



A COMPARATIVE ANALYSIS OF HUMAN EMBRYOLOGY IN BUDDHIST TEACHINGS AND MODERN MEDICAL SCIENCE: INSIGHTS ON PARENTAL GRATITUDE

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Abstract: The most important intention of this paper is to analyze materials concerning human embryology in Buddhism in order to reflect the gratitude of parents and in Medical Science and critically compare them in order to acquire improved comprehension about the different perspectives. By means of comparing these two different fields of study, it aims to make Buddha dhamma living, how difficulty to become a human life, to know the importance of parents' gratitude and relevant to modern society in Buddhist perspective.

Mainly the paper will emphasize the morphological appearance and size of the embryo with its respective age or period of gestation. The developmental stages with their respective names such as *Abbuda*, *Pesi*, *Gana* and *Pasākhā* will be elucidated to determine the growth of the embryo week by week from Buddhist perspective. Furthermore, the paper contains the illustration of the process of normal labour, sufferings of mother as well as baby during the pregnancy and process of delivery, reasons for abortion mentioned in both Buddhism and Medical Science will also be studied.

Overall, the essential part of this work assembles systematized compilation of the data concerning the human embryology scatter throughout the Pāli Canonical texts, commentaries and sub-commentaries. Specially, for this study the *Abhidhammatthasaṅgaha* will be the key to unlocking this vast storehouse of Buddhist knowledge.

Keywords: Parents, Gratitude, Buddhism, Embryology, Morphological, Medical, Science, Foetus, conception

INTRODUCTION

Nowadays, with the development of medical sciences such as human embryology, the Buddha's teachings are more profound when they are researched more comparatively, and not only medical scientists but also most of the world's people have accepted the Buddha's *Abhidhamma* and teachings. Western doctors and scientists started to know about embryology around 300 years ago. But the Buddha discovered and expounded in detail about the embryo over 2,500 years ago, without any X-ray, telescope, microscope, or any mechanical equipment. In this paper, the author will discuss emphatically human embryology, not only from a Buddhist perspective but also from a medical science perspective. It is worthwhile to elaborate a little further on how human embryos and parents' gratitude are concerned and how rare to get human life.

According to Sagāthāvagga Saṃyutta, the Buddha expounded that there are five kinds of very rare opportunities to get. They are (1). To become a Buddha is very rare, (2). To become a human being is very rare, (3). To be a generous person is very rare, (4). To become a monk in the dispensation of Buddha is very rare and (5). To hear the truth *Dhamma* of the saint is the rarest. So, the author would like to highlight the second point of rare opportunity to become a human life.¹

Therefore, for the study of human embryology, the term "Embryology" generally means the scientific study of the development of embryo. According to the Oxford Advanced Learner's Dictionary "embryo" means "a young animal or plant in the very early stages of development before birth, or before coming out of its egg or seed, especially a human egg in the first eight weeks after fertilization"². Moreover, it is also necessary to give the meaning of the word "foetus" which means fully developed embryo in the womb or in an egg³

¹ Sagāthāvagga Saṃyutta commentary, P.225.

² A.S.Hornby, E.V. Gatenby, H.wakefield, The Oxford Advanced Learner's Dictionary of Current English 2nd ed (London: Oxford University Press, 1964), 323.

³ Ibid, 385.

In the *Mahātaṇhāsaṅkhaya Sutta*, there it is said that there are three factors which are indispensable for achieving pregnancy. The followings are these three factors;

- (i) The union of the father and mother (*Mātāpitāro ca sannipatitā honti*)
- (ii) The mother is in her period too (*Mātā ca utunī hoti*), and
- (iii) The being to come into being is present (*Gandhabbo ca paccupaṭṭhito hoti*)⁴

The combination of these three factors resulted in conception. If any one of these three things are absent, there will be no conception.

From the *Theravāda Abhidhamma* point of view, every being in the thirty-one realm of existence except the *Arahat* (who realized the Noble Path) has to die in this present life and will be born in new existence according to his or her own deeds either good or bad without any delay.

The *Abhidhamma* states that while the death consciousness and the consciousness that links rebirths are intimately associated, they are not considered to be one and the same, nor are they forever connected; rather, their relationship is a process. The *kammic* energy required to propel the death consciousness into rebirth-linking consciousness in a new existence, carrying the *kamma* of one existence into the next, is generated through the process of consequences as cause and effect.⁵ Rebirth-linking consciousness does not come from previous existence and enters or remains in the new existence. Indeed, any phenomenon belonging to the previous existence does not transmigrate to another existence. Rebirth-linking consciousness does not arise in another existence without any condition belonging to the previous existence. It is like the echo, the lamp, or the seal.⁶

From the medical point of view, "Normal fertility is dependent on many factors in both the man and the woman. The male must produce a sufficient number of normal, motile *spermatozoa*⁷ that can enter the *urethra* through patent pathways to be ejaculated and deposited at the appropriate time for fertilization. After deposition, the male gametes must be able to penetrate and be sustained in the cervical mucus. Following *capacitation* and *acrosomal* reaction, the preparation of the spermatozoa for fertilization, they must ascend through the uterine cavity into the fallopian tube to meet the ovum.

