# Have Eggs Gotten Smaller Since *Matan Torah?*

By Avraham Yehuda Greenfield

Everyone has heard the old question: Which came first, the chicken or the egg? Here we will deal with the Jewish version of this question: Which came last, the modern chicken egg or the *Matan Torah* egg? In other words, are today's eggs significantly smaller than the eggs at the time of *Matan Torah*?

The importance of Torah units of measure cannot be overstated. These units are indispensable in carrying out *mitzvot* and quantifying Torah concepts and ideas. For example, at the Pesach Seder we use these measurements to determine how much matzah to eat and how much wine to drink. The required amounts are surprisingly large. A *kezayit* of matzah ranges as high as 1/2 or even 2/3 of a machine matzah.[1] The 150cc requirement for each of the four cups of wine also seems excessive. And the amount of horseradish required for *maror* may even endanger one's health.

Many of the required volumes are so large because they are based on a measurement of the Noda B'Yehudah (1713-1793), which we will discuss shortly.

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## Eggs

In order to answer the question above, it is vital to first understand the volume of the egg, one of the most important Torah units of measure. Most halachic measures of volume are defined as a given number of eggs.[2]

a *revi'it* equals 1.5 eggs
a *toman* equals 3 eggs
a *lug* equals 6 eggs
a *kav* equals 24 eggs
a *seah* equals 144 eggs
an *omer* equals 43.2 eggs
an *efah* equals 432 eggs
a *homer* equals 4,320 eggs

The egg also plays a central role in connecting volume and linear measures, based on the relation that one egg volume is 7.2 cubic thumbs.[3]

## The Famous Discrepancy

It was concerning this relation between eggs and thumbs that the Noda B'Yehudah came upon his famous discrepancy.[4] The required volume of flour for taking *challah* is an *omer*, which equals 43.2 egg volumes. Traditionally, the Geonim measured the *omer* in terms of eggs, never in terms of thumbs.

The Noda B'Yehudah decided to build two *omer*-sized vessels: one based on egg volumes and a second, on thumbs. To his amazement, the volume of the thumb-based *omer* turned out to be almost twice as large as the egg-based *omer*, which was a far cry from the equality that Rambam had discovered. The Noda B'Yehudah surmised that either eggs had gotten smaller or thumbs had gotten larger. He concluded that during the time of *Chazal*, eggs must have been almost twice as large as they were in his generation. In other words, the volume of an egg had become gradually smaller until it was reduced to only half of the size it was during the time of *Chazal*. To take into account the decrease in egg volume, the Noda B'Yehudah decided that all volume measures (egg, *kezayit*, *revi'it*, et cetera) must be doubled. It is this assumed change in the size of the egg that has given rise to the huge amounts that we eat and drink to fulfill the *mitzvot* at the Seder.[5]

However, many old responsa of the Geonim that were found a century ago seem to contradict this. In particular, Rav Sherira and Rav Hai Gaon write that various foods (such as eggs and olives) were chosen as units of measure because they are available everywhere and "do not change."[6] This is further substantiated by Rav Avraham Yitzchak Kook who writes:

*The words of the Gaon are explicit, that there is no need to worry that measures may change. In addition, I have heard from a trustworthy source that embalmed eggs were recently found in Egypt…having the same volume as our eggs.*[7]

Rav Kook concludes that, "this is strong support for the words of the Gaon Rav Sherira." All of this was unknown at the time of the Noda B'Yehudah.

Notwithstanding the definitive claim of the Geonim, were the eggs of *Chazal* really twice as large as the eggs were in the days of the Noda B'Yehudah? To answer this question, we shall determine the size of the egg at five specific milestones (see Table I)

**Table I. Milestones**
***Hebrew & Secular Dates***

**2400 (1400 BCE):** *Matan Torah*
**3100 (700 BCE):** King Chizkiyahu, 700 years after *Matan Torah*
**4000 (200 CE):** Time of *Chazal*, 900 years after King Chizkiyahu
**4960 (1200 CE):** Rambam, 1,000 years after *Chazal*
**5560 (1800 CE):** Noda B'Yehudah, 600 years after Rambam
**5760 (2000 CE):** Present, 200 years after Noda B'Yehudah

## Matan Torah Eggs

The Gemara (*Eruvin* 83a) relates that a special vessel, called a *modia*, was sent to Reb Yehudah HaNasi. According to Tosafot and Ritva, the volume of this vessel was 207 desert eggs, that is, eggs from the time of *Matan Torah*.

