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Natural Family Planning - Is it Scientific? Is it Effective?

With the significant decline in infant mortality since the beginning of the 20th century, the need for child spacing became evident to many persons. In the second half of the 20th century non-coital contraceptives were discovered and assumed a high profile because they were aggressively promoted. Nevertheless, cost-free natural methods are still preferred by many couples for reasons of economy, ecology, religion, as well as a desire to maintain control of one's own fertility.

Definition

Natural family planning is planning for achieving or preventing a pregnancy by the timing of intercourse. By observing and recording certain natural symptoms and bodily changes that occur in a woman's menstrual cycle and using the information as a guide, a couple can learn to identify the fertile and infertile phases of the menstrual cycle. If the couple wishes to achieve pregnancy, they can be aware of the best days for this to occur. If the couple wishes to avoid pregnancy, they should abstain from intercourse or genital contact during the fertile or risk period of the cycle. Natural family planning for preventing pregnancy is also referred to as "periodic abstinence." The World Health Organization (WHO) defines periodic abstinence as voluntary avoidance of intercourse by a couple during the fertile phase of the menstrual cycle in order to avoid pregnancy.(1)

While the male is fertile from puberty onward, the female's fertile phase is recognizable by prospective and retrospective physiological markers, and normally occupies not more than one-third of the cycle.

The Hormonal Cascade of Ovulation

Prospective recognition of the fertile phase is based upon an understanding of the physiology of ovulation (Figure 1).

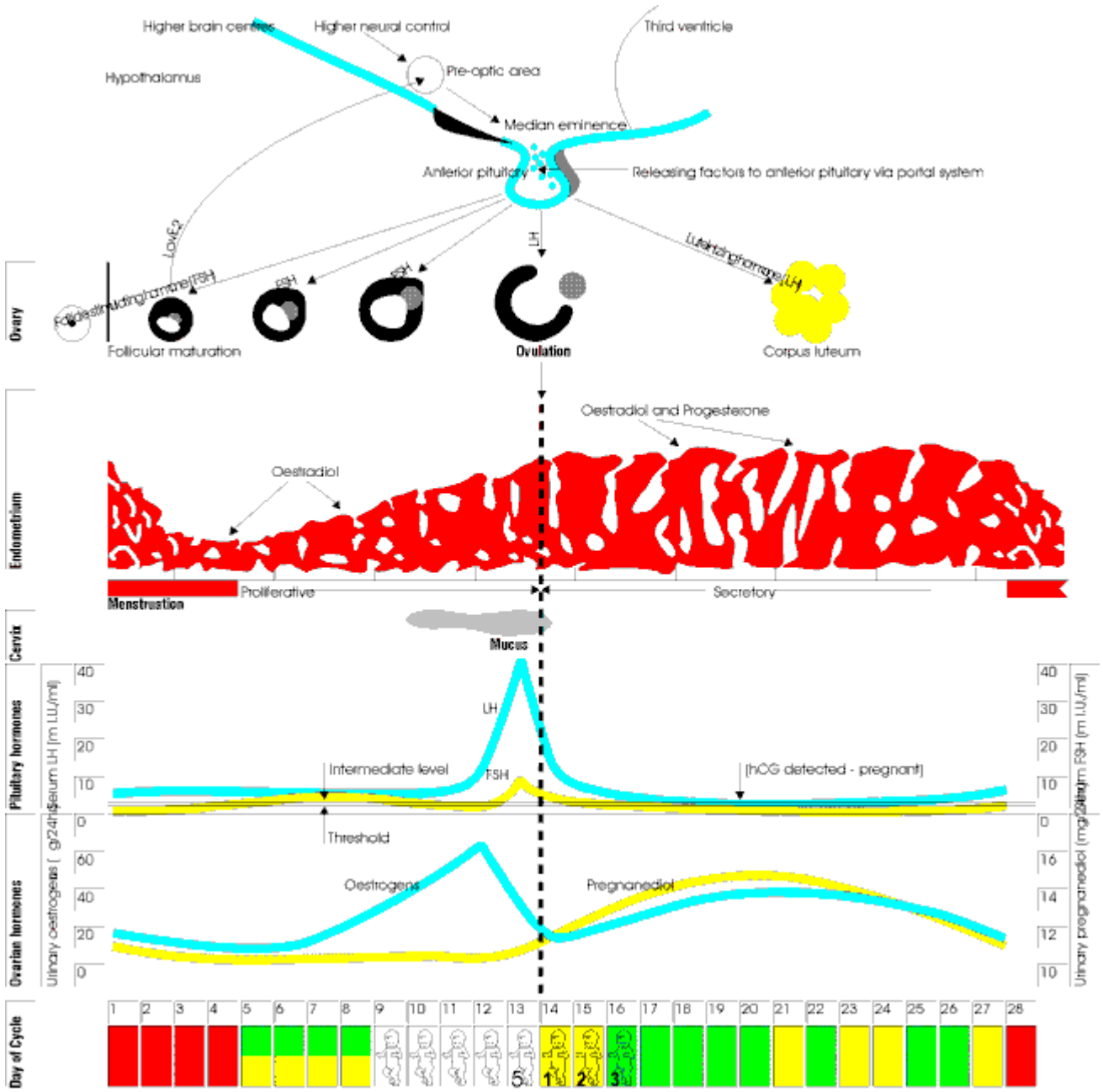

Figure 1. Relationship of the hormonal events of a woman's reproductive cycle to the stamp record (green, dry; yellow, infertile) made by the woman in that cycle. (After J.B. Brown) *N.B. Figures 1, 2, 5a,b,c, 6.,7,& 8 are reproduced by permission from* ***Teaching the Billings Ovulation Method-Variations of the Cycle and Reproductive Health****, by Evelyn L Billings AM, MBBS, DCH (Lond.) and John J. Billings AM, KCSG, MD, FRACP, FRCP(Lond.), Ovulation Method Research and Reference Centre of Australia, Melbourne, 1997.*

At birth, the girl's ova are in the diplotene stage of development. They either remain quiescent or undergo atresia until puberty when some oocytes will mature and complete their meiotic division. The dominant follicle is selected within the first few days of the cycle by a rise in follicle stimulating hormone (FSH). FSH stimulates the granulosa of the healthy follicle to produce oestrogen and follicular fluid to form antral follicles. Oestrogen is produced by aromatization of androgens within the ovary. Antral follicles with the highest concentration of granulosal proliferation contain the highest oestrogen concentrations. These have the lowest androgen/oestrogen ratios and are most likely to house a healthy oocyte. In the

antral follicle, LH receptors are present only in the theca cells, while FSH receptors are present in the granulosa. LH stimulates the theca to produce androgens which can then be aromatised to oestrogens. Oestrogen exerts a negative feedback onto pituitary FSH production, which in turn causes withdrawal of gonadotropin support from the less well developed follicles which had begun to develop at the beginning of the cycle, causing a decline in their aromatase activity and limiting oestrogen production in those follicles. The dominant follicle reaches a maximum diameter of 19.5-25 mm prior to ovulation. The granulosa cells begin to acquire LH (luteinizing hormone) receptors. Prior to ovulatory stimulation by LH, the concentration of oestradiol must be over 200 pg/ml and must be sustained for at least 50 hours until the LH surge has occurred. GnRH pulsatile release from the hypothalamus is present throughout the cycle, but is characterized by shorter pulse intervals and lower pulse amplitudes in the follicular, as opposed to the luteal phases of the cycle. Following ovulation or perhaps 24 hours prior to it, luteinization of the follicle produces progesterone, which in turn causes the well known conversion of endometrium to the secretory phase, suppresses cervical mucus with fertile characteristics (to be described subsequently), and when conjugated to pregnandiol, raises the basal body temperature.

The fertile phase of the female begins in the final ripening stage of the follicle when blood oestrogen level passes the threshold which triggers production of the different types of mucus from the cervical crypts. Prior to this event, the cervical canal has been protected and closed by a plug of tenacious mucus, the G mucus. (Figure 2).