Having understood the normal physiology of reproduction," it is appropriate to consider the couple as the "biologic unit" of reproduction."⁸ The primary cause is more frequently observed in females than in males, although semen research reveals that 40 percent of the affected husbands exhibit some level of reduced fertility. However, the male partner is solely responsible for only 10 percent of the cases. Out of every 100 males who get married, one is completely infertile.⁹

MORPHOLOGY OF THE EMBRYO ACCORDING TO BUDDHISM

This section deals with form and structure of the human embryo in accordance with the Pāli Texts, Commentaries and Sub-commentaries. Morphological appearance, dimension and size of the embryo with respect to its gestational period will be studied here as well.

According to the *Theravāda* Buddhism, when all the necessary conditions (main factors) required for conception which has already discussed in previous unit are fulfilled, the *rūpas* (material phenomena) of the being start to arise. They arise simultaneously with the arising instant of the *paṭisandhi citta* (rebirth-linking consciousness) that is the commentarial usage of *viññāṇa*. According to Buddhism the so-called human being is mere the composite of mind and matter, they could not come to be existed without cause.

Only three material groups arising from *kamma* (*kammaja kalāpa*) are obtained in spite of nine *kammaja kalāpas*, which are fashioned from the eighteen *kammaja rūpas*. The *kammaja rūpa* means material phenomenon arisen out of past *kamma*. *Kamma*, here means *cetanā* (volition) in the past.

According to Buddhist texts, when the rebirth-linking consciousness arises, the three material groups born of *kamma* also arise simultaneously. Indeed, it means they arise at the rising instant of the rebirth-linking consciousness though each consciousness has three instants viz., arising, existing, and dissolving instant.

The three *kammaja kalāpas* obtained at the time of conception are as follows.

- (I) *Kāyadasaka* (Body decad)
- (II) *Vatthudasaka* (Heart decad)
- (III) *Bhāvasakasaka* (Sex decad)¹⁰

I. *Kāyadasaka* (Body decad)

Kāyadasaka (Body decad) is made up of eight *avinibbhoga rūpas* (inseparable material phenomena), *jīvita rūpa* (material quality of life) or *jīvitindriya* and *kāya-pasāda* (sensitive part of the body). As a result, *kāyadasaka* in line with its name contains ten material phenomena.

II. *Vatthudasaka* or *Hadayadasaka* (Heart decad)

It consists of eight *avinibbhoga rūpas* (inseparable material phenomena), *jīvita rūpa* and *hadaya-vatthu* (the heart base). In this *kalāpa*, only the *hadaya-vatthu* (the heart base) is needed to elaborate since the other two have been mentioned before.

The heart's base, known as *hadaya-vatthu*, spreads throughout the blood inside the heart. It serves as the consciousness's depends (*manoviññāṇa*). There are billions of *hadaya-vatthus* distributed throughout the blood of the heart. This *kalāpa* has ten material phenomena too.

⁴ M.I.332 Mahātaṇhāsaṅkhaya Sutta, cf. Vin.A.I.180

⁵ Sayadaw U Dhammapiya, *Nibbāna in Theravāda Perspective* (Selangor: Triple Gem Publications, 2004),73.

⁶ Bhaddanta Sumaṅgalasāmi Thera, *Abhidhammatthavibhāvinī-ṭīkā* (Yangon: KāyasukhaPress,1981), 190.

⁷ Frederic H Martini, and Bartholomew, Edwin F *Essentials of Anatomy and Physiology*.4th ed (San Francisco: Pearson Benjamin Cummings,2007),613.

⁸ Ibid 173.

⁹ Jefcoate. op.cit.,579.

¹⁰ Mon, op.cit.247.

III. Bhāvasaka (Sex decad)

Bhāvasaka (Sex decad) may be either *Pumbhāvasaka* (male sex decad) or *Itthibhāvasaka* (female sex decad) depending on the gender of the embryo. It means if the embryo will develop to be a boy, male sex decad arises and if the embryo will become a girl, female sex decad manifests accordingly.¹¹

For *Pumbhāvasaka* (male sex decad), eight *avinibbhoga rūpas*, *jīvita rūpa* and *pumbhāvarūpa* (male sex decad) are obtainable. Again, for *Itthibhāvasaka* (female sex decad) *itthibhāvarūpa* is obtainable instead of *pumbhāvarūpa*.

If, however, there is a sexless rebirth-connection (*napuṃsaka paṭisandhi*) and the sex decad is mislaid and only the twenty *kamma* natural material phenomena are obtainable.¹² *Purisabhāva* or *pumbhāva* is the material quality that imparts masculinity whereas *Itthibhāva*, material quality that imparts femininity. This *kalāpa* also has ten material phenomena.