The *modia* was a standard Roman vessel, whose volume was known to be one-third the volume of another standard Roman vessel, called the *amphora*. Fortunately, a complete *amphora*[8] vessel has survived to our day. From the volume of this *amphora*, one finds that the volume of an egg at the time of *Matan Torah* was 45cc.[9]

## Chazal Eggs

At the time of *Chazal,* Reb Yehudah HaNasi measured the volume of the *modia* and found it to hold 217 eggs. This implies an egg volume of 43cc,[10] which is only a 5 percent decrease from the *Matan Torah* value.

## Are today's eggs significantly smaller than the eggs at the time of *Matan Torah?*

## Rambam Eggs

One thousand years later, Rambam found that one egg volume of water is equal in weight to 11.7 silver dinars, which had been determined by the Geonim to be equal in weight to the gold *shashdang*,[11] a famous Arabic coin, weighing 4.23 grams.[12] The *shashdang* was noted for its precision minting and widespread usage over the centuries in many places. Rambam's measurements therefore imply an egg volume of 49cc,[13] which is 9 percent larger than the *Matan Torah* egg.

## Noda B'Yehudah Eggs

Six hundred years after Rambam, the Noda B'Yehudah measured 43.2 eggs of his day and found their volume to be exactly equal to one *phint*[14] (2 liters). This yields an egg volume of 46cc,[15] only 2 percent more than at the time of *Matan Torah*.

These results are summarized in the first four lines of Table II.

**Table II**

| Date | Egg Volume | |
|---|---|---|
| Date of *Matan Torah* | 45cc | N/A |
| Date of *Chazal* | 43cc | -4% |
| Date of Rambam | 49cc | +9% |
| Date of Noda B'Yehudah | 46cc | +2% |
| Date of King Chizkiyahu | 46cc | +2% |

We note with satisfaction the striking consistency between the various values for the volume of the egg, measured at three different dates, which differ from the *Matan Torah* value by only a few percentages.

## Matan Torah Ratios

We have seen that the egg volume has remained very close to its *Matan Torah* value over several millennia. However, we have not yet demonstrated that there is consistency between this egg volume and other units of measure at the time of *Matan Torah*. Therefore, let us determine the size of the *amah* at *Matan Torah* and derive from it the corresponding volume of the egg for comparison with the above-determined *Matan Torah* value. We will thus demonstrate the striking consistency of the measurements.

## King Chizkiyahu's Tunnel

One of the great feats carried out by King Chizkiyahu was the carving out of a tunnel and an adjoining pool (Bereichat Hashiloach) from bedrock. The purpose of this tunnel was to bring the water of the Gichon spring to this pool. The tunnel was designed to stay within the city walls, where it would be inaccessible to an enemy laying siege; it would also help supply the water needs of the city. The workers started to carve out the tunnel at the same time from opposite ends. We can appreciate their joy when they finally came close enough to hear the sound of one another's pickaxes, as described in the engraved message on the wall of the tunnel. This message was discovered about one century ago, after remaining unnoticed for more than three millennia:

*. . . and this is the matter of the tunnel, when the workers on each side heard the sounds of their pickaxes and when they were three* amot *apart, they could hear the shouting of each other's voices. On the day they broke through, pickax to pickax, and the water flowed from the spring to the pool, 1,200* amot.[16]

## The Amah and the Egg

The distance from the spring to the pool was 1,200 *amot*, known precisely in meters, because the tunnel, including the two ends, was carved from the

original rock. The length of the tunnel was measured almost one century ago and found to be 533 meters,[17] yielding an *amah* of 44.4 cm. Since there are 24 thumbs to an *amah* and 7.2 cubic thumbs equal an egg volume, a simple calculation[18] yields an egg volume of 46cc, which is only 2 percent larger than the *Matan Torah* value of 45cc (last line of Table II). We see that, once again, the consistency with the other values is striking.

It could be argued that the *amah* measured at the time of King Chizkiyahu was not the same *amah* as the one at the time of *Matan Torah*, rather the *amah* of 700 years later. However, the Mishnah (*Kelim* 17: 9) tells us that as long as the First Temple stood, standard *amah* bars from the time of Moshe Rabbeinu were kept in the Shushan room of the Temple. Thus, the *amah* in Chizkiyahu's time was the same as the *amah* at *Matan Torah*.

## Eggs are Getting Larger

Finally, we note that during the last century—particularly the last fifty years—the average egg volume has increased substantially, to about 60cc, due to the special breeding and diets of chickens. Thus, there is no evidence that eggs have shrunk by half. Quite the contrary. With time, they have significantly increased in size.

