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Can Fasting in the Holy Month of Ramadan Affect on the Levels of Luteinizing Hormone, Follicle-Stimulating Hormone, and Prolactin?

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ABSTRACT

Adherence to the recommendations and obligations of Islam is of great importance in achieving a desirable lifestyle. Fasting in the holy month of Ramadan is one of the main principles of Islam, in which Muslims refrain from eating, drinking, oral medications, and smoking from Fajr (pre-dawn) to Maghrib (sunset). Islamic rules dictate that fasting is unacceptable if it causes harm to the health of an individual. Luteinizing hormone (LH), follicle-stimulating hormone (FSH), and prolactin (PRL), which are secreted by the pituitary gland, play a key role in maintaining health. LH and FSH are predominantly involved in setting the normal function of the reproductive system and PRL has a key role in lactation, and collapsed levels of these hormones is associated with severe health problems. Given the conditions of Islamic fasting and importance of the normalized levels of these hormones in fasting individuals, the effects of Islamic fasting on these parameters must be investigated thoroughly. This review was performed to evaluate the credible published articles collected via searching in databases such as Science Direct, Google Scholar, and PubMed. According to the results, Ramadan fasting has no adverse effects on the concentrations of LH, FSH, and PRL.

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Introduction

Nutrition and nutritional observations play a key role in achieving a healthy lifestyle, so that individuals could live with prosperity and wellbeing. Adherence to Islamic principles is considered to be an effective approach in this regard. Fasting is an Islamic pillar and obligation. Fasting during the holy month of Ramadan is a divine duty with numerous therapeutic attributes. In Ramadan, Muslims must abstain from eating, drinking, oral medications, and smoking from Fajr (pre-dawn) to Maghrib (sunset). Although fasting is obligatory for alls male and female adult Muslims, it is not allowed for the individuals whose health might be threatened by this religious duty. Depending on the geographical location and season, duration of fasting may range from 12 to 19 hours (1-6). Normal levels of the luteinizing hormone (LH), follicle-stimulating hormone (FSH), and prolactin (PRL) are important indicators of health. FSH is a glycoprotein hormone (gonadotropin), which is secreted via the anterior pituitary gland, and regulates the reproduction system in the human body. FSH plays a pivotal role in the development of ovarian follicle and spermatogenesis formation; therefore, normal concentration of this hormone is essential to fertility in men and women (7-10). LH is among the main pituitary hormones. It is a gonadotropin that plays a key role in the stimulation of the ovaries. Level of LH must be normal since it produces testosterone via the Leydig cells and is involved in follicle growth. Furthermore, LH plays a key role in steroidogenesis (10-14). PRL is a protein

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hormone secreted from the anterior pituitary gland and originally functions in increasing lactation. Hyperprolactinemia is defined as the elevated serum level of PRL, which may cause secondary amenorrhea and estrogen deficit in women. In addition, it could lead to infertility, gynecomastia, and reduction of the muscle mass in men (15-17). With this background in mind, it has been well established that the normal levels of LH, FSH, and PRL are of paramount importance in maintaining health. Therefore, investigating the cases that lead to the disruption of the normal and physiological states of these hormones could effectively prevent the disturbances caused by the collapse and non-normalization of their concentrations. Since Ramadan fasting has specific conditions to be observed during this month, the effects of this Islamic principles on the levels of LH, FSH, and PRL should be determined. The present study aimed to evaluate the effects of Ramadan fasting on LH, FSH, and PRL concentrations.

Material and methods

This was a review to assess the credible published articles that were collected via searching in databases such as Science Direct, Google Scholar, and PubMed, using keywords such as fasting, Ramadan, nutrition restriction, anorexia nervosa [Footnote1], luteinizing hormone, follicle-stimulating hormone, and prolactin.

How is the effects of Ramadan fasting, nutrition restriction, and anorexia nervosa on the LH, FSH, and PRL levels?