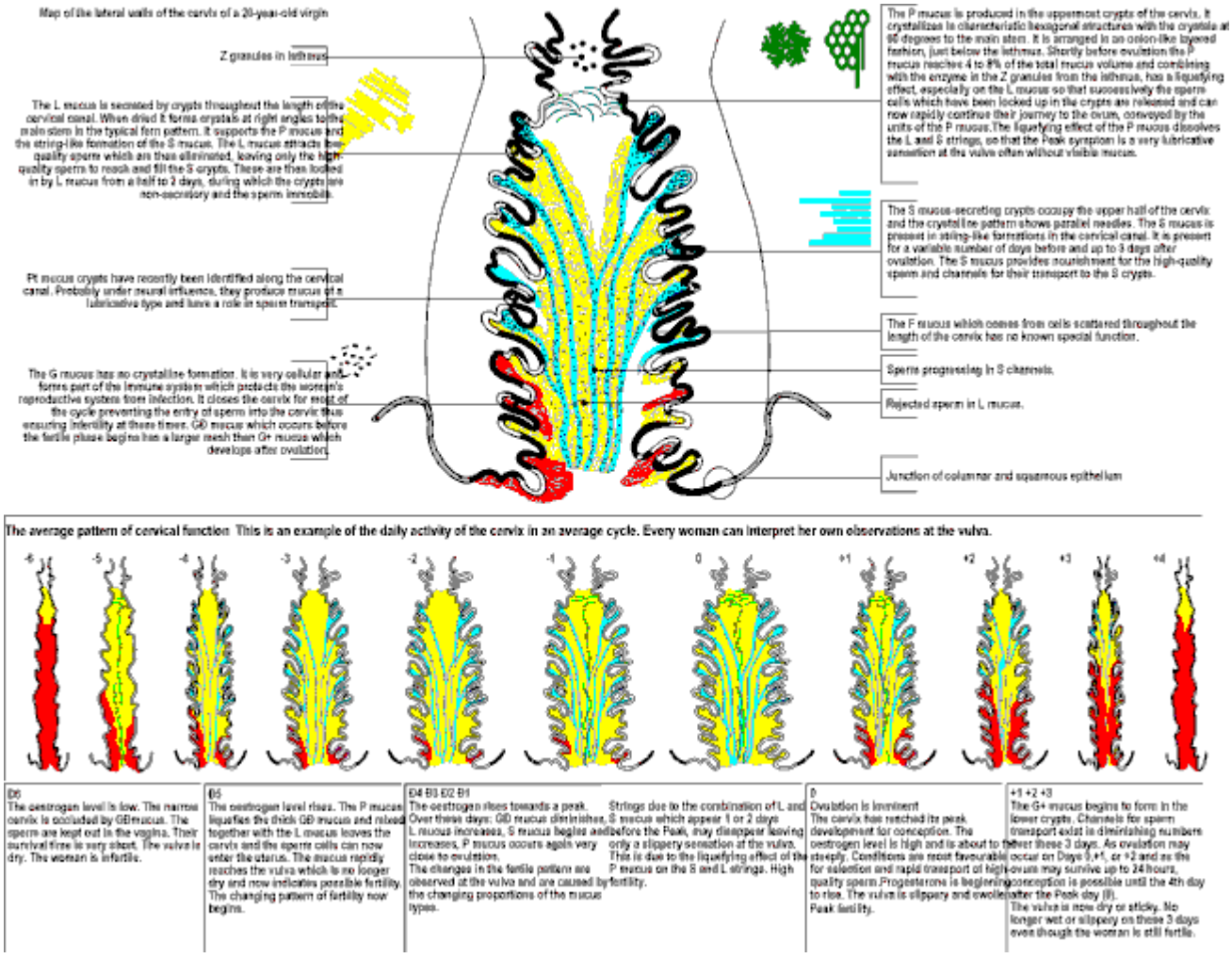

Figure 2. Cervical anatomy, cervical function and cervical mucus types in an average cycle of a 20-year-old virgin. (After E. Odeblad.)

When oestrogen rises, it stimulates the production of mucus from the L and S crypts which are located somewhat higher in the cervical canal. L mucus is slightly more fluid and initially dislodges the plug of thick mucus which then flows to the introitus. Women can both feel and see this without difficulty. L mucus is rather sticky, a bit elastic, and either opaque or translucent. Its function is to remove imperfect sperm forms and to close the opening of the S mucus crypts once these have been filled with (approximately) 20-30 spermatozoa. S mucus is more lubricative, elastic, and clear. It appears in strands, which actually conduct the sperm into the S crypts. There are 200-300 such crypts in the cervical canal. Each crypt can hold between 20 and 30 sperm. Once in the crypts, the sperm are nourished by the S mucus. The opening of the crypt is closed by a plug of L mucus. Forty-eight to thirty-six hours prior to ovulation a surge of noradrenalin releases P mucus which comes in two forms. P_2 dissolves the plug of L mucus allowing the sperm to emerge from the crypts and enter the central cervical canal, while P_6 mucus strips prostaglandin F_2 from the spermhead and provides additional energy for the journey into the uterine cavity and tubes. Around the time of the appearance of P mucus, the luteinizing hormone surge initiates the process of ovulation. The plasma oestrogen peak is followed usually in 1 to 36 hours by the LH surge. Ovulation follows within 17-36 hours of the LH surge. The fertilizable life of the ovum after ovulation is 8-12 hours.

Observation of the mucus sign is essential for recognizing not only the beginning of the fertile phase, but also for its ending. If oestrogen rises, the mucus becomes progressively more slippery, stretchy, and clear. Peak, which is defined as the last day mucus with fertile characteristics -- slippery, stretchy, or clear appears at the vulva. The largest amount of mucus, and the greatest elasticity (stretchiness) is met the day prior to peak. On peak, the P mucus makes the mucus so slippery and fluid that the amount and elasticity are reduced. Mucus is changed in its passage from the cervix to the vulva. Two structures parallel to the urethra, called the pockets of Shaw, contain manganese in their epithelium. The function of manganese is to absorb fluid from the vaginal canal. Oestrogen suppresses the function of manganese; hence, fluid can easily exit to the vulva when oestrogen dominates the cycle. After peak, L, S, and P mucus do not disappear immediately, but are no longer filled at the vulva because the fluid content has been reabsorbed. (Figure 3)

