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## Milk and body fats from farm animals: Production trends

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### Abstract

Farm animals are used from ancient time for production of milk, meat and animal body fats. Milk and animal body fats are part of diet of all modern humans. Milk fat and animal body fat hold unique place as they do not only provide energy but are major contributor to food flavor and contribute to mouth feel. Production trends of milk and body fats provide information not about only production patterns but consumption patterns too. Knowing this information helps industry as well educators in getting idea of what is happening at global scale in milk and animal fat production. It was found in this study that butter is produced in highest quantity from animal milk fat, followed by ghee. Major animal body fats produced are lard and tallow and they are produced in equivalent quantity to milk fat. Both milk fats and animal body fats are showing similar net positive overall growth rate. It was also discovered that most of products, production is concentrated in few countries.

**Keywords:** Butter, ghee, lard, tallow, production, scenario, trends

### Introduction

Edible fats and oils can be divided in two categories. Vegetable oils like palm oil, soybean oil, canola oil, sunflower oil etc. make one category and animal fats like lard, tallow, butter and fish oils form another category. As far production quantities are concerned vegetable oil production far outstrips animal fat production as per FAO [1]. World produces 1154727 thousand metric ton vegetable oils compared to 24842 thousand metric ton of farm animal fat i.e. vegetable oils are 46 time more abundant than farm animal fats as per year 2017, FAO production figures. One can see review by Patel et al. [2] for trends in vegetable oil production. This paper is about drawing conclusions from production figures of milk fat and animal body fats. Here production, growth rate and countrywide production trends are discussed first for milk fats and then for animal fats. Similar studies are already reported in literature for various other agricultural products [3-6].

Milk and animal body fats are unique in that they are more toward solid nature at room temperature [7]. This historically provided them with opportunity to give special body and texture which vegetable oils cannot provide though this niche use is now directly threatened by hydrogenated vegetable oils as hydrogenation can change liquid vegetable oils in semisolid or solids fats. But hydrogenated fats have their own disadvantages one being high trans-fat content and other being try-acyl glycerol composition which give different melting profile and crystallization behavior [8]. Another problem with hydrogenated fat is that it lacks natural flavor of body fats i.e. lard or ghee which is main attribute for consumer acceptability [9]. Further it is not allowed legally to add hydrogenated vegetable oil in animal body fat if you want to claim it is pure item for example pure ghee cannot have hydrogenated or any other kind of vegetable oil by law in India [10]. Thus animal body fats have unique unmovable position in oils and fats market and it will remain so till foreseeable future though cheaper substitute items may replace them on long run as it happened with butter and fat spreads case [11].

### Methodology

The data presented in this paper was obtained from FAO website [1]. It was then processed using spread sheet application to draw relevant conclusions. Only most recent six years data available was taken into consideration, assuming that six years is window long enough to provide meaningful insights in trends. It must be noted that agricultural output can vary due to seasonal effects i.e. one year may be draught year and another may be flush year.

Thus just comparing any two years is not enough to calculate growth rate in production. For that reason when growth rate is calculated it is based on comparing first three year average and last three year average out of six recent year data taken in study. All figures are in thousand metric tons.

## Results and Discussion

### World butter and Ghee production

**Table 1:** World dairy fat production in thousand metric tons

Fat Source	2014	2015	2016	2017	2018	2019
Butter, cow milk	5364	5364	5448	5440	5400	5316
Ghee, buffalo milk	3421	3524	3605	3744	3890	3933
Butter, buffalo milk	1518	1548	1559	1612	1654	1686
Ghee, and butter oil cow milk	258	270	279	288	315	319
Butter and ghee, sheep milk	57	61	59	67	65	66
Grand Total	10618	10767	10950	11152	11323	11320