The first of these two *viññāna* states is known as death consciousness (*cuticitta*) due to its descent, while the second is known as rebirth-linking consciousness (*paṭisandhi viññāna*) due to its ability to bridge the gap between the start of the next life and the present. It is important to understand that the *kamma*, *sankhāras*, pushing, objective field, etc., are all causes of its manifestation; it has neither come from a past life nor been apparent without them.

An echo, a light, a seal imprint, or an image in the mirror are all examples of this process of continuation. They appear by having the original sound etc., as their cause and come into being existed without going elsewhere, so also the *paṭisandhi viññāna*. It is not coming here from the previous existence and as regards its arising due to causes which are included in past existence. Therefore, neither absolute identity nor absolute diversity should be assumed here.¹³

THE PHYSICAL APPEARANCE OF THE EMBRYO REVEALED IN BUDDHISM

The appearance and form of the embryo is changing in accordance with the period of gestation. These stages are called by different names that are mentioned thus;

“Paṭhamam kalalam hoti, kalalā hoti abbudam,
Abbudā jāyato pesi, pesi nibbattate ghano,
Ghanā pasākhā jāyanti, kesā lomā nakhā pi ca”¹⁴

They are divided into five stages and each stage lasts for seven days.

“First there is *kalala*, after *kalala* there is *abbuda*,
After *abbuda* it becomes *pesi*, *pesi* becomes *ghana*,
After *ghana*, *pasākhā* arise, and also head hair, body hair and nails”

It is worthy to note that, the stages after arising of *pasākhā* were skipped i.e. the sixth, seventh and other weeks, in order to condense the discourse.¹⁵ Although these stages are not mentioned in the Pāli Texts, it should be understood that head hair, body hair and nails appear during the forty-second week.

First, together with the rebirth-linking consciousness there are no names as *Tissa* or *Phussa*, but there is *kalala*. The size of *kalala* is mentioned differently in the commentary particularly in the *Sammohavinodanī* (*Vibhaṅga Aṭṭhakathā*).

The first stage foetus (*kalala*) is minutely small. Its measurement is as much as the liquid that can be drunk by a little fly. Some refused to accept it as being too much and said it is equivalent to a drop hanging on the tip of a needle dipped in oil, withdrawn from the oil, and allowed to drip. This measurement is rejected again and said that one eighth of a single hair of the southern island woman is equal to a single hair of the northern island woman. Again, the *kalala*, which adorns the tip of a solitary hair of the northern island woman, is the size of a droplet, which is dipped into the purified oil, taken out from the oil and allowed to drip. Furthermore, it also is too much larger and exclaimed that it is about the size of an oil drop drizzled from a hair of the forest goat.¹⁶

Moreover, there is *kalala*, which is the size of an oil drop suspended on the tip of a single thread made of three hairs from a newborn baby's wool.¹⁷

Furthermore, the *kalala* resembles a drop of pure sesame oil in appearance and is transparent, pure, clear, and unclouded.¹⁸ The morphology of the *kalala* is given in the *Samyutta Aṭṭhakathā* too. There, the *kalala* is compared to the clarity of a drop of sesame oil or unclouded cream ghee.¹⁹

Within seven days, *kalala* (the first stage embryo) becomes bigger and bigger. From the *Abhidhamma* point of view, all the phenomena that arise will surely dissolve and disappear. From this fact a question may arise why the *kalala* becomes larger instead of smaller and disappear at last. The reason is as the new material groups born of four causes (*kammaja*, *cittaja*, *utuja*, and *āhāraja* *kalāpas* are constantly produced, and old groups dissolve and vanish when their life-time of 17 conscious-moments is completed.²⁰ The arising of number of *kalāpas* are more than the number of *kalāpas* which disappear. So, doing the net amount becomes bigger, larger, and greater.

After seven days, it is no more called as *kalala*, now it is called *abbuda*. In the second week, the arising of the materiality increases greatly and become more mature. The *kalala* fluid is now known as *abbuda*. It is similar in appearance of the water bubble, which has washed the meat. It can be portrayed as yellowish-pink coloured foam (meat-washed-fluid-coloured)

Having established as foam or water bubble for seven days it becomes piece of flesh. Now it is known as *pesi*. It is soft and thick liquid like in consistency. Moreover, this piece of flesh resembles molten lead.²¹ This is the third week. The colour of *pesi* is

¹¹ Mahā Minhla Sithu, “Kāyanupassanākyan” : Contemplation of the Body (Yangon: Hanthawaddy Press, 1953),62. cf. Abhi.A.II, 19.

