Although the annual population increase rate of the Al-Shbat clan decreased to 0.044 in the late period, this rate is still very high; according to the polynomial equation (Figure 6), which fitted the population change of this clan from 1930 to 2005, its population is estimated to double by 2030. It is well known that rapid population growth in rural areas of developing countries tends to cause soil erosion and overgrazing, subdivision or fragmentation of farmlands, a fall in real wages, landlessness and underemployment, and migration to urban areas (Grigg, 1980a, b). The Al-Shabat clan is especially disadvantaged in this respect because it owns only 35 hectares of land and thus its population density was 1300 persons per km² in 2005. In the same year, the unemployment rate of males aged 15–64 years reached 29.1%. From an anthropological or population-ecological aspect, it is concluded that a decrease in fertility through contraception in the Al-Shabat clan and other sedentarized Bedouins should be urgently promoted to prevent overpopulation, which threatens their subsistence adaptation.

**Acknowledgments**

This study was financially supported by the Fellowship Program for Intellectual Exchange in the Middle East from the Japan Foundation. We thank Mr. Abdulmonem Malkawi of the Higher Population Council, Jordan for his valuable comments. Finally, and not least, our deep gratitude goes to all members of Al-Shabat clan, especially Mr. Abdul-Jawad Al-Shabat, Sheikh Nail Al-Shabat, and Mr. Gazi Al-Shabat, for their generous support and cooperation in the field research.

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