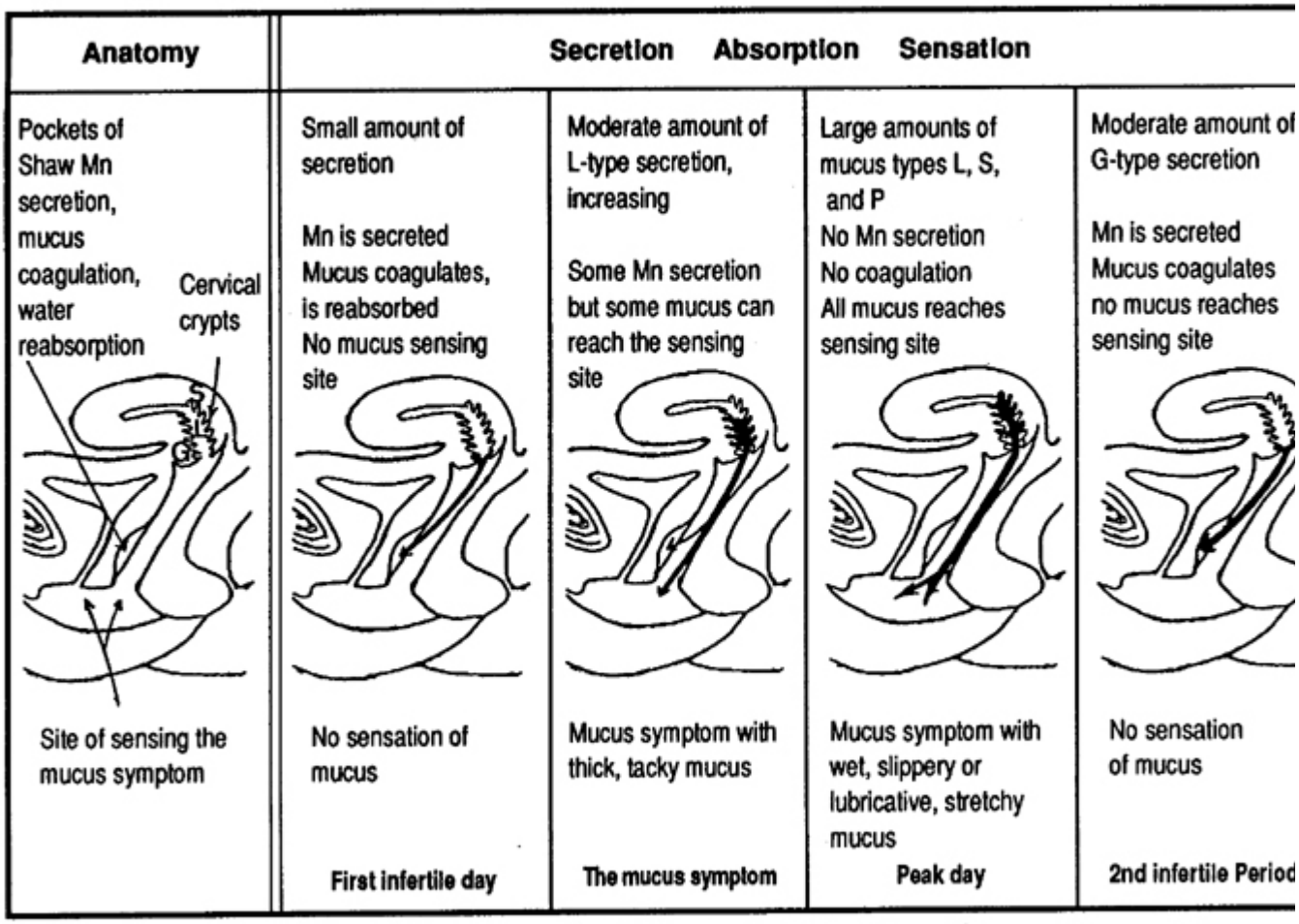

Fig. 3 : Correlation of Mucus Production and Reabsorption with Vulvar Sensation

This underlines the necessity of relying on external observations only when following the rules of the Billings Method. Eighty percent (80%) of women ovulate on peak day or the next day, 14% the day before peak, 3% two days before peak, and 3% two days after peak while a very small percentage - 0.3% have been found to ovulate on peak-3 or peak+3. Sperm are generally thought to be able to survive 48-72 hours in the cervical mucus. However, a longer sperm survival is occasionally encountered. This may be absolutely true or may be a combination of a longer sperm survival together with ovulation one or two days before peak. For all practical purposes, the fertile phase of the couple begins when the woman feels or sees mucus and ends the fourth day after peak.(3)

The cervix is a biological valve, and as such, is the gatekeeper for sperm to enter the uterus. Many investigators combined detection of cervical mucus at the vulva or at the cervix with temperature rise and calendar calculations to delineate the beginning and end of the fertile phase by multiple indices. Drs. John and Evelyn Billings pioneered the use of cervical mucus as a single parameter for the prediction of ovulation and its application to natural family planning. Women are taught to observe their **mucus patterns** at the vulva, relying primarily on the sensation of wetness and lubrication, obtained **via ordinary sensation**, augmented by the use of the Kegel exercise,palpation of the inner aspects of the labia minora with the finger, a "wipe-through" with toilet paper or a piece of cloth, or a combination of the above if needed. The mucus is then inspected for colour and is stretched to determine spinnbarkeit.

According to Brown, whenever total oestrogens exceed the threshold of 15mg/100 ml/24 hours, the cervical mucus is sufficiently liquefied to leave the cervix and appear at the vulva.(5) If a cycle is ovulatory, the mucus will become increasingly lubricative, elastic, and clear until it reaches its "peak;" the changing behaviour of the mucus is called the mucus "buildup." "Peak" is defined as the last day of lubricative mucus, not necessarily the day of maximum stretch (elasticity).

When a cycle is ovulatory, the rising oestrogen level produces mucus in the cervical crypts. The first mucus found at the vulva is frequently the mucus plug which had closed the cervix after menstruation. The mucus plug is sticky, gummy mucus, which Erik Odeblad calls G mucus. It does not flow to the vulva until oestrogen has caused sufficient build-up of L mucus to dislodge it. Mucus is a hydrogel consisting of glycoproteins, water, chemical and biochemical compounds, including sodium, chloride, potassium, protein chains, and enzymes. They become polymers which change in response to type and level of the hormones acting on them.

Erik Odeblad has studied the cervical mucus since 1949 with nuclear magnetic resonance and spectrophotometry. He has demonstrated not only unique crystalline structure, but unique chemical compositions in each mucus. Figure 2 correlates the site of mucus production in the cervix with its appearance at the vulva. Fig. 2 also indicates how the crystalline structure of dry G, L, S, and P mucus would look.

G- mucus is produced in response to low levels of adrenal progesterone. After ovulation, G+ mucus is found in sufficient quantities to leave the cervix and be detectable at the vulva. Oestrogen rise initially triggers the production of L mucus which appears as loaf-like structures on the strands of mucus and selects out imperfect sperm forms. A higher level of oestrogen produces the S (or string) mucus which conducts sperm into the higher S crypts of the cervix. The S mucus nourishes the sperm in the crypts. P mucus is produced + or - 36 hours of oestrogen peak. Two forms of P mucus exist: P_6 mucus, which conducts sperm cells from the S crypts into the uterine cavity and P_a mucus, which has a mucolytic function. It serves to open the barriers at the mouths of the S crypts and release the sperm at the time of ovulation. In addition, fetal cells which line the cervical canal produce a baseline discharge without lubrication, F mucus, in some women. As yet, no clinical significance has been discovered for F mucus.

Detection of the thermal shift via the daily basal body temperature (BBT) adds a retrospective confirmatory aspect. BBT is low until the event of ovulation, then rises .2-.3^{o} C. When progesterone from the corpus luteum increases significantly it dominates the histology of the endometrium, changes the oestrogen-dominated proliferative phase to the progesterone-dominated secretory phase, and changes the lubricative oestrogen-induced mucus of the cervix to a sticky non-lubricative G mucus and when metabolized to pregnandiol, raises the BBT to produce the biphasic curve. Fig. 4.

