

Milk and meat production from dromedary and bactrian camels in the world, Africa, Asia, Europe and their subregions from 1961 to 2013

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世界、アフリカ、アジア、ヨーロッパおよびこれら域内諸地域でのヒトコブラクダ
およびフタコブラクダからの 1961 年から 2013 年までの乳および肉の生産

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Abstract

Stock number, milk production and meat production of dromedary and bactrian camels in the world and in regions of Africa and Asia from 1961 to 2013 were analyzed based on data from FAOSTAT database provided by Food and Agriculture Organization of United Nations.

There were 48 countries in the world that have camels as livestock, 20 in Africa, 26 in Asia and 2 in Europe. The number of camels in the world doubled from 13 million in 1961 to 27 million in 2013. Approximately 85% of camels were in Africa in 2013. Stock number, and productions of milk and meat in Europe were nominal.

The productions of camel milk plus camel meat in the world increased 4.7 times between 1961 and 2013. Milk is the main product being 85% of camel food product in the world and in Africa, and 50% to 65% in Asia with considerable variance within the latter two regions. More than 90% of world production of camel milk is attributed to Africa. Camel milk production in Africa and in Asia increased nearly 9 times and 3 times between 1961 and 2013, respectively. Camel meat production in the world increased 4.3 times between 1961 and 2013. The share of Africa in world camel meat production increased from 54% in 1961 to 77% in 2013, where that of Asia decreased from 44% in 1961 to 23% in 2013.

Milk production per camel in the world increased 2.4 times from 46 kg/head in 1961 to approximately 110 kg/head between 2009 and 2013. That in Africa was 2 to 4 times higher than that in Asia. Camel meat production per camel increased a little more than twice in the World. Meat production per camel in Asia has been 1.3 to 1.7 times larger than that in Africa.

The food production from camel has been increasing steadily due to the increase in both stock number and productivity.

和文要旨

世界、アフリカ諸地域、アジア諸地域での 1961 年から 2013 年までのヒトコブラクダおよびフタコブラクダの飼育頭数ならびに乳生産および肉生産を国際連合食糧農業機関のデータベース FAOSTAT に基づいて考察した。ラクダを家畜として飼育している国はアフリカ 20、アジア 26、ヨーロッパ 2 の合計 48 カ国である。ヨーロッパの飼育頭数、乳生産、肉生産はごく少ない。2013 年のラクダの総頭数の約 85 % がアフリカで飼育されている。ラクダが生産する食糧のうち乳が世界全体およびアフリカでは 85 %、アジアでは 50 から 65 % を占めるが、両地域とも域内のばらつきが大きい。世界のラクダ乳の 90 % がアフリカで生産されている。アフリカおよびアジアの乳生産は 1961 年から 2013 年の間にそれぞれ 9 倍および 3 倍増加した。世界のラクダ肉生産は 1961 年から 2013 年の間に 4.3 倍増加した。1961 年から 2013 年の間にラクダ肉の世界総生産に占めるアフリカの割合は 54 % から 77 % へと増加しアジアの割合は 44 % から 23 % へと減少した。1961 年から 2013 年の間に飼育頭数あたりの乳生産量は世界全体で 46 kg/頭から 110 kg/頭へと 2.4 倍増加した。アフリカにおける飼育頭数あたりの乳生産量はアジアの 2 から 4 倍である。世界全体の飼育頭数あたりの肉生産量は 1961 年から 2013 年の間に 2 倍弱増加した。アジアの飼育頭数あたりの肉生産量はアフリカの 1.3 から 1.7 倍多い。以上のように、ラクダからの乳生産、肉生産は世界全体で増加しているが、これには飼育頭数の増加と生産効率の向上がともに貢献している。

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Introduction

It is not yet entirely clear when and where old world camels, *i.e.* dromedary camels (*Camelus dromedarius*) and bactrian camels (*Camelus bactrianus*), were domesticated^(1,2). However, it should not have been possible for humans to invade Afro-Eurasian dry land without using these livestock⁽³⁾. Humans are the most resistant mammal against heat, however at the vast expense of water for sweating⁽³⁾. Accordingly, humans *per se.* are not resistant to hot and dry environment. It is also a severe condition in the desert that many wells are saline wells⁽⁴⁾. On the other hand, camels can survive on salty water due to the high capacity of the kidney to reabsorb water⁽⁵⁾ and even secrete milk of salt content not different from other mammals⁽⁶⁾. In other words, humans have been using camels as a water desalinating instrument⁽⁶⁾. Therefore, it is reasonable that humans have been using camels essentially as a milk-producing animal⁽¹⁾. However, camel meat is also an important source of nutrients in many countries⁽⁷⁾. Therefore, the present author analyzed productions of camel milk and camel meat in individual countries^(8,9). Unfortunately, these articles lacked in more gross aspects at the level of continent or subregions in the continent.