It can be seen from above table that cow milk is most widely used for butter production and followed by distant second buffalo milk as source of butter. Contribution of other dairy animals to butter is negligible i.e. sheep and goat. Out of 100% butter produced by cow and buffalos, cows contribute 78% while buffaloes only 22%. Reason for this trend can be ascribed to almost exclusive use of cow as dairy animal in America, Europe and Australian continents as it can be seen from contrariwise production data by FAO [1]. In these areas butter is popular dairy product thus most of (94% as of 2019) cow milk fat is diverted to butter making. This is evident from Table 1 year 2019 figures i.e. 5316 thousand metric ton butter production vs. 319 thousand metric ton ghee and butter oil production from cow milk fat. Buffaloes are only found in Indian subcontinent and Africa. In Indian subcontinent high yield cows are adopted as buffalo milk production is less in quantity compared to cow, thus making cows more economically viable [12, 13]. Africa has buffaloes but lack organized dairy industry processing buffalo milk and this is evident from the fact that, FAO list no African country for buffalo milk fat products [1] as shown in Table 1. Thus in overall production relative dominance of cows is assured and likely to increase over time. We can see from Table 1, 2019 production figures, that large portion of buffalo milk fat (70%) is converted in ghee making and butter making is only account for minority (30%) use because ghee is more popular product in Indian subcontinent (major buffalo milk producing region) compared to butter [1].

### Growth in Production

**Table 2:** Percent growth in dairy fats production

Animal fat	% Growth per year
Butter, cow milk	0.0
Ghee, buffalo milk	3.2
Butter, buffalo milk	2.4
Ghee, butter oil of cow milk	4.8
Butter and ghee, sheep milk	3.9
Grand Total	1.5

If we see growth rate we can see that cow milk butter production is stagnant but ghee and butter oil production from cow milk is increasing at largest rate among all listed products in Table 2. The reason for this trend can be ascribed to growth of organized dairy sector in Indian subcontinent [14] along with

increasing popularity of cow as dairy animal in this region [12, 13] along with the fact that ghee is major use of milk fat in this region as we concluded earlier. Ghee and butter production from buffalo milk also show increasing trend due to growing organized dairy sector in Indian subcontinent [14] but it is evident from Table 2 that buffalo milk fat is showing more growth in ghee production compared to butter production. As stated earlier this can be ascribed to relatively more popularity of ghee compared to butter in Indian subcontinent. Sheep milk fat used for butter and ghee making is showing good growth rate in relation to other products, though total production is far less compared to cow and buffalo milk. The reason for growth in sheep milk fat is growth in world sheep stock and sheep milk yield due to demand of sheep milk cheeses [15]. Overall animal derived fat production growth rate is 1.5% while world population growth rate is hovering at around 1% [16]. This may create Malthusian catastrophe [17] as human population grows in proportion to existing population while farm animal produces are expected to grow at constant rate from baseline i.e. exponential growth is not expected.

### Contrariwise Production

#### Cow Milk Butter

**Table 3:** Percentage share of top cow milk fat butter crop producer countries

Country	2014	2015	2016	2017	2018	2019	Growth %
USA	15.7	15.6	15.3	15.4	16.5	17.0	2
New Zealand	10.6	10.6	10.3	9.0	9.3	9.5	-4
Germany	8.2	8.6	8.4	8.0	9.0	9.4	1
France	6.3	6.3	6.7	6.4	6.5	6.6	0
Russia	4.7	4.8	4.6	4.9	4.9	5.1	2
Total	45	46	45	44	46	48	0

Top five countries contribute only 45-48% of total cow milk butter production (Table 3) whereas in case of ghee top five countries account for 100% production (Table 4) indicating less concentrated worldwide production. The reason for popularity of cow milk butter in top producer countries can be ascribed to European origin population in these contraries [18] which share food preferences. Despite population growth, butter demand is not increasing in these counties due to negative health value associated with milk fat which is evident from zero growth overall growth rate of cow milk butter in this countries. Actually diet cholesterol is not of much importance in controlling blood cholesterol [19] but the myth is perpetuated through advertisement and result in stagnant butter demand though population is on rise. It must be noted that vegetable oils which are heralded as healthier alternatives and are much cheaper than animal fat [20] which also negatively affect animal fat production.