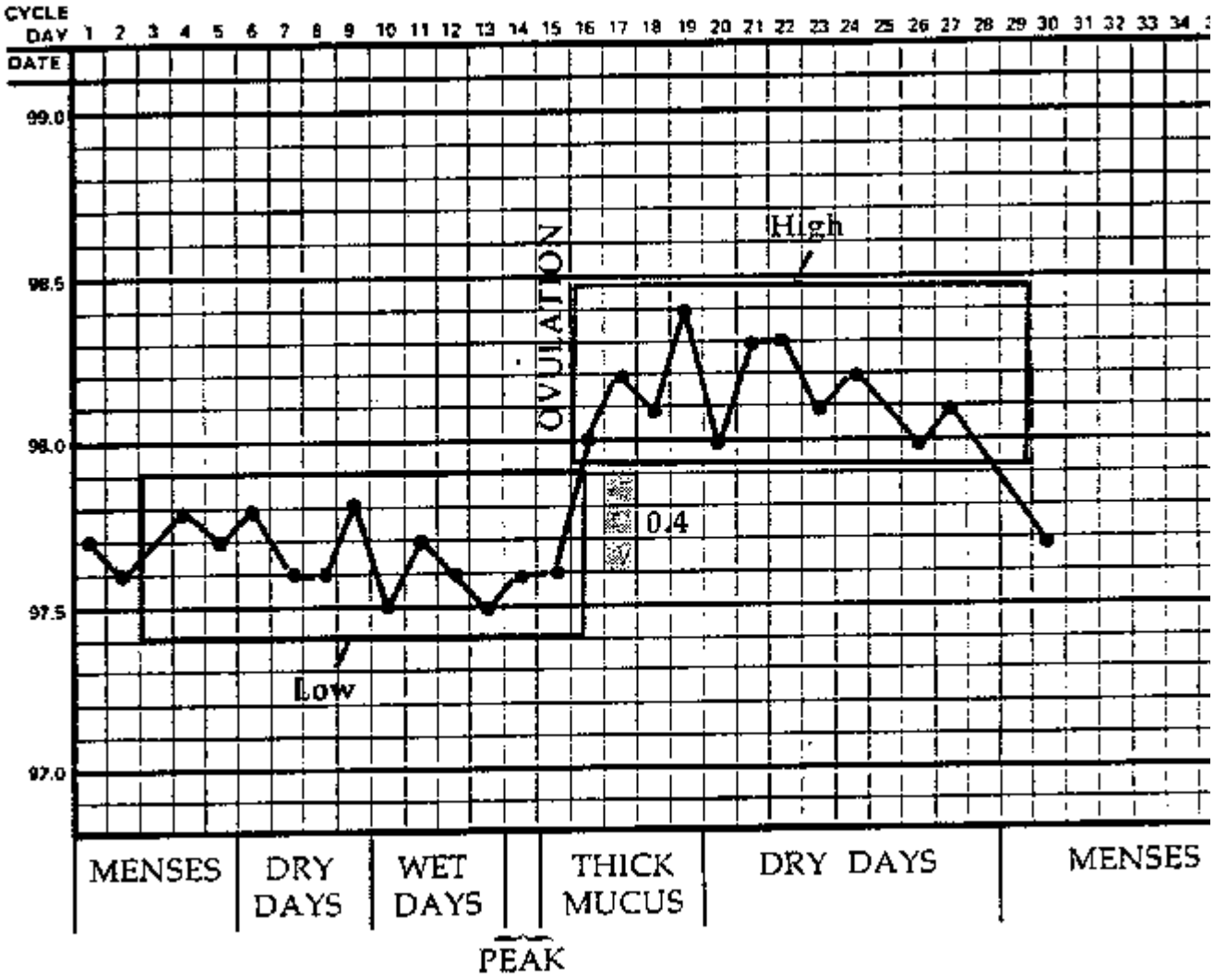

Figure 4. Basal Body Temperature

History of Natural Family Planning

Even though women worldwide intuited that they were not always fertile, and sometimes correctly associated the mucus at the vulva with fertility, scientific investigation began with Von Baer's description of the mammalian ovum in 1827. Pouchet described intermenstrual pain and cervical mucorrhea in 1847; the biphasic temperature curve of women was first discovered in 1877 by Jacobi, but not conclusively related to ovarian activity until van de Velde's demonstration in 1905 and Hansen's in 1913. Clinical application of these findings were not made until the mid 1930s.

Calendar Rhythm

In 1903, Fraenkel had demonstrated that the life of the corpus luteum is 2 weeks. His findings were verified by Ogino in 1924, who described the normal luteal phase as 12 to 16 days long, and by Knaus in 1933, who reported that menstruation follows ovulation by approximately 2 weeks. An accurate history of the last 6 to 12 menstrual cycles is necessary to calculate the fertile and infertile phases of the cycle. Hartman calculated the fertile phase of the cycle by assuming a 12 to 16 day normal luteal phase, 72 hours for sperm survival, and 12 to 24 hours of ovum fertilizability. To estimate the fertile phase within the

cycle, a woman with regular cycles needs to know the exact length of her last 6-12 cycles. She then subtracts 18 days from the shortest cycle to determine the last day of the early infertile phase, and subtracts 11 days from the longest cycle to find the last day of the fertile phase. Few women are "regular," but some have marked variations. Calendar rhythm is generally credited with at least 20 per cent method failure. Roetzer has found that if one subtracts 20 days from the shortest cycle, rather than 18, the unplanned pregnancy rate is reduced; Roetzer uses the calculations in combination with cervical mucus and thermal shift (See Appendix). The use of calendar rhythm as an isolated method is not advocated by natural family planners, but it is still widely practiced, often by women who have an inadequate grasp on the necessary calculations, and still leads to many unplanned pregnancies.

In the Philippines, Laing found that the long-term unplanned pregnancy rates were similar for the pill and calendar rhythm (18 for both methods by 36 months), a figure which needs to be explained by the higher acceptability of calendar rhythm. Pill users were far more likely to discontinue the method.

METHODOLOGIES

Basal Body Temperature

Low basal body temperature in the preovulatory oestrogenic and slightly higher temperature in the postovulatory, progestational phase is a reliable indicator of the biphasic, ovulatory cycle. Various methods used to determine the onset of postovulatory infertility are described in the Appendix. A basal body temperature or a digital thermometer must be used. The same body orifice -- oral, vaginal, or rectal -- must be used throughout the cycle. The woman must have at least three hours of uninterrupted sleep prior to taking her waking temperature. She should take her temperature at the same time daily and use the same thermometer. Calibrations vary, so that if a thermometer is broken and a different one is used, the record may not be valid. Today few people use either the calendar or the basal temperature by themselves, because everyone agrees that the prospective sign of the cervical mucus is key for avoiding, as well as achieving pregnancy. When the granulosa cells of the cumulus oophorous of the follicle multiply rapidly, as they do just prior to ovulation, they produce interleuken 1. Interleuken 1 also raises the basal body temperature which could lead to error in determining the onset of postovulatory infertility.

The Symptothermal Methods

Several Western Centres have combined the prospective sign of the cervical mucus with the retrospective sign of the thermal shift after ovulation and with calendar rhythm calculations. Some systems, especially in parts of the U.S., have also added internal palpation of the cervix (See Appendix). Preference for a single or multiple index system depends on the availability of teaching and on the temperament of the learner. When either system is used correctly and consistently, results are comparable (See Effectiveness below).

Because the prospective sign of the cervical mucus is common to all methods, and is indispensable detecting the beginning of the fertile phase, it will be described in greater detail. The three most common symptothermal methods will be described subsequently.

The **Billings Ovulation Method** depends on self-detection of cervical mucus at the vulva by paying attention to how the vulva feels -- dry, sticky,or lubricated. The vulva can sense the presence of as little as 5 mg of mucus, while 40 mg of mucus are needed to obtain enough mucus for visual inspection. A woman is invited to observe for the presence or absence of mucus at the vulva prior to each act of urination and to

is invited to observe for the presence or absence of mucus at the vulva prior to each act of urination and to record what she has felt and seen on a simple chart at the end of each day. (*N.B. The Billings publications have generally avoided recommending specific times and places and techniques for making observations. The most recent Personal Record Chart Instructions state "As you go about your normal activities the sensations at the vulva can be identified". Ed.*) If she is already sexually active when she is learning the method, she must refrain from sexual activity from the beginning of one cycle until she has experienced the changing mucus "build-up" pattern which leads to ovulation and to continue sexual abstinence until the fourth day after peak. The usually encountered build-up pattern is shown in Figure 5b. The fertile phase begins when mucus is detected at the vulva and continues until the fourth day after peak. Any intercourse or genital contact may lead to pregnancy during this time.

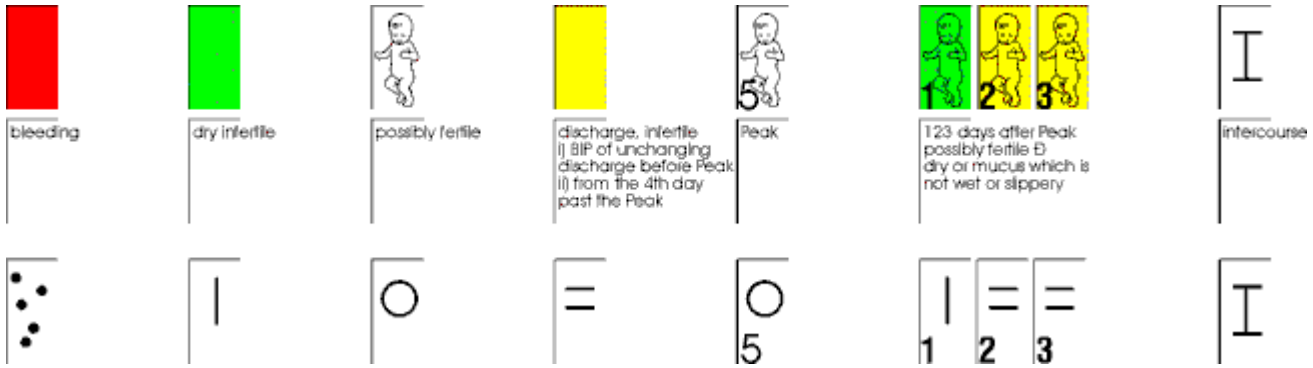

Figure 5a Legend for figures to Stamps and Symbols. The legends to the various colored stamps used in the charts apply equally to the black and white symbolic representation of these colored stamps. See below.