Accordingly, here I analyzed data on the stock size, milk production and meat production in the world, Africa and Asia, and in their subregions provided by FAOSTAT⁽¹⁰⁾ to demonstrate the time-course and among-region variance. FAOSTAT is a statistical database constructed by Food and Agriculture Organization of United Nations. Unfortunately, many countries where camels are reared are lacking in domestic structures to support reliable data collection. Thus, the data adopted for the present paper inevitably include “estimated” data. Therefore, too much precise analysis should not be appropriate.

However, we have no other database that is more general and more comprehensive than FAOSTAT. Since FAOSTAT treat dromedary and bactrian camels just as camels, I did not handle them separately in the present article.

Camel-rearing countries

There are the following 48 countries in the world that have camels as the livestock, 20 in Africa, 26 in Asia and 2 in Europe⁽¹⁰⁾:

Africa

Eastern: Djibouti, Eritrea, Ethiopia, Kenya, Somalia,
Middle: Chad
Northern: Algeria, Egypt, Libya, Morocco, Sudan, Tunisia, Western Sahara
Southern: Namibia
Western: Burkina Faso, Mali, Mauritania, Niger, Nigeria, Senegal,

Asia

Central: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan
Eastern: China, Mongolia
Southern: Afghanistan, India, Iran, Pakistan
Western: Azerbaijan, Bahrain, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, Turkey, UAE, Yemen

Europe

Russia, Ukraine.

Camel number in the world

The number of camels in the world has been growing from approximately 13 million in 1961 to 27 million in 2013. (Figure 1) This is mostly due to the steady increase in Africa, while the number of camels in Asia and Europe has been gradually declining. Accordingly, the proportion of African camel stock in the world increased from 67% in 1961 to 85% in 2013, while

that of Asian camels decreased from 21% to 15% during this time frame, respectively. (Figure 1) The number of camels in Europe has been negligibly small. (Figure 1) Thus, we may reasonably say that Africa is the major place for camel rearing and its importance is steadily increasing.

Camel number in Africa

The number of camels has been increasing in all African regions other than Southern Africa. (Figure 2)

The largest number of camels has been

reared in Eastern Africa followed by Northern, Western, Middle and Southern Africa. (Figure 2) The share of Eastern Africa in Africa increased from 14% in 1961 to 50% in 2013. It is to note that the camel number in Eastern Africa declined between 1990 and 1993. The present author has no explanation for this decline. On the other hand, the number of camels in East Africa markedly increased between 2006 and 2007, directly influencing on the increase in the world camel number during this period. Prof.Dr. Horst-Jurgen Schwartz of Humboldt University, who for a long time

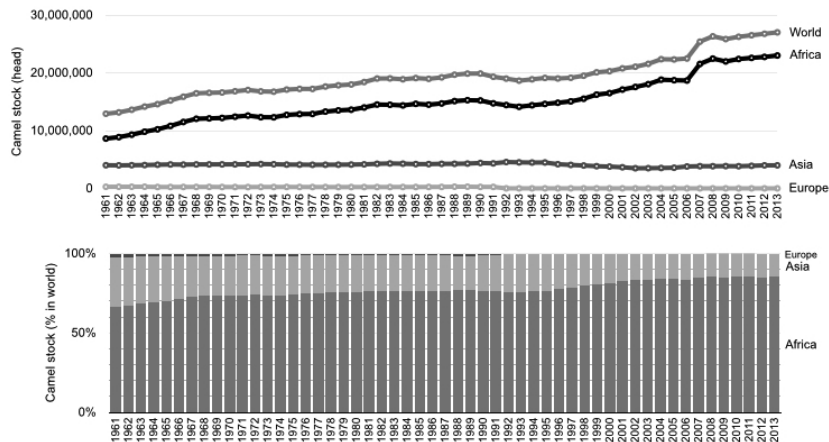


Fig. 1 Number (upper panel) and regional share (lower panel) of camels in the World from 1961 to 2013. (data from FAOSTAT⁽¹⁰⁾)

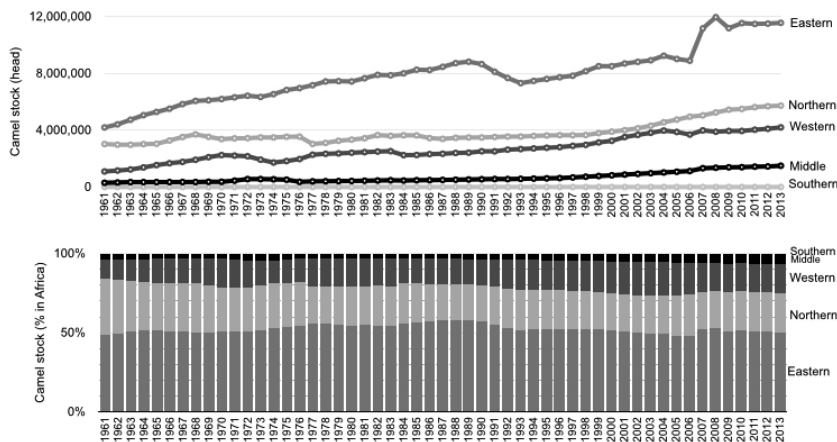


Fig. 2 Number (upper panel) and distribution (lower panel) of camels in regions of Africa from 1961 to 2013. (data from FAOSTAT⁽¹⁰⁾)

served as a professor in veterinary physiology of University of Nairobi, considers that “the regional authorities in Northern Kenya undertook the first proper livestock census in about 20 years during this period, which resulted in much higher numbers than the previous estimates”. (Horst-Jurgen Schwartz, personal communication, January 5, 2015) This should be the most likely explanation. We should keep it in mind that such an artifact may occur in other cases as well.