“rūpasantatiyā ṭiṇi santatisīsāni honti-vatthudasakam, kāyadasakam, ithiyā itthindriyavasena purisassa purisindriyavasena bhāva-dasakanti”

¹² Bhikkhu Nāṇamoli, *The Dispeller of Delusion (Sammohavinodanī) Part I* (Oxford: The Pali Text Society, 1996), 24. see also in Abhi.A.II, 22. “Sace pana napuṃsakapaṭisandhi hāyati. Dvinnāmasakānam vasena samavīsati kammajarūpāni rūpakhandho nāma hoti”

¹³ Nāṇamoli, op.cit., 200.

¹⁴ S. I. 208. Indaka Sutta

¹⁵ Sayadaw USīlānanda, *Abhidhammatthasaṅgaha: Handouts from a series of lectures* (California: Tathagata Meditation Centre, 1994),117.

¹⁶ Abhi.A.II. (Sammohavinodanī), *Khandha vibhaṅga*, 20. Janakābhivamsa, op.cit.,527

¹⁷ Sīlānanda, loc.cit

¹⁸ Abhi.A. II,22.

¹⁹ S.A.I.300 Indakasuttavaṇṇanā

²⁰ life span of rūpa is equal to 17 cittakhaṇa

²¹ Sīlānanda.loc.cit

mentioned differently by various renowned authors. This piece of flesh is reddish in colour.²²It resembles sediment of thoroughly ripe chili.²³Though they express the likeness of the third stage of the embryo in the mother womb diversely, in essence this piece of small flesh is more or less in red colour as the fully ripe chili becomes reddish which formerly was green colour in unripe state.

In the fourth week, the piece of reddish flesh mass *pesi* becomes tender and solidified mass called *ghana*. Its measurement is about the size of a hen egg and it is oval in shape. It stays as *ghana* for one week.

After completing seven days, in the fifth week there are five swellings or buds appear from this tender solid mass. From these five buds two hands and two feet and the head will be formed in due course. Since they appear from the body just like a tree branches arise from the trunk, they are known as five main branches.²⁴Seven days after appearance of the five buds the foetus is now five weeks (thirty-five days) old.

Based on these sequences, the fetus progressively ages until it reaches eleven weeks (seventy-seven days). At this stage, four *kammaja-kalāpas* emerge, namely the eye decad, ear decad, nose decad, and tongue decad.²⁵

The developing embryo in the mother's uterus acquires nourishing essence (*ojā*) from the food and beverages consumed by the mother. At that time the material phenomena born of nutriment arise from the nutritive essence obtained from the mother. Thus, the child in the womb survives on the nutritive essence of the mother's food and drink.²⁶It is explained more in detail in the Commentary thus, the umbilical cord (*nāḷa*) arise from the navel of the child. It connects with the interior membrane of the mother. This umbilical cord is like a stalk of the lotus flower (*uppaladaṇḍaka*) which has small holes. By means of these apertures, the child absorbs the nourishing essence from the mother's food and subsequently distributes it throughout the child's body. In this way, the child in the mother's womb is nourished for ten months.²⁷ With regard to the time of arising of material phenomena born of nutriment is discussed in the commentary on the *Vibhaṅga*, it is stated that, at the stage of *kalala* the nutritive essence could not spread, so the material phenomena born of nutriment (*āhārajarūpa*) also could not establish.

The embryo in the mother's womb grows accordingly and when the age of pregnancy reaches forty-two weeks, head hair, body hair and nail, etc., starts to grow.²⁸Though head hair, etc., grows forty-two weeks of pregnancy, some babies could be born before forty-two weeks and they have complete head hair etc. Therefore, the sub-commentaries said if head, upper limbs and lower limbs mature enough head hair is able to grow before forty-two weeks.²⁹

As the foetus reaches full term, generally at nine months or ten months baby could be delivered from its mother womb. However, in some cases, it could be born either at 7th or 8th or even 12th month.

MORPHOLOGY AND SIZE OF THE EMBRYO ACCORDING TO MEDICAL SCIENCE

Nevertheless, this author will use this term embryo for the entire stages of development commences from fertilization up to the giving birth of the baby.

According to the Medical Science, despite having billions of cells, a complex human being begins as a single cell termed a zygote, which is created when two single cells known as an egg or ovum (from the mother) and a sperm (from the father) fuse together. A male propels millions of sperm into his partner's vaginal canal during copulation with significant power.³⁰They cannot be visible by an ordinary naked eye. However, they can be seen under microscope. At least 300 million sperms are deposited in the vagina during one sexual intercourse. Usually 200 million to 600 million sperms are in the ejaculate, but only a few hundred sperms are believed to reach the fertilization site. when the oocyte finally reaches the uterine tube, it is heading towards the uterus. Subsequently, they will combine with such perfect contact that the contents of both cells will be integrated into a single membrane without any leakage occurring.³¹ Ultimately, the fusion of the male and female pronuclei during fertilization results in the creation of a solitary cell called a zygote.³² which is also known as *conceptus*³³

As with other species, embryonic development begins with the process of fertilization forming a *zygote*. This process marks the beginning of the development of a new individual.³⁴ It completed within 20 hours, resulting in a restore of a diploid genetic constitution. Since each germ cell, that means the sperm and the ovum contains the reduced or haploid number of *chromosomes*. The mature sperm contains 22 chromosomes and either X or Y sex chromosomes (22+ X or Y) while the ovum has 22 chromosomes and X sex chromosomes (22+X). As a result, the zygote re-establishes 46 chromosomes inclusive of a pair of sex chromosomes, XX and XY (44 + XX or XY) depending on the gender of the individual.