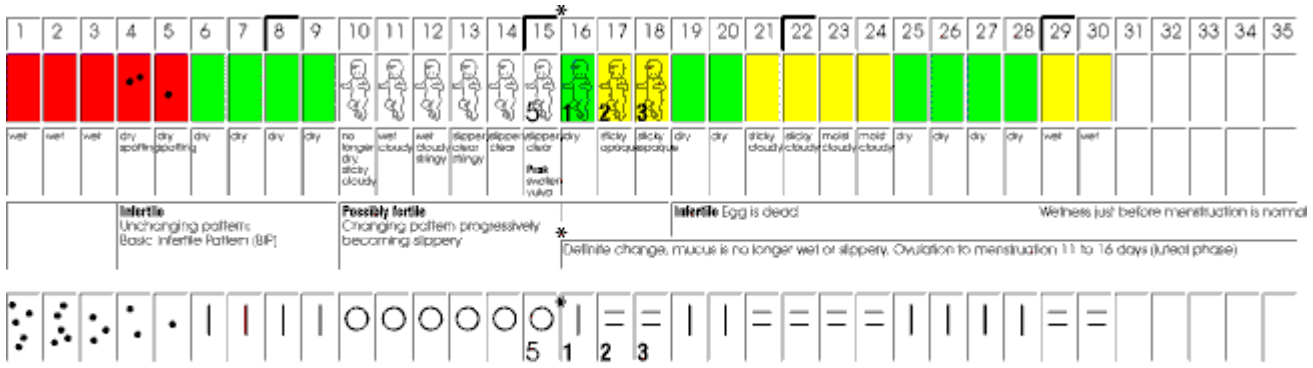

Chart 1. Recording with stamps and also with symbols the observations made at the vulva in a normal fertile cycle.

Figure 5b. Recording with stamps and also with symbols the observations made at the vulva in a normal fertile cycle.

While the menstrual days as such are not necessarily days of fertility, nevertheless, most cultures avoid intercourse during menses. This serves the purposes of the Ovulation Method well as bleeding may obscure the beginning of mucus build-up prior to the end of menses in the case of a short cycle. It is

known that sperm die rapidly - perhaps within 30 minutes - in the acid vagina, but may survive up to five days when the mucus is in its fertile phase. Dry days following menses then are not yet days of fertility. Couples wishing to avoid pregnancy may have intercourse on the infertile days; however, it is suggested that they restrict intercourse to alternate evenings in order to permit the woman to observe for the presence of mucus and also to avoid the confusion between seminal discharge or 'arousal fluid' (Bartholin gland secretion) and beginning mucus on the day following intercourse. Thus, alternate evenings of dry days are available during the early infertile days. When avoiding pregnancy, all the days of mucus until peak (the last day during which mucus is either slippery, stretchy, cloudy, or clear) and a full three days following peak are the fertile days of the couple. Once the mucus peak has been identified, it is followed by the luteal phase. Women generally have the same length of luteal phase each month. The normal range is 11-16 days. Once the peak rule of waiting until the fourth day after peak to resume intercourse has been observed, there are no further rules until the next period (see Fig. 5c and Appendix). Figures 5b & 5c show a typical ovulatory cycle recorded with colored stamps as well as the simpler symbols, which are used in many developing countries.

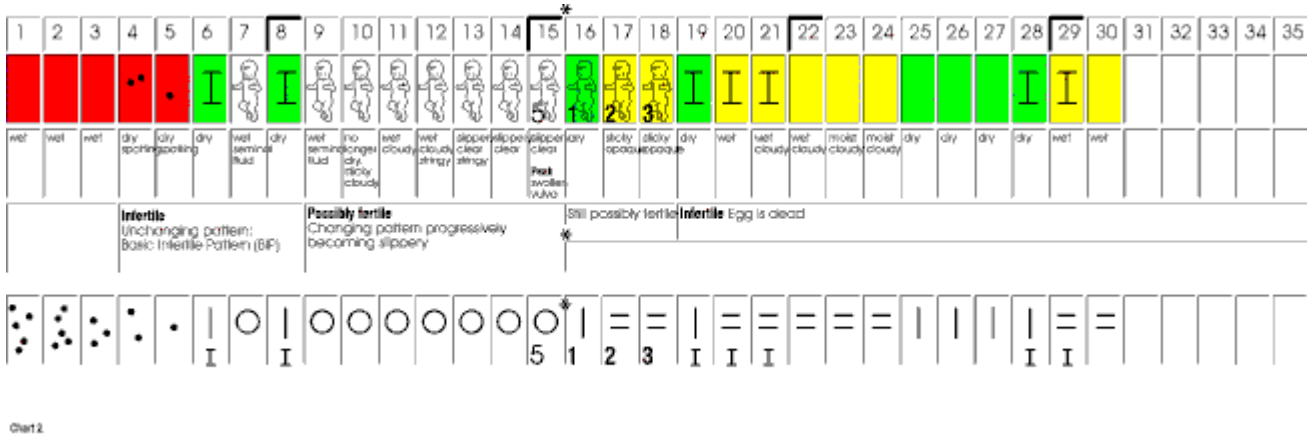

Figure 5c. Application of the Early Day Rules and the Peak Rule to postpone conception in the same normal fertile cycle as in Fig. 5b. The white baby stamp (or the circular symbol) is used to indicate days of possible fertility and to record a change from the Basic Infertile Pattern (BIP), and is also used to record secretions following intercourse (represented by I) which might obscure the mucus. * Definite change, mucus is no longer wet or slippery. Ovulation to menstruation 11 to 16 days (normal length luteal phase)

If there is any bleeding or spotting other than menstruation, this is considered to be a sign of fertility, and is not available for intercourse, nor are the following three days until the evening of the fourth day. When a woman has a long cycle or a day or more of mucus which does not progressively change towards the more slippery, stretchy* variety, these are called patch patterns. [* "'stretch' and at other times as 'elasticity', neither of those words being appropriate to the observation of the mucus with fertile characteristics showing a tendency to form strings exactly as was originally described by the Germans with their word spinnbarkheit.It is the loss of any slipperiness or wetness that helps define the Peak and the tendency to form strings usually occurs, if at all two or three days before the Peak and ceases because of the mucolytic effect of the enzyme formed by a combination of zymogen granules from the isthmus of the cervix with the P-mucus.The same enzyme liberates sperm which may have been locked in the crypts by the L-mucus.The liberation of the G-mucus plug is also assisted by P-mucus working in combination with the L-mucus when the oestogen level begins to rise. (Personal correspondence from Dr. John Billings, September 26, 2000)]. Figure 6 shows such a cycle in which a typical "buildup" occurred. Later, peak was on day 46.

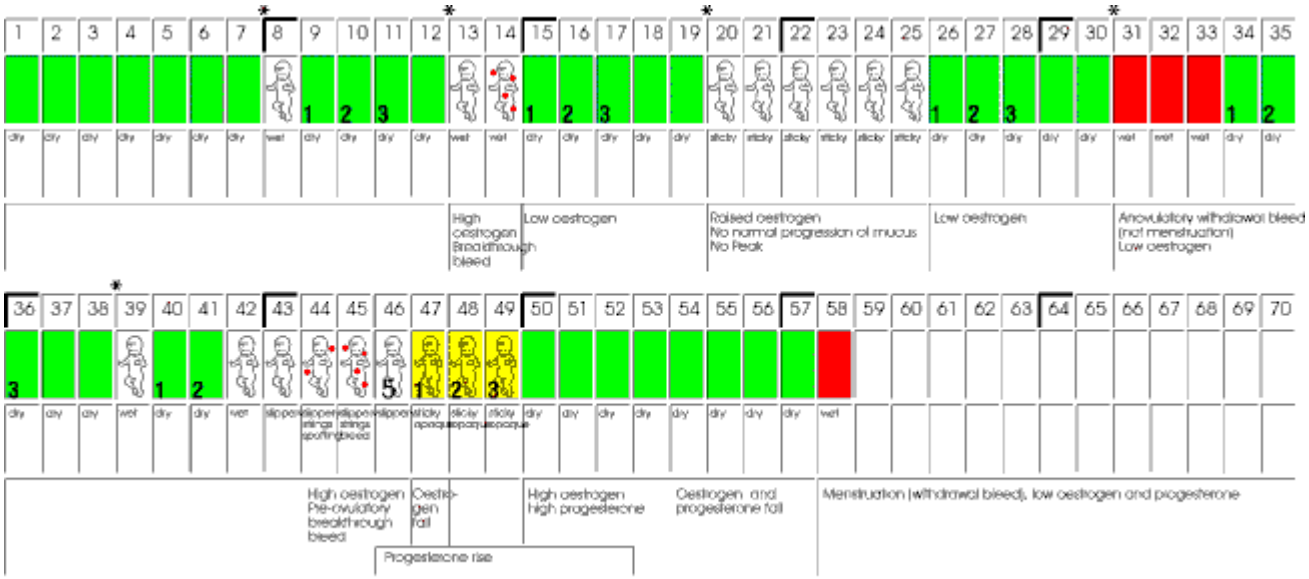

Figure 6 Delayed ovulation in a normal fertile cycle. The record begins sometime after menstruatiion had finished. Note application of the rule *'Wait and see, 123'*. On five occasions (*) in the cycle, the pattern retuned to the BIP and the rule *'Wait and see, 123'* was applied. On day 42 the rule *'Wait and see'* was applied and on day 46 the Peak was recognized and the Peak Rule was applied.