The share of Northern Africa in Africa declined from 35% in 1961 to 10% in 2013 in spite of the rapid increase in camel number from 1998 to 2008. (Figure 2) The shares of Western and Middle Africa in Africa was 13% and 3% in 1961 and 3% and 7% in 2013, respectively. (Figure 2) The number of camels in Southern Africa was less than 115 heads between 1961 and 2013. (Figure 2)

Camel number in Asia

Camel number in Western and Central Asia increased and that in Southern and Eastern Asia decreased from 1961 to 2015. (Figure 3) Southern Asia has been rearing the largest number of camels in Asia. (Figure 3) The

number of camels in Southern Asia increased from approximately 2 million (51% in Asia) in 1961 to a little more than 2.5 million (69% in Asia) in 1995, and thereafter has been decreasing to less than 1.7 million (29%) by 2013. The numbers of camels in Western and Eastern Asia were approximately 0.7 million (18%) and 1.2 million (31%) in 1961, and 4.2 million (36%) and 0.6 million (15%) in 2013, respectively. (Figure 3) The number of camels in Central Asia, *i.e.* in countries that became independent from USSR, has been between 0.2 to 0.3 million since 1992. (Figure 3) Thus, Southern Asia and Western Asia are the dominating camel-rearing regions in Asia. It is an overall tendency that the share of Eastern Asia is declining and that of Western Asia is increasing.

Food production from camel in the world

The weight sum of productions of camel milk and camel meat in the world increased 4.7 times from 0.75 million tonne in 1961 to a plateau of 3.5 million tonne since 2010 and on, with some gap between 1991 and 2006. (Figure 4)

On weight basis, the amount of camel milk production was approximately 4.6 to 8.1 times

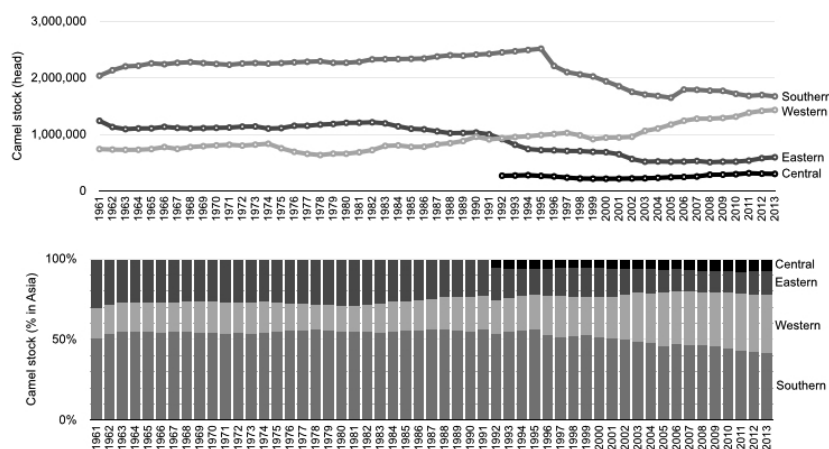


Fig. 3 Number (upper panel) and distribution (lower panel) of camels in regions of Asia from 1961 to 2013. (data from FAOSTAT⁽¹⁰⁾)

as that of camel meat production. (Figure 5) Thus, milk is the main food product of camels.

Food production from camel in Africa

The weight sum of productions of camel milk and camel meat in Africa increased 4.8 times from 0.66 million tonne in 1961 to 3.1 million tonne in 2013. (Figure 4) Africa is characterized by the large contribution of milk, more than 85% without too much fluctuation between 1961 and 2013. (Figure 5) This may reflect that the condition to use camels for food production has not been changed markedly though, with a slight shift to meat production during that time frame in Africa.

The proportion of meat production in camel food production varies among African regions. (Figure 6) It was from less than 7% in Eastern and Middle Africa, between 9% and 27% in Western Africa, and between 41% and 71% in Northern Africa. (Figure 6) Thus, milk is the

predominant camel food product in Eastern and Middle Africa, while meat is becoming the major camel food product in Northern Africa. There is a tendency for the ratio of meat in camel food production to increase in all African regions other than Western Africa.