#### Buffalo Milk Ghee

**Table 4:** Percentage share of top buffalo milk fat ghee producer countries

Country	2014	2015	2016	2017	2018	2019	Growth %
India	86.2	86.2	86.8	86.9	87.0	86.8	3
Pakistan	13.3	13.3	12.7	12.6	12.5	12.7	2
Nepal	0.5	0.5	0.5	0.5	0.5	0.5	4
Bangladesh	0.0	0.0	0.0	0.0	0.0	0.0	0
Total	100.0	100.0	100.0	100.0	100.0	100.0	3

Although buffalos do exist in Africa, ghee production is nonexistent there due to two facts i.e. lack of cultural tradition to eat ghee and lack of organized dairy sector in Africa. Thus Indian subcontinent is only place where buffalo ghee is produced consumed on large scale as it can be seen from production figures. India is foremost country in Ghee production due to demand by local population and development of organized dairy sector. Ghee production is growing at overall 3% and India, Pakistan and Nepal i.e. only contribute to this growth. Among top producers Nepal is clocking maximum growth due to growth of industry as whole i.e. more buffalos and more processing plants <sup>[21]</sup>.

### Buffalo Milk Butter

**Table 5:** Percentage share of top buffalo milk fat butter producer countries

Country	2014	2015	2016	2017	2018	2019	Growth %
India	53.6	54.7	55.9	56.2	56.4	56.3	3
Pakistan	37.5	37.8	36.8	36.6	36.7	37.1	2
Egypt	6.7	5.4	5.2	5.1	4.7	4.4	-4
Nepal	1.4	1.3	1.4	1.4	1.4	1.4	4
Total	99.2	99.2	99.2	99.3	99.3	99.3	2

Situation is same as ghee in case of butter from buffalo milk butter but instead of countries of Indian subcontinent other countries are also involved. India, Pakistan and Nepal show growth rate with is similar to ghee but Egypt shows marked decline. The reason is same as discussed earlier i.e. high yield cow population competition with buffalo population and thus growth in buffalo milk and products are in general decline. The low buffalo milk yield problem in Egypt is already cited as reason of concern in literature <sup>[22]</sup>.

### Cow Milk Ghee and Butter Oil

**Table 6:** Percentage share of top cow milk fat ghee and butter oil producer countries

Country	2014	2015	2016	2017	2018	2019	Growth %
India	54.2	57.4	58.8	61.0	60.0	59.4	7
Bangladesh	9.8	9.7	9.7	9.5	9.0	9.2	3
Ethiopia	5.5	5.0	4.8	4.6	4.3	4.4	0
Tanzania	4.4	4.3	4.3	4.1	4.3	4.2	4
Total	73.9	76.5	77.5	79.1	77.6	77.2	6

Here you can see that cow milk derived ghee and butter oil production is increasing in India at fastest pace and this partly due to development of organized dairy sector i.e. Amul pattern <sup>[14]</sup> and partly due to more growth is occurring in cow milk production compared to buffalo milk production due to popularity of high yielding cow varieties <sup>[12, 13]</sup>. If this trend continues it will lead to more and more domination by India. Bangladesh is at distant second position followed by Ethiopia and Tanzania. As stated earlier vegetable oils are heralded as healthier alternatives and are much cheaper than animal fat <sup>[20]</sup> but they are not able to affect ghee in India as it affect cow milk butter producing countries. India is exception in this trend due to strong organized dairy sector growth <sup>[14]</sup> which also helps in maintaining consumer preferences.

### World Lard and Tallow Production

**Table 7:** World lard and tallow production in thousand metric tons

Fat	2012	2013	2014	2015	2016	2017
Lard	6574	6844	6730	6897	7034	7271
Tallow	5922	6041	6342	6429	6420	6419
Grand Total	12496	12885	13073	13326	13454	13690

Lard is pig body fat and used for its unique physical properties it provide because of its solid nature like butter. Lard can be considered butter of poor people. Tallow is cow or buffalo body fat. Tallow is widely in bakery industry as shortening to substitute butter to bring down cost. Both lard and tallow can be considered byproducts of meat industry. We can see that both lard and tallow are produced in comparable quantities. Further collectively lard and tallow production (13690 thousand metric ton) is comparable to milk fat (11323 thousand metric ton) but slightly more than milk fat.