Figure 7 shows a cycle with bleeding.

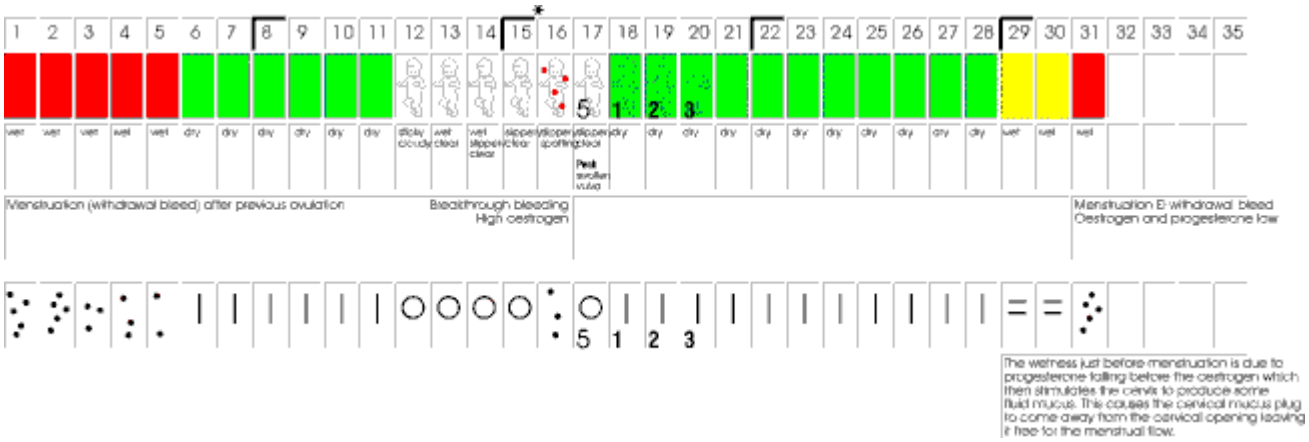

Figure 7. Physiological bleeding. Note breakthrough bleeding on day 16 (*) just prior to the Peak symptom. Menstruation is also noted to be a withdrawal bleed on this chart. Day 1 to 16 is not a cycle. Day 1 to day 30 is the ovulatory cycle.

Figure 8 includes two anovulatory cycles which show both basic infertile patterns. Chart A - dryness; Chart B - a combined pattern, which includes patches of discharge without lubrication.

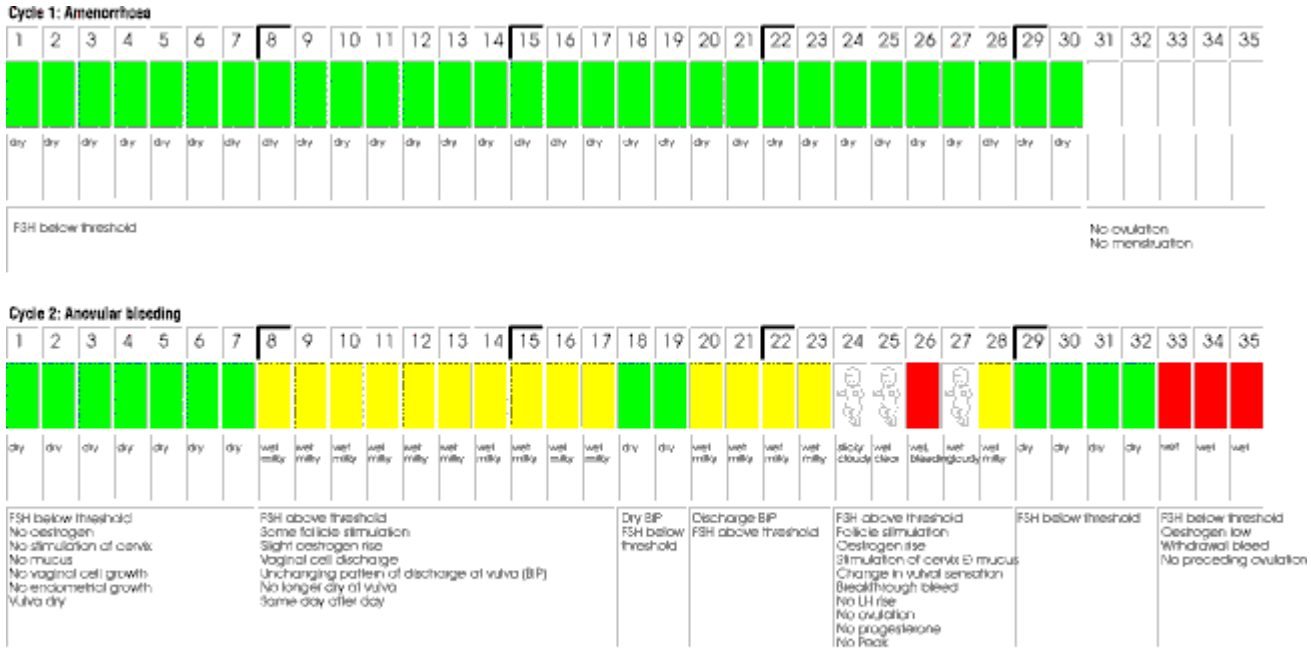

Figure 8. Infertility indicated by dry BIP (Chart A), combined dry and unchanging discharge BIP (Chart B). Pituitary and ovarian correlations are indicated. See **Hormonal Cascade of Ovulation** above.

A trained teacher is the best vehicle for correct instruction. The World Health Organization found that more than 90% of women could identify their cycle phases correctly in the first month of learning, the rest no later than by the third month. The mucus sign reflects the rising oestrogen of the ripening follicle and gives warning of the beginning of the fertile phase in all reproductive situations. The method has been applied successfully, not only during regular and irregular cycles, but during breastfeeding, premenopause, cessation of anovulant medication and during puberty.

Modifications of cervical mucus methods

To make natural family planning more attractive to potential acceptors by reducing the days of necessary abstinence, K. Dorairaj, who works mostly with very poor, uneducated, and poorly nourished women in India, has adapted the Billings rules: the women do not chart their observations, do not follow the "early day rule" which restricts intercourse to alternate evenings of the early infertile days of the cycle and wait only two days after peak day to resume intercourse. Comparative studies found somewhat higher rates of unplanned pregnancy and lower continuation rates than the Billings method.

Another modification was introduced at Creighton University in Omaha, Nebraska. It utilizes a standardized nomenclature to describe mucus observations, has modified several rules and considers any pregnancy as planned if conception occurred after the first three months of instruction from an act of coitus during a time of recognized fertility. Thus comparison of unplanned pregnancy rates as defined by other methodologies is not possible.

Anovulation

Oestrogen withdrawal bleeding in the absence of ovulation is encountered frequently in early puberty, after childbirth, when beginning weaning as well as after weaning, during premenopause, and upon discontinuation of anovulant medications, either oral or injectable. In those situations, the temperature pattern is monophasic, while the mucus pattern displays only patches of mucus with fertile characteristics, usually without a proper buildup to peak and with either breakthrough or withdrawal bleeding. In addition, the number of days which follow the last day of mucus seldom equal those of a normal luteal phase, being either shorter or longer. Only 50% of cycles are ovulatory in the first year of menses are ovulatory cycles. This increases by 10% each year until the woman is five years past menarche, when 85% of cycles are ovulatory. Even at the peak of fertility, women do not ovulate every month. In the face of stress, rapid weight loss, or rapidly increasing athletic training, anovulatory cycles are frequently encountered.

Lactation

Full lactation suppresses FSH and LH initially because of the high prolactin level, but amenorrhea may very well persist even when prolactin drops because the hypothalamo-pituitary ovulatory cascade is disrupted. When using the ovulation method or sympto-thermal methods, the woman is instructed to observe for the return of any signs of mucus, either by sensation or visual observation, and to presume that fertility is returning when signs are encountered. It is not uncommon to encounter a thin gray non-lubricative discharge during full lactation because of (physiological) atrophic vaginitis. This is different from mucus which has body and lubrication, or at least a rubbery consistency and elasticity. Once signs of fertility are encountered, the woman initiates the rules of the method.