SEQUENTIAL DEVELOPMENT OF AN EMBRYO OR FOETUS ACCORDING TO MEDICAL SCIENCE

Before explaining the natural developmental process of either embryo or foetus, it is necessary to understand the gestational age and embryonic age of the conceptus. The amount of time since the previous menstrual cycle began, which typically starts two weeks prior to actual fertilisation, is known as gestational age. On the other hand, embryonic age quantifies the true age of the embryo or foetus as at the moment of fertilisation. The actual time between the previous menstrual cycle and fertilisation, however, may vary by a few days from the typical two-week period. As a result, if one counts with gestational age, week 1 of embryonic age is already week 3.³⁵

²² Janakābhivamsa, op.cit., 530.

²³ S.A.I.p.274, Yakkhasamyutta, Indakasuttavaṇṇanā

²⁴ Ibid

²⁵ Ashin Ānandā, "mūlaṭṭhā" Vol.III..130,131

²⁶ S.I.208. Yakkhasamyutta

²⁷ S.A.I. 274.

²⁸ S.A.I.274. Sagāthāvagga yakkhasamyutta, "ito param chaṭṭhasattamādāni sattāhāni attikkamma desanaṃ saṅkhipitvā dvācattālīsime sattāhe parinātakālam gahetvā dassento kesātiādīmāha"

²⁹ Janakābhivamsa, op.cit.,533.

³⁰ Elaine N. Marieb, *Human Anatomy And Physiology, 4th ed* (California: Benjamin/Cummings Publishing Company, Inc, 1998),1080.

³¹ Marieb, loc.cit

³² OTT. 42.

³³ CD.355. "The products of conception; the developing foetus and surrounding tissue in the uterus"

³⁴ C.R. Asutin, "Fertilization" The Encyclopedia Americana Vol. II (USA: Grolier Incorporated, 1997),130.

³⁵ http://en.wikipedia.org/wiki/Fetal_development

THE FIRST WEEK OF EMBRYONIC AGE; WEEK 3 OF GESTATIONAL AGE

At the beginning of development that means soon after fertilization, the single-cell conceptus, or zygote is just barely visible to the naked eye. It has a diameter of about 180 microns and enclosed in an acellular capsule known as the *zona pellucida*, which is formed around the ovum during its maturation phase in the ovary.³⁶ The zygote divides again during mitosis after it reaches the two-cell stage, which increases the number of cells in the *zona pellucida*.

Around the sixth day in a human, trophoblastic cells covering the embryoblast pole start to proliferate through the uterine mucosa's epithelial cells. Proteolytic enzymes generated by the trophoblast cause the mucosa's epithelial cells to penetrate and then erode. Thus, the human zygote has progressed through the morula and blastocyst stages and has initiated implantation in the uterine mucosa by the end of the first week of development.³⁷

WEEK 2 OF EMBRYONIC AGE; WEEK 4 OF GESTATIONAL AGE

This week mainly concerned with the implantation of the *conceptus* into the *endometrium* and the development of the *trophoblast* into the earliest form of a placenta. The *zona pellucida* eventually vanishes, enabling the blastocyst to infiltrate the endometrium of the mother's uterus. By the eleventh or twelfth day, the endometrial surface epithelial cells completely fill the initial defect or implantation site in the uterine wall, effectively embedding the blastocyst in the endometrium. At this point, the blastocyst makes a little protrusion into the uterine lumen.³⁸ The inner cell mass grows to become the bilaminar (two-layered) embryonic disc. One layer of cells faces the inner cavity of the *blastocyst* and is known as primitive endoderm. The outer layer of cells next to the outer *trophoblastic* shell is known as the formative cell layer. The developing embryo at nine days is 500 to 600 microns in diameter.