Food production from camel in Asia

The weight sum of productions of camel milk and camel meat in Asia increased 2.8 times from 0.12 million tonne in 1961 to 0.33 million tonne in 2013. (Figure 4) Asian camel food production is characterized by the relatively large proportion of meat production. (Figure 5) The proportion of meat production in the total camel food production has been relatively stable between 34% and 45% between 1961 and 2013. This may reflect that the condition to use camels for food production has not been changed too much during that time frame in Asia.

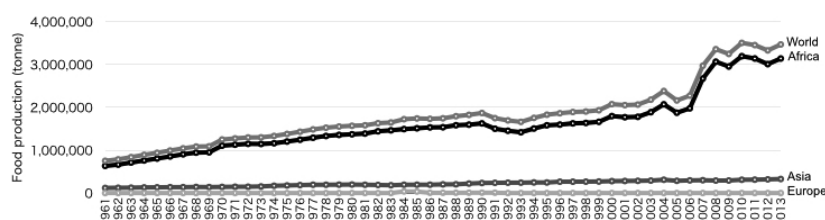


Fig. 4 Camel food (milk plus meat) production (upper panel) and its regional share in the world from 1961 to 2013. (data from FAOSTAT⁽¹⁰⁾)

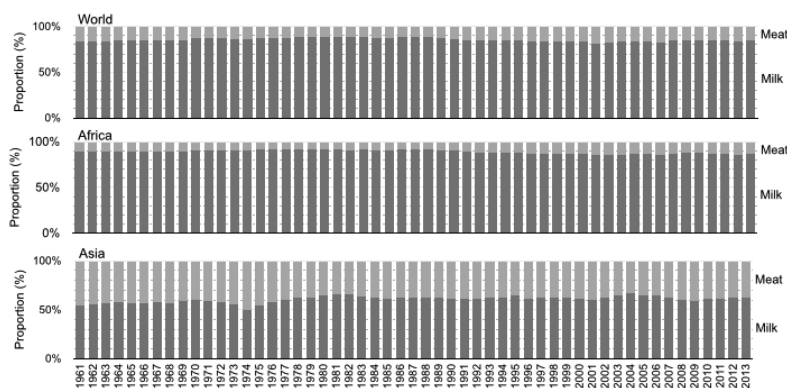


Fig. 5 Weight ratio of camel milk and camel meat in the world, Africa and Asia from 1961 to 2013. (data from FAOSTAT⁽¹⁰⁾)

Milk and meat production from dromedary and bactrian camels

Camel was used exclusively for meat production in Central Asia from 1998 to 2002. (Figure 7) However, the proportion of milk production has been markedly increasing in this region. Meat has been the major camel food product up to 2001 in Eastern Asia, though declining a bit since then, and still is an important component of camel food product. (Figure 7) The proportion of meat production in camel food production has been between 31% and 41% in Southern

Asia between 1961 and 1991, and is increasing to become more than 50% thereafter. (Figure 7) The proportion of meat production in camel food production in Western Asia has been approximately one third since 1961. (Figure 7) Thus, the meat vs. milk ratio in Asia varies differently among Asian regions. The background reasons are yet to clarify.

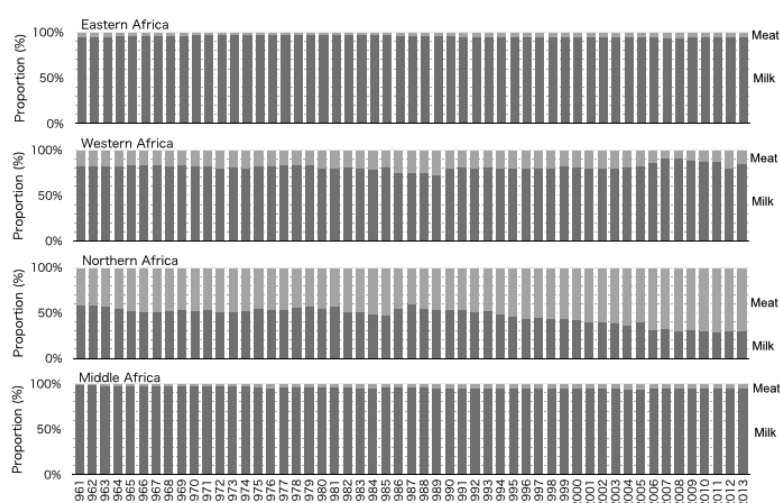


Fig. 6 Weight ratio of camel milk and camel meat in camel food product in regions of Africa from 1961 to 2013. (data from FAOSTAT⁽¹⁰⁾)