The **lactational amenorrhea method (LAM)** is now being used in a number of countries, mostly through World Health Organization efforts. The Bellagio Consensus found that if women are still amenorrheic when the baby is six months old, and they are fully nursing, i.e., giving the baby only the breast, no top feeds, no fluids, except for an occasional taste of food, the woman had only a 2% risk of pregnancy.[(6)] At such time, she is invited to consider a transitional method. Many women do not fully breastfeed for six months, while other women return to menstruation and ovulation at 90-180 days postpartum. The "short amenorrhea" group has lower biologically active (BIO-PRL) prolactin than immunoreactive (IR-PRL) levels, while the "long amenorrhea" groups exhibit higher BIO-PRL levels. Unless one is able to screen for BIO-PRL/IR-PRL ratios, it is highly advisable to invite women to begin to observe for signs of mucus as soon as the lochia stop. In that way, they will not be surprised by the return to fertility.

Premenopause

The mucus sign is the most useful sign in premenopause. As the cervix ages, squamous epithelium begins to extend into the endocervix, the G mucus bearing area is found higher in the canal and the areas which produce L and S mucus gradually decrease; the number of days of mucus with fertile characteristics are reduced. Odeblad has shown that between ages of 13-17, the average woman has 8 days of mucus of which 6 are slippery (S mucus), while by age 33-37, the total days of mucus are 4.8 and less than 2 are slippery. Clearly the window of opportunity for fertility is considerably reduced in this age group. Odeblad has also shown that pregnancy increases the growth of S mucus crypts, hence, multiple pregnancies will maintain fertility until an older age is reached. When the cervix has aged, a woman may ovulate, but produce no cervical mucus even though she may have a biphasic temperature. Since the mucus is essential for sperm entry, such women are said to have non-fertile ovulations. A study of 138 premenopausal women found no pregnancies beyond the age of 45; the method-related pregnancy rate at 40-44 years of age was 0.32%, and the informed choice pregnancy rate was 1.6%.

40-44 years of age was 0.52%, and the informed choice pregnancy rate was 1.0%.

Discontinuation of Ovulation Suppression

The return to fertility after discontinuation of ovulation suppressants varies from immediate resumption of previous patterns to post-pill amenorrhea. If the woman is going to ovulate, she will find a mucus build up followed by biphasic temperatures. The cervical eversion which is found in at least 25 percent of women who have used the birth control pill for over 3 months weeps copious amounts of fertile-type mucus once the woman stops ingesting progestins. It is not unusual to find 14 days of slippery, stretchy, clear mucus in the first off-pill cycle. Experience has shown that if the number of mucus days do not decrease considerably by the third cycle, cryosurgery or silver nitrate treatment after cytologic and colposcopic studies have shown no other pathology, is appropriate and curative. Care must be taken not to confuse the normal eversion of the preovulatory cervix with persistent effect of the "pill." It is also important to freeze only the glandular epithelium on the portio vaginalis, and not destroy the normal endocervix. Excess freezing or hot cautery can destroy the mucus producing crypts, as can a high conization. While a cervical eversion is weeping mucus, a woman may not be able to distinguish her peak symptom, particularly if she has had no prior experience. Monitoring BBT at least initially may help build confidence.

Cervicitis and Vaginitis

Any woman who knows her fertility pattern will detect an abnormality quickly and seek treatment. Chronic baseline discharge is readily distinguished from the buildup pattern. Local medication may mask mucus (as do contraceptive foams and gels). If the pattern cannot be perceived, and the couple do not wish to risk a pregnancy, they must abstain until their pattern becomes recognizable. Trichomoniasis and bacterial vaginosis will alter the normal pattern and require appropriate treatment.

With systemic or local antibiotic treatment, monilial vaginitis is common, and may obscure the mucus pattern; abstinence must be advised until the pattern clears, if pregnancy avoidance is desired. Antihistamines tend to thicken mucus, while guafenisin liquifies it. Cervicitis may produce an "inflammatory mucus" similar in structure to G mucus.

Ovulation Suppression by Stress and Pharmaceuticals

The role of physical and emotional stress in suppressing ovulation via alteration of the hypothalamo-pituitary axis is well-known and well documented. Sudden weight loss, environmental stress and/or change, have led to amenorrhea. When stress suppresses ovulation, a pattern of intermittent mucus without a peak is seen. Such a cycle is, of course, monophasic, and shows no increase in progesterone. Often the emotionally or physically stressful events are easily correlated with the mucus patterns, and resolution of conflict is then followed by (delayed) ovulation. McArthur et al. found that in three women who recently began running, the amenorrhea was associated with normal body composition, low baseline concentrations of LH and normal concentrations of FSH, normal to hyperresponsiveness of LH and FSH to GnRH testing, and normal and possibly increased frequency of LH pulsations. They believe that an alteration in the hypothalamic control of gonadotropin release, independent of body composition, is operant in the development of "athletic amenorrhea." While mucus observations were not made in these women, vaginal cytohormonal studies indicated moderate vaginal atrophy. Taylor et al. have correlated the highest karyopyknotic index with the peak mucus symptom and found close correlations to date.

The use of psychotropic drugs, particularly the phenothiazines, is associated with amenorrhea and, at times, with inappropriate lactation, presumably as a result of prolactin increase. In such women, the normal ovulatory mucus pattern is disturbed and can signal the disturbed hormonal picture. There are anecdotal reports of ovulation suppression following tetrahydrocannabinol (THC) smoking, as reflected in the mucus patterns. While ovulation disturbances are seen in hard drug users, they are difficult to define

due to erratic use (they are known to become pregnant) and are not easily separated out from their dietary confounding factors. Any systemic illness which interferes with ovulation, i.e., hypo- or hyperthyroidism, will be reflected in the mucus and thermal patterns.

Biochemical Indicators of Fertility

Various monitoring devices have been used to correlate physiological fertility signs with hormonal parameters. Some devices are teaching aids or are used to clarify a difficult mucus pattern while others are being marketed as "less subjective" than self detection of mucus. Still other devices measure vaginal fluid volume, or program calendar rhythm data, thermal shifts, and mucus patterns into computers. Most devices attempt to identify the beginning and end of the fertile phase, among them home monitors which detect the oestrogen rise which marks the beginning of fertility and those which detect the rise of progesterone at the end of fertility. WHO has supported field testing of several monitors, J. Brown's assay is among the most widely tested. The Brown Ovarian monitor utilizes a micrococcus enzyme immunoassay to measure the levels of oestradiol and progesterone metabolites in the urine (oestrone glucuronide [E_1G] and pregnanediol glucuronide [PdG]). Another monitor uses an expensive device to monitor urine oestrogen and LH surge. The average number of fertile days obtained:

NFP Method	**Ave. No. Fertile Days**
Ovarian Monitor	8.9
Ovulation Method	10.4
Sympto-thermal	11.8
Bioself 110	15.0
Persona	6-12 [7]

Dipsticks for LH surge which identify the impending LH surge 72 hours in advance can assist couples who are seeking to achieve pregnancy. LH monitors cannot be used for pregnancy avoidance, as most women have more than 2 days of mucus before peak, and sperm will remain viable in mucus for more than 3 days. Since it is the mucus and not the hormone that serves as the gatekeeper for the sperm, it is never prudent to ignore the mucus sign. To date, none of the devices except the Brown ovarian monitor have duplicated the radio-immune assayed plasma hormonal levels. In clinical trials the unplanned pregnancy rates were 5-10%.

Couple Autonomy

Self-efficacy in the use of Natural Family Planning means achieving not only method, but couple autonomy. The couple must first learn to understand the signs of their cyclic fertility. The man is fertile all the time; the woman is fertile only when mucus keeps her husband's sperm alive in her body until ovulation, and for the extent of the life of the ovum. Once the mucus pattern has been understood, the couple needs to become comfortable with living with their rhythm of infertility and fertility. To do so requires communication. Respecting one's cycle demands respect for one's body, hence respect for the person. Couples find that living with their combined fertility changes their relationship to one of greater mutual consideration and respect.