WEEK 3 OF EMBRYONIC AGE; WEEK 5 OF GESTATIONAL AGE

During this week the placenta continues to form from *trophoblastic* cells (of embryo) and *decidual* cells (of mother). This week marks the becoming of *trilaminar* (three-layered) embryonic disc from the *bilaminar* embryonic disc. So altogether, ectoderm (the outer layer adjacent to the *trophoblast* shell), the endoderm (already formed in the second week which remains unchanged), and the mesoderm (the layer interposed between the ectoderm and the endoderm). The process that creates the embryo's three germ layers is referred to as gastrulation. Blood vessel networks and the rudimentary central nervous system are also formed. Furthermore, at the end of the third week a primitive heart starts to develop as a pair of adjacent vessels.³⁹

WEEK 4-5 OF EMBRYONIC AGE; WEEK 6-7 OF GESTATIONAL AGE

The foregut, midgut, which is accessible to the developing yolk sac, and hindgut are the three segments of the cranio-caudal, blind-ending tube that the embryonic disc folds into during this week. This phase is when organogenesis begins. The embryo, which is 4 mm long, starts to take the form of a C. The somites and pharyngeal arches are the prominent exterior structures near the end of the fourth week, when the embryo has around 28 somites. Both the forelimbs and the hindlimbs form paddle-shaped buds before the start of the fifth week. The cranial nerves are observable, and the brain is divided into five distinct areas. The development of the ear and ocular structures begins. The vertebrae and certain other bones undergo development. At this stage, the heart continues to undergo growth and maintains a consistent rhythm of contractions. The embryo is 8 mm long at the end of the fifth week.

WEEK 6 OF EMBRYONIC STAGE; WEEK 8 OF GESTATIONAL AGE

The size of the foetus is about 13 mm in length. The major thrust of organ formation is complete during this week and only a few new structures appear. There is distinct variation between the foot and hand sections, and the arms and legs have experienced an increase in length. Despite being initially webbed, fingers and toes gradually become visible. The brain undergoes ongoing development. Pulmonary development commences.

By the end of this week the face has some recognizable human features is well established. The gonads become histologically recognizable as either testes or ovaries by the end of this week.

WEEK 7 OF EMBRYONIC AGE; WEEK 9 OF GESTATIONAL AGE

Now the embryo is less than 18 mm long and by the end of the week it looks very much like a human in miniature. The forerunners of the external genitalia continue to grow and develop, but they still cannot be grossly identified as male or female at this time. Interestingly it is now that the placenta begins to take on its definite characteristics. For the first time during development, blood from the maternal circulation begins to enter the placental circulation under arterial pressure. Nipples and hair follicles form.

WEEK 8 OF EMBRYONIC AGE; WEEK 10 OF GESTATIONAL AGE

The foetus is 3–8 cm in length. Eyelid development is more advanced. The ear's external characteristics start to take form. Facial traits are continually evolving. On the head, lugo (a small hair) grows. The foetus moves actively. The embryonic stage comes to conclusion at the end of week 8, and the foetal period begins.

WEEK 9-12 OF EMBRYONIC AGE; WEEK 11-14 OF GESTATIONAL AGE

During this period the foetus more than doubles in length, and its weight increases from less than 2 grams to about 12 grams. The eyelids seal and do not reopen until the 28th week. Legs are slender and long. The genitalia are distinct. A baby's head accounts for over half of its total size. Its fingers are capable of forming a fist. For the newborn teeth, tooth buds emerge.

³⁶ EA Vol.X. 291

³⁷ Ibid

³⁸ Ibid, 43.

³⁹ EA Vol.X.292.

WEEK 13-16 OF EMBRYONIC AGE; WEEK 15-18 OF GESTATIONAL AGE

A skeleton has formed that can be visualized on an X-ray of the mother's abdomen. The skin is almost transparent. The foetus begins to make active movement and weak, irregular sucking and breathing movements. Meconium is produced in the gastrointestinal system. External genital development is complete. Now it weighs about 100 grams.

WEEK 17-20 OF EMBRYONIC AGE; WEEK 19-22 OF GESTATIONAL AGE

The major feature of the period is growth. The foetus gains around 20 centimeters in length and 300 grams in weight. The body is covered with lanugo hair. Lashes and eyebrows emerge. On the fingers and toes, nails grow. The infant is hearing. Usually, the mother feels the foetal movements, or quickening. The foetal heart beats can be heard with stethoscope.

Even though the baby's lower airways grow, they still don't make surfactant, which is what opens the alveoli for gas exchange.

WEEK 21-24 OF EMBRYONIC AGE; WEEK 23-26 OF GESTATIONAL AGE

The length and weight of the foetus is about 28 cm and 725g respectively. The lanugo disappears. Every eye component is designed. The infant has a startle reaction and a hand. Fingerprints and footprints are developing. Alveoli (air sacs) are forming in the lungs. All the organ system undergoes functional maturation.

WEEK 25-28 OF EMBRYONIC AGE; WEEK 27-30 OF GESTATIONAL AGE

In this period the foetus reaches 38 cm and 1.2 kg. The brain undergoes rapid growth. The nervous system possesses sufficient sophistication to govern several physiological functions. The eyelids of the foetus may open and shut. Despite its immaturity, the respiratory system is sufficiently developed for gas exchange.

WEEK 29-32 OF EMBRYONIC AGE; WEEK 31-34 OF GESTATIONAL AGE

Even though the lungs are still developing, breathing moves in a pattern. Despite being completely grown, the bones are still flexible and supple. The foetus weighs 2 kilograms and measures 38–43 centimeters.