### Growth in Production

**Table 8:** Percent growth in lard and tallow production

Body fat	% Growth per year
Tallow	1.3
Lard	1.8
Average	1.7

Production of animal body fats shows 1.7% growth and lard production is growing at faster pace compared to tallow production. This suggests in future lard will become slightly more dominant. Reason for this faster growth in lard can only be ascribed to preference by people because in general animal body fats are under pressure from decline due to availability of substitutes made from vegetable oils with healthier image and cheaper rates <sup>[20]</sup>. But we cannot expect lard and tallow to completely disappear as they are by products of meat industry and long entrenched consumer preferences perpetuates their existence. It should be noted as discussed earlier, that constant growth rate of commodities is not enough to cover population growth predicting commodity boom in prices.

### Contrariwise Production

**Table 9:** Percentage share of top tallow producer countries

Tallow	2014	2015	2016	2017	2018	2019	Growth %
USA	53.7	53.1	54.9	54.7	52.5	53.3	1
Brazil	9.4	8.7	8.8	9.0	10.9	10.7	6
Australia	8.7	8.8	7.2	7.2	8.0	7.7	-1
Canada	3.7	3.4	3.5	3.6	3.8	3.9	4
France	1.1	2.8	2.8	2.8	2.9	2.8	10
Total	77	77	77	77	78	78	2

If we see country-wise production figures, we can see that tallow production is concentrated in few countries i.e. top five produces contribute almost 80%. USA is single largest producer of tallow. The reason is USA is dominant in tallow industry its large meat production industry of which tallow is by-product. It can also be seen that production of tallow is stagnant in USA. Only Brazil, Canada and France is showing growth among top five producers. As production of meat is projected to rise with population <sup>[23]</sup> we can expect same with tallow and other body fats.

**Table 10:** Percentage share of top lard producer countries

Lard	2012	2013	2014	2015	2016	2017	Growth %
China	37.6	37.9	39.7	39.6	39.3	38.2	2
Germany	10.6	10.4	9.4	9.7	8.9	8.8	-2
Brazil	7.5	7.5	7.0	6.9	7.4	7.7	2
USA	6.7	6.5	6.1	6.4	6.6	6.8	3
Russia	5.1	5.5	5.5	5.7	6.1	6.4	7
Total	67	68	68	68	68	68	2

In lard production top five nations contribute close to 70% instead of 80% found in case of tallow i.e. less regional concentration of production. Whereas in tallow USA is responsible for words 50% production, China holds the crown of largest lard producer at 37% level. The reason is human preference for different kind of body fats based on region<sup>[24]</sup>.

### Conclusions

Many prominent trends were observed in this analysis. It was found that among dairy fats butter is commodity produced in highest quantity. Within butter category, cow milk butter is produced in highest quantity followed by buffalo milk butter. Ghee which is popular product in Indian subcontinent is second most produced commodity from dairy fats and for this buffalo milk fat is used almost exclusively. Dairy fat production has 1.5% growth rate which is comparable to lard and tallow growth rate of 1.7%. Among dairy fat ghee and butter oil production from cow milk has highest growth momentum of 4.8% which is not matched by either lard or tallow due to development of organized dairy sector and popularity of high yield cow breeds as dairy animals. There are regional differences and some countries dominate in some products while others dominate in different products. USA is leader in cow milk fat butter production with 15% of world production along with 54% of world tallow production. India cranks out 86% of word buffalo milk ghee, 54% of world buffalo milk fat butter and 54 % of world cow ghee and butter oil combined production. China is top lard producer country with 38% share in production. On overall animal body fats are produced in slightly more quantity of 13000 thousand metric tons compared to 11000 metric ton production of dairy fat. Efforts must be done to increase production of farm animal produces to cover exponentially growing human population to avoid shortages.

### Conflict of Interest

All the authors involved in this study hereby declare that there is no conflict of interest involved any way in this study.

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