Effectiveness of Natural Family Planning

All methods of family planning - natural or artificial - have unplanned pregnancies associated with their use. No method is 100%. Unlike contraception, natural family planning can be used either to achieve or to avoid pregnancy. Initially, investigators classified unplanned pregnancies into method failures and user failures. Method failures occurred when the method had been used correctly and consistently, user failures

when the method was either not correctly understood or incorrectly used. Later, the concept of extended use effectiveness was introduced: any pregnancies which occurred when acceptors had discontinued the use of the contraceptive, but before using a different one, were classed under extended use-effectiveness, unless the woman has indicated that she wished to achieve pregnancy. While contraception uses a medication, device, or technique (such as withdrawal) to prevent conception, natural methods demand recognition of the fertile phase, and abstinence during the fertile phase according to the rules of the method, if pregnancy is to be avoided. Both the Pearl Formula - the number of unplanned pregnancies per 100 woman years:

$$P.R = \frac{\text{N unplanned pregnancies x 1200 (or 1300)}}{\text{N exposure cycles}}$$

- and the Life Table have been used to gauge the effectiveness of family planning methods. Natural Family Planning users differentiate between: 1) Method-related pregnancies: the method has been used correctly and consistently; 2) Teaching-related pregnancies: misunderstanding of the method due either to poor teaching or poor learning or both; and 3) Informed choice pregnancies: pregnancy was not planned, but the couple chose to have intercourse on a day of recognised fertility. Most recently, Trussell et al. introduced the concept of "perfect use" and "typical use" to evaluate unplanned pregnancies. Perfect use is similar to method-related pregnancy, while typical use includes all of the user factors. Rates are computed separately to permit better identification of factors leading to unplanned pregnancy. As most NFP trials found fewer than 2% method related pregnancies, the new terminology makes little practical difference. The frequently cited 1978 World Health Organization trial of the Ovulation Method found only slightly higher method related pregnancies (2.8%) and user-related pregnancies (19%). More recent studies have shown far lower unplanned pregnancy figures as teachers become more experienced (Table 1).

Table 1. NATURAL FAMILY PLANNING (NFP) USE EFFECTIVENESS

Current NFP Effectiveness Studies Ranked by Pregnancy and Continuation Rates. Life Table Rates are Cumulative Net Pregnancies at One Year or 13 Cycles. Method: OM-Ovulation Method; MMM-Modified Mucus Method; ST-Sympto Thermal Method. Continuation Rate is the percent of acceptors who are still using NFP for pregnancy avoidance at one year, irrespective of their reason for discontinuation.

One Year (Total) Unplanned Pregnancy Rate

Country	Year	Method	Life Table	Pearl Rate	Continuation Rate
Indonesia	1990	OM	2.5		89.6
Liberia	1993	ST/OM	4.3		78.8
Nepal	1986	MMM	7.3		45.0
Zambia	1993	ST/OM	8.9		71.2
Indonesia	1990	MMM	10.3		81.2
Kenya	1988	OM	10.5		46.0
Korea	1988	OM	13.4		57.0
Bangladesh	1988	OM	14.9		72.0
India	1991	MMM		2.0	N.A.
Germany	1992	ST		2.3	92.9
UK	1991	ST		2.7	N.A.
Italy	1988	ST		3.6	100.0
China	1994	OM	7.0		86.0
Europe	1993	ST		2.5	48.0 (9 countries, 14 sites)
Liberia	1994	OM/ST	1.5		93.7
Liberia	1994	MMM	6.6		66.0
India	1994	OM	11.6		76.4 (5 states)

China [8]	2000	OM	0.51	97.4	
U.S.	1994	OMCr	12.8	78.0	(Creighton Model)

APPENDIX

WAYS OF IDENTIFYING FERTILITY/INFERTILITY

CALENDAR RHYTHM

Calendar Rhythm calculates the fertile and infertile days of the cycle based on the life of the corpus luteum plus sperm survival in cervical mucus.

The most conservative systems assume maximum life for both: 16 days for corpus luteum survival and 5 days putative sperm survival. Thus a woman who knows the length of her last 6 cycles subtracts 21 days from the shortest cycle in order to know the number of early infertile days. Other systems subtract 20 days or 19 days. Since normally, corpus luteum life is no less than 11 days, one may calculate 10 days from the longest previous cycle in order to know the first late infertile day. Some groups subtract 11 days. For example, if one woman's cycles ranged from 27-35 days in length, her last early infertile day would be Day 6 of the cycle and her first late infertile day would be Day 24.

SYMPTO-THERMAL METHODS

Calendar rules are retained to identify the early infertile days, but superseded by any appearance of mucus, which signals the beginnin of the fertile phase. Postovulatory infertility is identified in the following ways:

A. Rötzer

After peak has been identified, the thermal rise is considered to have occurred if the first two higher temps. are at least 0.2°F, and the third is at least 0.4°F above the last 6 low temps.

B. Coverline

A line drawn 0.1°F above the last 6 low temps. before the rise. Three consecutive highs at least 0.4°F above the coverline.

C. Vollman

Average all temperatures of the previous month from day 6 until the end of the cycle. Average these to 0.01°F. Draw a line across current cycle at last month's average. The fourth day of rise of the current cycle above the previous average begins the late infertile phase. (Also called the mean intercept.)

D. McCarthy

Peak symptom, cycle length pattern, coverline, or running average plus 0.3°F. Applies several variations and advises caution as failure to identify a rise may not indicate anovulation.

E. Kippley's Four Basic Rules

1. Rule C
a. third day of full thermal shift
b. fourth day of drying up or disappearance of mucus
c. fourth day of cervix closing or lowering may also be used in absence of cervical os monitoring

2. Rule A - in the presence of a strong thermal shift, infertility begins on the evening of the 3rd day (or more) of full thermal shift, simultaneously crosschecked by 2 (or 3) days of drying up past the peak day.

3. Rule B - used for temperature patterns not as strong or clear as Rule A, and a mucus pattern not as clear of helpful.
1) evening of 4th day of drying up past peak day,
2) crosschecked by 3 (or more) days of overall thermal shift past the peak day. All temperatures must be at least 0.1°F. above the pre-shift base line, the last day must be 0.4°F. higher than the baseline.

4. Rule R - Postovulatory infertility begins the evening of Peak day + 3 cross checked by 3 days of strong thermal shift. Four or more days of drying up or dryness corroborated by temperature sign of:
a. at least 3 days of temps. higher than preovulation base;
b. these temps are in a rising or elevating pattern;
c. at least one or more of these temps. has reached the normal thermal shift level of 0.4°F above preovulatory baseline.

Kippley adds calendar calculations for the determination of the early infertile days.

Note: Changed mucus is present after peak in most women. Peak is the last day of mucus with fertile characteristics: lubricative, stretchy, clear or cloudy. See Ovulation Method, below.

RULES OF THE OVULATION METHOD

To learn the method to avoid pregnancy:
In the first cycle, refrain from intercourse and any genital contact from the beginning of the cycle until the mucus peak has been identified, and for three full days after peak. Once the mucus pattern has been observed, apply the:

Early Day Rules:
1. Avoid days of menstruation
2. The basic infertile pattern (BIP):
a) Dry days after menses are not yet fertile. Alternate evenings of dry days are available for intercourse (early day rule).
b) There is only one B.I.P. in the average length cycles. There are either dry days or an unchanging discharge, usually slight (desquamated vaginal cells or a small amount of mucus from vaginal epithelium) and producing only a dry or sticky sensation at the vulva, the change from the B.I.P. signifies the start of days of possible fertility.
3. If the B.I.P. is dry days after menstruation, any change in sensation or appearance of the discharge at the vulva signifies possible fertility.
4. When the B.I.P is an unchanging discharge, any change in sensation or appearance at the vulva signifies possible fertility. It requires three average length cycles to become accustomed to this point of change, during which time the couple should confine intercourse to the post-ovulatory days, according to

the Peak rule. In the event of a "patch" of mucus -- one or more days of non-changing mucus followed by dryness, or if there is any bleeding or spotting outside of menstruation, avoid all days of mucus, bleeding, or spotting, and wait until the fourth evening after the last fertile sign to resume intercourse (the "wait and see" rule).
5. When ovulation is delayed, so that the pre-ovulatory phase is more than three weeks, the B.I.P. can then be studied for a period of 2 weeks. It may be:
i) All dry
ii) A continuous unchanging discharge, or
iii) A combination of (i) and (ii)
The Early Day Rules are applied in all these circumstances.
6. When returning to fertility during or after lactation, wait until the fourth evening after the first two menses.
7. The early day rules apply in all special circumstances: lactation, weaning, premenopause, discontinuation of anovulant medication - any anovulatory state.
8. The Peak Rule: Wait until the fourth day after peak to resume intercourse. After the peak rule has been observed, there are no rules.

To achieve pregnancy:
Identify the fertile pattern as above. Intercourse on Peak or the day after is most likely to achieve pregnancy.

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