WEEK 36 OF EMBRYONIC AGE; WEEK 38 OF GESTATIONAL AGE

Body fat levels rise. The tips of the fingers are covered with fingernails. The foetus reaches 40-48 cm in length and 2.5-3 kg in weight.

WEEK 37-40 OF EMBRYONIC AGE; WEEK 39-42 OF GESTATIONAL AGE

With the exception of the shoulders and upper arms, lanugo is absent. Nails grow beyond the tips of fingers. Now, head hair is thicker and coarser. The main structural event is the testes' descent into the scrotum from the abdomen. Every organ systems of experiences functional maturity. A 37-week pregnancy is considered full term when the length reaches 48–53 cm.⁴⁰ Pregnancy is often defined as lasting 280 days or 40 weeks from the start of the last regular menstrual period (LNMP). Stated differently, the most precise indication of the date of birth is 266 days or 38 weeks after fertilization.⁴¹

COMPARISON BETWEEN TWO PERSPECTIVES

Now it is time to discuss the issue on morphology and developmental stages of a being from two different perspectives- Buddhism (*Theravāda*) and Medical Science.

Buddhism mentioned the very first stage of human being known as *kalala* is a clear droplet about the size of a head hair louse during the first week. (Its size was explained thoroughly in advance). In subsequent two weeks, a clear droplet of *kalala* becomes foam of meat washed fluid coloured *abbuda*, and a piece of flesh which is soft and not solidified called *pesi* arises respectively. Their sizes are not mentioned directly in the Pāli texts and commentaries. The reason for lack of mentioning it might be due to the ancient authors wanted to avoid the repeating again and again.

Medical texts though it explores and gives the different names and increasing number of cells -zygote, *morula*, and *blastocyst*, taking the same size during week 1 of embryological age. It is 180 μ in diameter. It cannot be seen by naked eye. In week 2 it begins to embed in the uterus and reaches the size about 500-600 μ in diameter. The head of a pin is about the size of it. And near the end of week 2 and beginning of week 3 the *blastocyst* embedded completely in the *endometrium* of the uterus. The implantation site is visible on the uterine mucosa as a 1 mm red spot.

In Buddhism gender of the being has already established since at the time of rebirth-linking (*Paṭisandhi Khaṇe*). For a baby boy male sex deced (*Pumbhāvadasaka*) and for a baby girl female sex deced (*Itthibhāvadasaka*) arise since the arising of respective rebirth-linking consciousness (*Paṭisandhi viññāna*). In Medical Science, the zygote re-establishes 46 chromosomes inclusive of a pair of sex chromosomes, XX and XY (44+ XX or XY) after fusion of sperm cell and ovum each carrying 22 chromosomes and either X or Y sex chromosomes (22+ X or Y) and 22 chromosomes and X sex chromosomes (22+X) respectively. Gender of the child has already determined since at the stage of zygote.

Buddhism said that the heart base (*hadayavatthu*) has arisen since the rebirth-linking as it included as one of the *kammaja kalāpa* arisen simultaneously with the rebirth-linking consciousness. In Medical Science, it is stated that the primitive heart starts to develop during the week 3 of embryonic age.

Buddhism stats that in the fifth week there are five buds, *pasākhā* appear. From these five buds two hands and two feet and the head will be formed in due course. In Medical Science, the heart continues to grow and now beats regularly between weeks 4-5. The brain grows into five parts. Arm and leg buds appear and the formation of the eyes, lips, and nose has begun.

In Buddhism, it is accepted that the growth of head hair, body hair, and nails occurs towards the end of pregnancy, typically around 42 weeks. According to Medical Science, although hair follicles appear during week 7, head hair becomes coarse and thicker fingernails extend beyond fingertips in week 37-40.

⁴⁰ <http://en.wikipedia.org/wiki/Fetal-development>

⁴¹ Sadler, op.cit.90,93.

By mean of above comparison, it is found that though the usage of terms in Buddhism (*kalala*, *abbuda*, *pesi*, *ghana*) and Medicine (*zygote*, *morula*, *blastocyst*) are different, in principle they most likely are the same. Moreover, the gender of the child has already determined since the time when the rebirth-linking consciousness arises in Buddhism and the stage of zygote in Medicine.

Consequently, the developmental sequence of embryo or foetus explained in Buddhism and Medicine seemed to be an agreement. Most of them are quite similar, however, one opinion which is not accord with each other. This diversity is regarding the time of coming to life of the baby. In Buddhism even at the stage of *kalala* which is considered as a living being. Regarding this Buddhist view about what life is like in the womb, there are several texts and commentaries definitely recognized the conceptus (embryo or foetus) no matter how small or young as being and alive. It can be clearly understood by reading the following passage from the *Mahānidāna Sutta* of *Dīgha Nikāya* as follows;

“Were consciousness (*viññāna*), *Ānanda*, not to fall into the mother’s womb, would the sentient body (*nāma-rūpaṃ*) be constituted there?” “It would not, Lord”. “Were consciousness, having fallen into the mother’s womb, to turn aside from it, would the sentient body come to birth in this present state?” “It would not, Lord”⁴²

A body (*rūpa*) with mental faculties comparable to sentience (*nāma*) cannot arise and grow in the womb without the transfer of awareness from an earlier existence.⁴³

Furthermore, the monastic order acknowledges that human life begins at conception and that twenty is the minimum age required for complete ordination, measured from that point rather than from delivery.