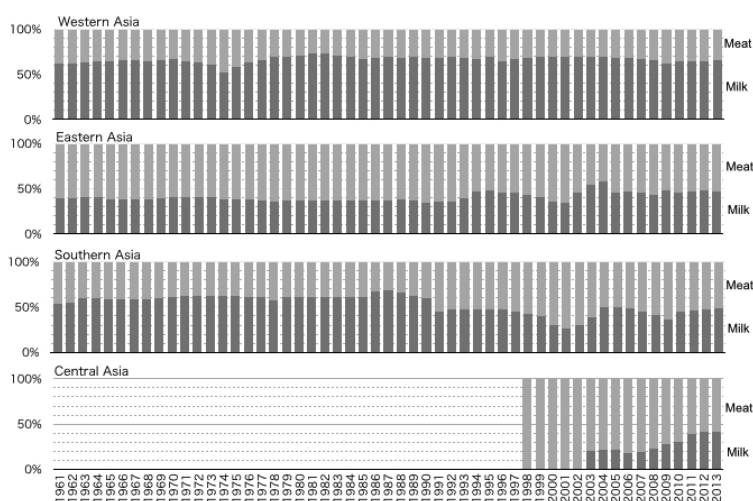


Fig. 7 Weight ratio of camel milk and camel meat in regions of Asia from 1961 to 2013. (data from FAOSTAT⁽¹⁰⁾)

Camel milk production in the world

Camel milk production in the world increased 4.8 times from 0.6 million tonne in 1961 to 2.9 million tonne in 2013 more-or-less reflecting that in Africa. (Figure 8) The marked increase in World camel milk production from 1.7 million tonne in 2006 to 2.3 million tonne in 2007 yet remains to explain. However, this might be the result of the improvement in data collection in Kenya as stated above.

More than 90% of world production of camel milk is attributed to Africa. (Figure 8) Camel milk production in Asia accounts for most of the rest beside nominal production in Europe. (Figure 8) This proportion has not changed since 1961 in spite of marked increase in world production. (Figure 8)

Camel milk production in Africa

Camel milk production in Africa increased nearly 9 times from 0.6 million tonnes in 1961 to 2.7 million tonnes in 2013. (Figure 8) The share of camel milk production in Africa was in the order of Eastern (75 to 85%), Western (10 to 25%), Northern (5 to 10 %) and Middle Africa (less than 2 %) during the above period. (Figure 9) The share of Western Africa has been increasing and those of Northern Africa

have been decreasing.

Annual camel milk productions in Eastern, Western, Northern and Middle Africa increased 5 to 15 times between 1961 and 2013, *i.e.* from 0.46 million tonnes, 44 thousand tonnes, 49 thousand tonnes and 1 thousand tonnes in 1961 to 2.3 million tonnes, 0.66 million tonnes, 0.58 million tonnes and 0.10 million tonnes in 2013, respectively. (Figure 9) Camel milk production in Eastern and Western Africa seems to have reached a plateau since 2007 or 2008. This may be the result of the plateauing of camel number in these regions since 2007 or 2008. (Figure 2)

Camel milk production in Asia

Camel milk production in Asia increased approximately 3 times from 65 thousand tonnes in 1961 to 205 thousand tonnes in 2015 (Figure 8), approximately one third as that of the increment in Africa (Figure 8).

The share of camel milk production in Asia has been in the order of Western, Eastern, Southern and Central Asia. (Figure 10) The share of Western Asia has been increasing from 69% in 1961 to 87% in 2013. On the other hand, the share of Eastern and Southern Asia has been decreasing from 20% and 12% in 1961

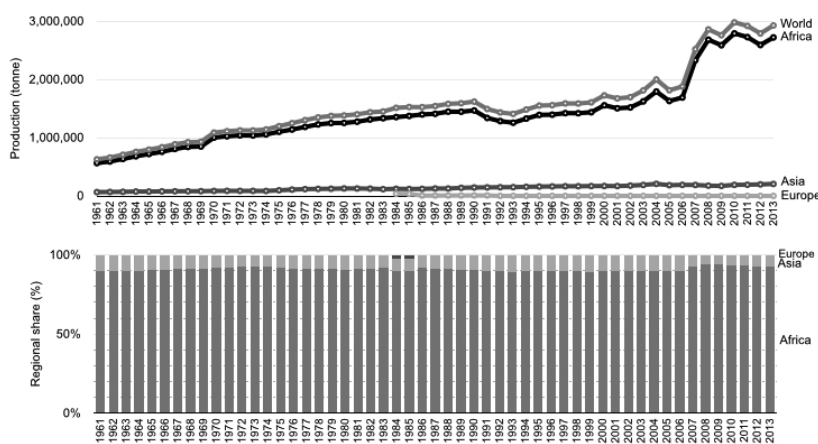


Fig. 8 Camel milk production and its regional share in the world from 1961 to 2013. (data from FAOSTAT⁽¹⁰⁾)