A great advantage of using the *Matan Torah* values is their fixed sizes for all units of measure, as derived from the *Matan Torah* value of the egg and of the *amah*. This avoids the need for frequent checks for changes of any of the units of measure. Under this fixed system, we may safely ignore the large increases artificially assumed for the "average" egg of today and rely completely on the *Matan Torah* value.[19]

## Encyclopedias

We now turn to a sensitive subject: using encyclopedias to support statements about *halachah*. Some might hesitate to depend on secular sources.

**The importance of Torah units of measure cannot be overstated. These units are indispensable in carrying out *mitzvot* and quantifying Torah concepts and ideas.**

But this hesitation disappears when we study the words of Rav Yaakov Yisrael Kanievsky, *z"l*, who wrote:

*. . . and why was he such an expert . . . it was certainly by his study of the official history books and government records. Clearly, governments are very particular that the information presented about coins, weights, measures, et cetera, is not worse than* Arkaot *[information in documents from Gentile courts]* (Gittin *10b, and* posekim), *concluding that this evidence is as good as* Arkaot.[20]

Similarly, Rav Yisroel Yaakov Fisher, wrote:

*If the words brought from the encyclopedias are correct, and since Rav Sherira Gaon wrote that volume measures are mainly based on the egg, one is inclined to agree that the volume of the egg must remain the way to determine the* halachah.[21]

We have demonstrated that the major assumption for explaining the discrepancy found by the Noda B'Yehudah—that the volume of the eggs of *Chazal* were twice as large as the eggs of today—is not tenable. This is demonstrated by showing that the egg volume had virtually the same *Matan Torah* value of 45cc at five different times extending over a period of more than three millennia.

**Notes**

1. Rav Yaakov Yisrael Kanievsky, *Shiurin Shel Torah*, 66.

2. It is widely accepted to consider the *kezayit* to be half the volume of an egg. However, a careful study of the sources shows the correct ratio between the egg and the olive is the ratio between their average natural values, about 45cc vs. 5cc, roughly 10 to 1. See, for example, A. Greenfield, "The Ratio Between the Volume Measures of the Egg and Olive," *Tehumin* 14 (5754): 405-407; Rav Hadar Margolin, "Clarification of the Hazon-Ish System for the Olive Measure," *Moriah* (Elul 5753): 99.

3. Derived from the volume of a mikvah: 40 *seah*=3 cubit *amot*=5,760 egg volumes.

4. Noda B'Yehudah, *Tzelach, Pesachim*, 116b.

5. Chazon Ish, *Hilchot Shabbat*, 39, *Kunteres Hashiurim*, sec. 5. This is the basis of the large *shiurim* of the Chazon Ish, central to which is an egg volume of 100cc and a thumb of 2.4 cm. Much smaller *shiurim*, closer to the value proposed here, are associated with Rav Avraham Chaim Naeh. In addition, there are other important *posekim* who reject the concept that the egg volume was 100cc and decreased by half (see, for example, *Mishnah Berurah*, 271:67).

6. Hayim P. Benish, *Midot Veshiurei Torah* (5747): 30 (Geonim).

7. Comments of Rav Kook on *Otzar Hagaonim*, Levin, 5692, *Betza* (*Yom Tov*), 61.

8. Yaakov Gershon Weiss, *Midot Umishkalot shel Torah* (Jerusalem, 5744), 376 (*amphora*).

9. That is, 9,300/207=45cc.

10. That is, 9,300/217=43cc.

11. Benish, 462 (*shashdang*).

12. Weiss, 82 (*dinar* weight=4.23 g).

13. That is, 17.5/1.5 (=11.7) x 4.23=49cc.

14. Weiss, 231 (*phint*).

15. That is, 2,000/43.2=46cc.

16. *Jewish Encyclopedia* 11, (1905), 340. A replica is shown of the old Hebrew script, transliterated into the current block script; and a translation is given in English. (Unfortunately, the English has a glaring error, the length of the tunnel is listed as 200 *amot*, instead of 1,200 *amot*, as clearly stated in the Hebrew texts.)

17. H. Vincent, *Revue Biblique* (1912), 425-6 (in French).

18. That is, 44.4/ 24=1.85 cm/thumb and $1.85^3$ x 7.2=46 cc.

19. For a resolution of the contradiction found by the Noda B'Yehudah, see A. Greenfield, "Measure for Measure," *Moriah* (Tamuz, 5742), particularly p. 61, sec. 5.

20. Kanievsky, 79.

21. Quoted from a letter of *haskamah,* written to me by Rav Fisher and published in *Hama'ayon* (Tamuz, 5748), 62. JA