“When in his mother’s womb, the first mind-moment has arisen, the first consciousness appeared, and his birth is to be reckoned as from that time. I allow you, monks, to ordain one who is aged twenty from being an embryo”.⁴⁴

On the contrary, foetal movement (quickening) can be felt and foetal heart sound can be heard during week 7-20. So, taking these movements and sound as criteria Medical Scientists said that the conceptus becomes alive when it reaches the week 7-20 and before this time it is considered as an inanimate.

The definite variation between these two views is about the time of the embryo’s or foetus’ life or in other words the notion of the conceptus as person (living being) since conception or later about week 7-20. This difference of opinion should be compromised as follows.

The consciousness is extremely subtle. It can be seen neither by naked eyes nor even with very powerful electron microscope of today’s invention. It can only be perceived by wisdom eye like psychic powers or insight wisdom. According to Buddhism, as soon as the rebirth-linking awareness dissolves (*Paṭisandhi citta*) the life continuing consciousnesses (*bhavaṅga citta*) arise successively till interrupted by the arising of any particular cognitive series or processes of consciousness (*vīthi*). Now in the very first stage of developmental process the *kalala* also consists of mind and matter even though it shows no functioning. Regardless of it’s missing in functionality it could be accepted as a living being. This stage can be compared with a person in a coma. The comatose person would not move and we accept he or she is still alive with lack of functional ability. So also, in the case of *kalala* consciousness is already present with no foetal movement yet.

In Medical Science, the scientists reckon the coming to life of the foetus as roundabout week 7-20 by using the criteria of foetal movement and heartbeat. Moreover, the presence or not of the consciousness in the foetus before the week 7-20 may be able to decide by examining the interdependent relationship between the material and mental phenomena.⁴⁵

Though if it is not possible to accept at present since the scientific knowledge and techniques are growing rapidly, it will be recognized as humanness from the very first mind moment of conception in the future.

CONCLUSION

In the end, considering all of these research investigations, it can be concluded that our lives have been initiated by the direct assistance of mothers and indirectly through the support of fathers. The developing embryo in the mother's uterus acquires nourishing essence (*ojā*) from the food and beverages consumed by the mother. During that period, the physical manifestations that result from nourishment emerge from the nutritive substance acquired from the mother.

Thus, the child in the womb survives on the nutritive essence of the food and drink that the mother swallows. Mother also helps to keep her foetus comfortable by avoiding foods that are too hot, spicy, salty, or sour. Once the nutritive essence of the food and drink that the mother swallows are established in the child's body, it gives birth to the *āhārajarūpa*. That mean mainly the human life was began by the help of mother’s nutritive. Moreover, they were maintained to live by the help of mother’s warm temperature *utuja*, by providing proper medication for their fetus comfortable *kammaja*. After giving bath as we, all known the parents care and administer to the children *āpādakā*, feed and serve proper food *posakā*, and they show us the world, mean they allowed us to becoming human being *imassa lokassa dassetāro*. As ancient Myanmar saying, you have to think that all good things that happen our lives are given by the help of our parents. So, reader may repay the debt knowing gratitude to your parents contemplating the virtues of the parents according to Buddhist regulations.

ABBREVIATIONS

S.A.I	= Saṃyutta-aṭṭhakhathā
M.I	= Mūlapaṇṇāsa-pāḷi
Abhi.A.I	= Sammohavinodanī-aṭṭhakhathā (Vol-I)
S.I	= Sagāthāvagga and Nidānavaggasaṃyuttapāḷi
Abhi.A.II	= Sammohavinodanī-aṭṭhakhathā (Vol-2)
D.II	= Mahāvaggapāḷi

⁴² D. II.52. Mahānidāna Sutta

⁴³ Harvey, loc.cit

⁴⁴ Vin.III.92. Gabbhavīsūpasmpadānujānaṇā

⁴⁵ Ahin Sobhana (Mahāsi Sayadaw), *The Problems of Life* tr by Ven. Dr. Sunanda. (Yangon: Buddhasāsana Nuggaha Association, 2004), 31.

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Sammohavinodanī-aṭṭhakathā
Saṃyuttanikāya, Indaka Sutta
Abhidhammatthasaṅgha
Abhidhammapiṭaka, Khandhavibhaṅga
Sagāthāvagga-ṭīkā, Yakkhasaṃyutta, Indakasuttavaṇṇanā
Mūlaṭīkā
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