Milk and meat production from dromedary and bactrian camels

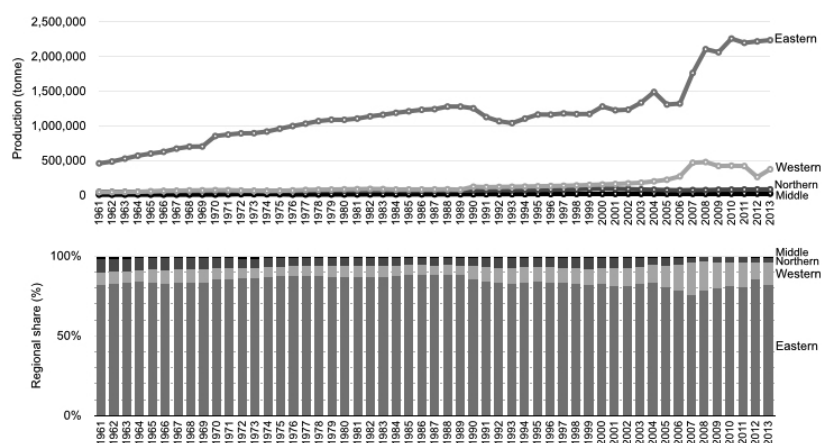


Fig. 9 Camel milk production and its regional share in Africa from 1961 to 2013. (data from FAOSTAT⁽¹⁰⁾)

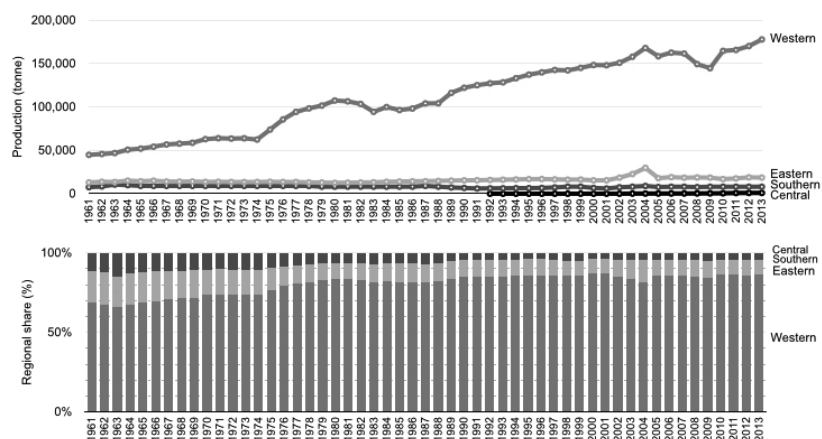


Fig. 10 Camel milk production and its regional share in Asia from 1961 to 2013. (data from FAOSTAT⁽¹⁰⁾)

to 9% and 4% in 2015, respectively. The camel milk production in Central Asia is at most 0.26% of camel milk production in Asia.

Annual milk production in Western Asia has been more-or-less stably increasing approximately 4 times from 45 thousand tonne in 1961 to 180 thousand tonne in 2013. That of Eastern Asia also increased by 46% from 13 thousand tonnes in 1961 to 19 thousand tonne in 2013. (Figure 10) Annual camel milk production in Southern Asia was fluctuating between 6 and 10.5 thousand tonne between 1961 to 2013. In Central Asia annual camel milk production has

been increasing from 0.16 thousand tonne in 2005 to 0.9 thousand tonne in 2013. (Figure 10)

Camel meat production in the world

Camel meat production in the world increased 4.3 times *quasi* exponentially from 0.12 million tonne in 1961 to 0.52 million tonne in 2010 and then slowed down. (Figure 11) This pattern basically reflects the pattern in Africa. The increment in world camel meat production between 1961 and 2013 is comparable to that for camel milk production stated above.

The share of Africa in world camel meat

production increased from 54% in 1961 to 77% in 2013, where that of Asia decreased from 44% in 1961 to 23% in 2013. The share of Europe has been at most 0.09%. (Figure 11)

Camel meat production in Africa

Camel meat production in Africa was 70 thousand tonne in 1961 and increased approximately 6 times to 412 thousand tonne in 2011 and stayed around 416 thousand tonne since 2011. (Figure 11) The share of Northern, Eastern, Western and Middle Africa has been approximately 40% to 60%, 25% to 45%, 15% to

20%, and less than 1%, respectively. (Figure 12)

Annual camel meat production in Northern, Eastern, Western and Middle Africa increased 5.9 times, 5.7 times, 7.4 times and 6.7 times from 35 thousand, 25 thousand, 9 thousand and 180 tonnes in 1961 to 205 thousand, 142 thousand, 67 thousand and 1.2 thousand tonne in 2013, respectively. (Figure 12)

Camel meat production in Asia

Camel meat production in Asia was 54 thousand tonne in 1961 and increased 2.3 times to 123 thousand tonne in 2013 (Figure 11), far

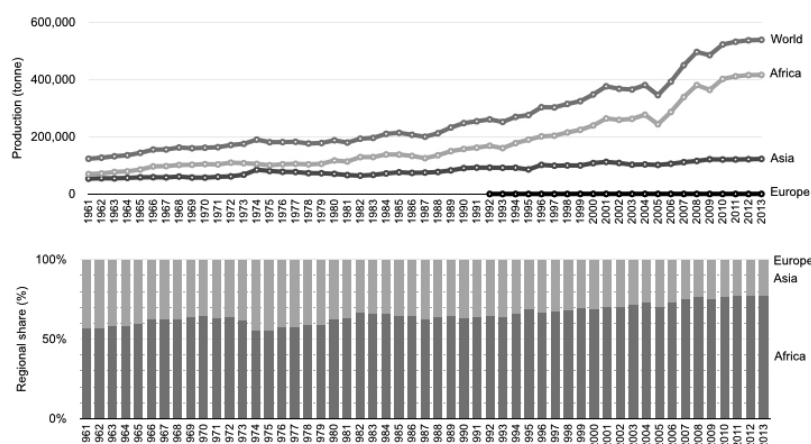


Fig. 11 Camel meat production (upper panel) and its regional share in the world from 1961 to 2013. (data from FAOSTAT⁽¹⁰⁾)

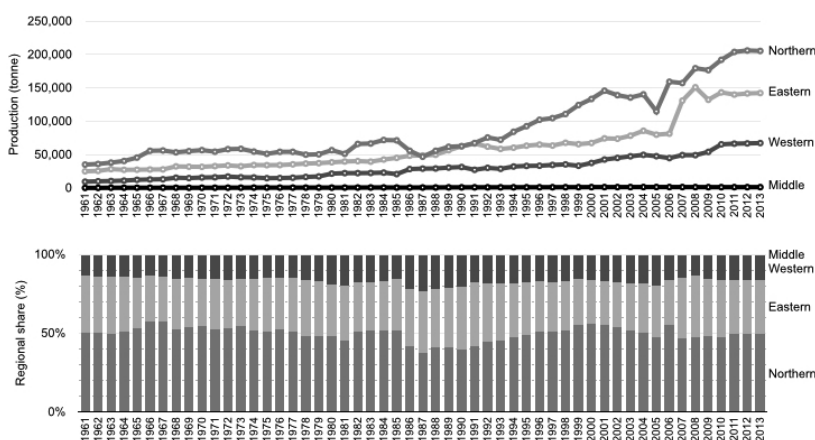


Fig. 12 Camel meat production (upper panel) and its regional share in Africa from 1961 to 2013. (data from FAOSTAT⁽¹⁰⁾)

Milk and meat production from dromedary and bactrian camels

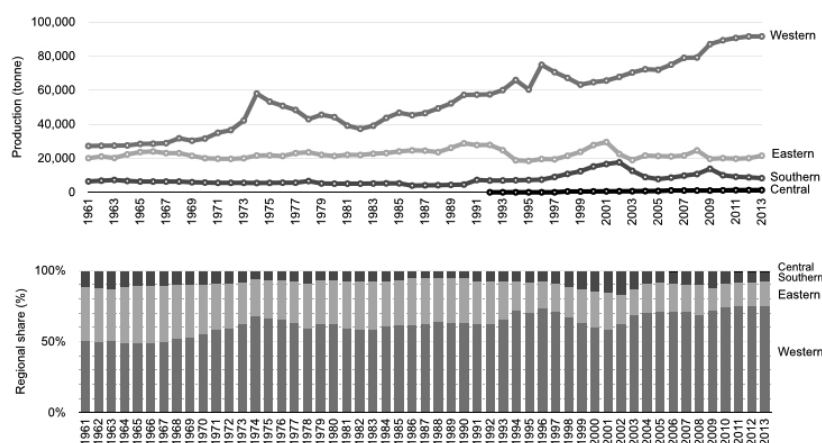


Fig. 13 Camel meat production (upper panel) and its regional share in Asia from 1961 to 2013. (data from FAOSTAT⁽¹⁰⁾)

smaller increment than in Africa.

The share of camel meat production in Asia has been in the order of Western, Eastern, Southern and Central Asia since 1961. (Figure 13) The share of Western Asia increased from approximately 50% in 1960s to approximately 75% since 2010. The share of Eastern Asia has been decreasing from approximately 40% in 1960s to 16% since 2010. That of southern Asia has been fluctuating between 5% and 16% between 1961 and 2013. The share of Central Asia has been at most 1%.

Annual camel meat production in Western Asia increased 3.4 times from 27 thousand tonne in 1961 to 92 thousand tonne in 2013 with sharp and transient increases between 1972 and 1982, and between 1995 and 1999. (Figure 13) That in Eastern Asia has been fluctuating between 18 thousand and 30 thousand tonne since 1961 and was 22 thousand tonne in 2013. (Figure 13) Annual camel meat production in Southern Asia had been declining from 6.4 thousand tonne to 3.9 thousand tonne with transient increases in 1963 and 1978, and started to increase to 18 thousand tonne in 2002, and then declined to 8.3 thousand tonne in 2013 with a transient increase from 2005 to 2013 reaching 14 thousand tonne in 2009. (Figure

13) That in Central Asia has been increasing from 500 tonne in 1998 to 1.3 thousand tonne in 2013. (Figure 13)

Productivity of camel milk

The productivity of camel milk, *i.e.* camel milk production per camel per year, has been increasing in the world, in Africa and in Asia since 1961. That in the world increased 2.4 times from 46 kg/head/year in 1961 to approximately 110 kg/head/year between 2009 and 2013. (Figure 14)

Camel milk production per camel per year in Africa was 2 to 4 times higher than that in Asia, *i.e.* 65 vs. 16 (kg/head/year) in 1961, and 118 vs. 53 (kg/head/year) in 2013. (Figure 14) The difference in the proportion of camels used for milk production and/or the productivity of individual milking camel should be responsible for this difference. The former factor can further be divided into the proportion of female camels in total camel stock and the proportion of milking female camels versus immature or dry female camels. The latter can be decided by the duration from birth to the first milking and the duration between births.

There was a gradual growth of world milk productivity from 1961 to 2004 followed by a

jump up between 2006 and 2007. The jump up can be due to the improvement in the animal census in Kenya as stated above. On the other hand, there was an exponential growth in camel milk productivity in Asia between 1961 and 2004 to reach a plateau thereafter. The reason for this fluctuation is yet to clarify.

Productivity of camel meat

The productivity of camel meat, *i.e.* camel meat production per camel per year, increased a little more than twice in the World, in Africa and in Asia from 10, 13 and 8 (kg/head/year) in 1965 to 20, 31 and 18 (kg/head/year) in 2013. (Figure 15) These increases are comparable to those of camel milk productivity in these regions (Figure 14).

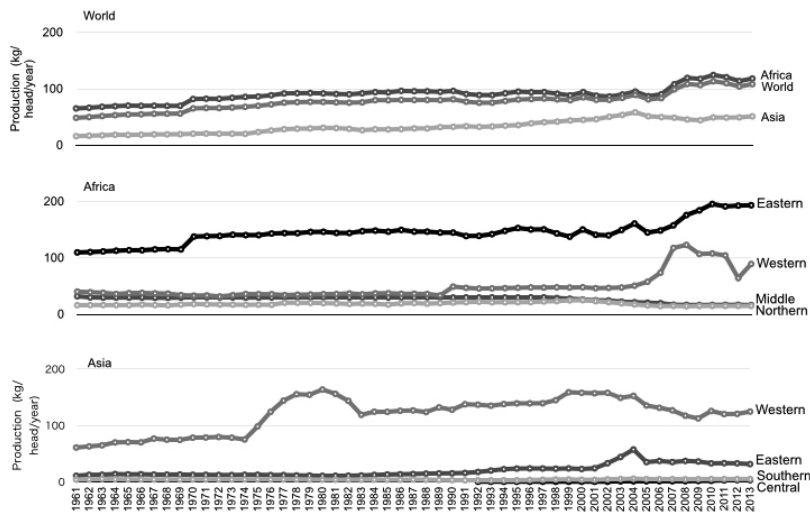


Fig. 14 Camel milk production per animal in the World (top), in Africa (middle) and in Asia (bottom) from 1961 to 2013. (Data from FAOSTAT⁽¹⁰⁾)

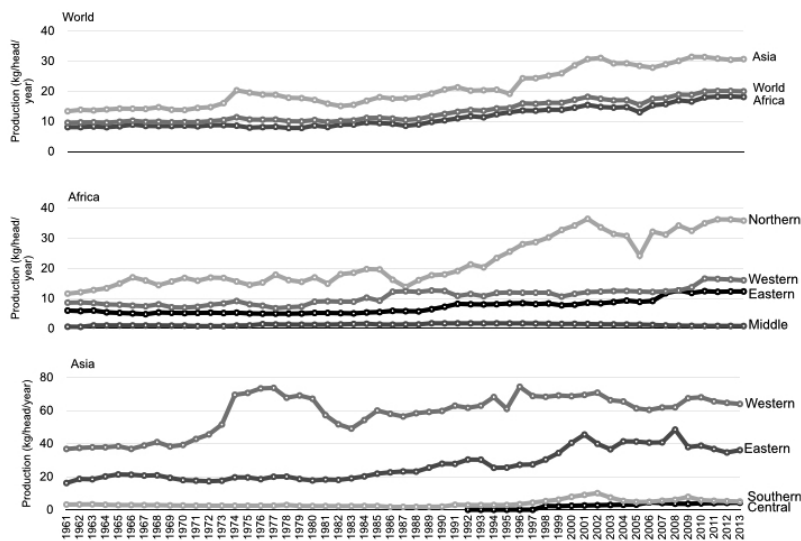


Fig. 15 Camel meat production per animal in the World (top), in Africa (middle) and in Asia (bottom) from 1961 to 2013. (Data from FAOSTAT⁽¹⁰⁾) Note the difference in scales.

Camel meat production per camel per year in Asia has been 1.3 to 1.7 times larger than that in Africa. This again shows the importance of camel meat production in Asia.

Concluding remark

The above data indicate that the production of camel milk and camel meat has been increasing from 1961 to 2013. Both the increase in stock number and improvement in productivity contributed to the increase in food production from camels. It is also to note that the major product of camel vary among regions.

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