LH and FSH Hormones

As mentioned earlier, duration of Ramadan fasting may vary from 12 to 19 hours, which is known to cause changes in some of the biochemical indicators in the human body. Considering the objectives of the present study, Mesbahzadeh et al. and Al-Chalabi assessed single healthy males and infertile males, respectively. According to the findings, serum FSH and LH remained unchanged during Ramadan fasting (18, 19). Moreover, in another study, changes in the FSH and LH concentrations were reported to be within the normal range in fasting young males during Ramadan (20). According to another research in this regard, the concentration of LH remained unchanged after 10 days of fasting in obese males. Moreover, findings of two other studies indicated that Ramadan fasting had no adverse effects on the levels of LH and FSH in healthy and non-smoking males (21-23). Also, in a research conducted on obese males, Suryanarayana et al. reported that 27-190 days of total starvation might not influence the concentrations of the two mentioned hormones (24). In the study by Qadeeri and Khameneh, the FSH concentration was reported to reduce during Ramadan in single healthy males, while in this research was stated that Ramadan fasting has no adverse effects on reproductive health (25). In another study, Cameron et al. confirmed that the concentration of FSH decreased after 48 hours of starvation in healthy males, while the findings of another research in this regard showed that the FSH concentration reduced during 10 days of fasting in obese males (21, 26). It is notable that in the study by Qadeeri and Khameneh, the LH level had no alteration in fasting males (25), while the reduction of this hormone was reported by Cameron et al. (26). With respect to the effects of Ramadan fasting on the female hormone levels during and after the first menstrual period, Caglayan et al. stated that LH and FSH levels had no statistically differences during and before fasting (27). Also, findings of different studies and researches were planned based on impacts of Ramadan fasting and nutrition restriction, and they confirmed lack of changes or noticeable changes on FSH and LH levels and also they illustrated that there were no considerable changes in their pulsatile secretion. As well as, above findings emphasized on lack of undesirable effects on mentioned parameters levels (28-41). In this regards, researchers were emphasized suitable influences of Ramadan fasting on gonadotropins (42). In other study, researchers confirmed that 5 days of nutritional deprivation can reduce secretion of LH (41). Furthermore, in a study was demonstrated that changes of FSH concentration were within normal limits in fasting healthy men during Ramadan, also in another research was declared that 56 hours of nutritional restriction has minor changes and impacts on FSH level in healthy men (33, 43). Bahreyni et al. assessed the concentrations of LH and FSH levels in 58 pre-menarche girls.

According to the obtained results, Islamic fasting had no significant effects on the LH and FSH concentrations, and no differences were observed in the levels of these hormones before and after Ramadan (44). This finding is consistent with the study performed by Zangeneh et al. on the women with polycystic ovary syndrome (PCOS) (45). Shahabi et al. have claimed that Ramadan fasting was associated with no significant changes in the secretion of LH and FSH in healthy women with regular ovulatory cycles (46) Levels of LH and FSH hormones in patients with eating disorders such as anorexia nervosa were normal or unaltered. In this regard, changes related with mentioned hormones in some studies confirmed that there were no significant changes. But, in a paper was reported that basal LH levels were reduced in patients with this disorder (47-50). Bergendahl et al. stated that LH secretion was suppressed in young men under nutritional restriction but this case is not true about older men and it didn't confirm (51). On the other hand, researchers have evaluated the effects of Ramadan fasting on the levels of gonadotropins in healthy young females, stating that the changes in the gonadotropin levels caused by physiological factors (e.g., menstrual periods) and fasting had no significant effects on gonadotropins alterations (52). Findings of one study indicated that level of LH hormone was significantly unaltered in postmenopausal women (53). It is also noteworthy that FSH concentration was reported to increase in response to the injection of the gonadotropin-releasing hormone (GnRH) in obese males, while the level of LH remained unchanged in response to the GnRH injection (21). In other study, researchers did a study on healthy men and found that FSH changes were not considerable in response to GnRH (39).

PRL Hormone and Its Response to Thyrotropin-releasing Hormone (TRH)

PRL is an important health indicator, which might be affected by fasting. Some studies have investigated the effects of fasting on the PRL level. Based on the relationship between fasting and levels of male and female hormones, it has been claimed that fasting has no significant effects on the basal PRL level. Of note, participants in these studies consist of healthy men and women that were investigated in view influence of fasting in Ramadan month and influence of starvation for 12 to 60 hours on mentioned index (22, 34, 54). In another research, PRL level was reported to increase in men during the first two weeks of fasting, while it reduced afterwards. Additionally, the results of the mentioned study indicated that this parameter was within the normal ranges during Ramadan (20). On the other hand, findings of Cağlayan et al. demonstrated that Ramadan fasting had no significant effects on the PRL level in healthy women (27). In this regard, Al-Chalabi stated that PRL serum concentration remained unchanged after Ramadan fasting in infertile males (19). But Tegelman et al. stated that PRL level had reduction in healthy males and females under nutritional restriction (39). In addition, other similar studies have denoted no significant alterations in the basal PRL level in fasting obese males. It is notable that the basal PRL level was measured during 3-9 weeks of starvation in the mentioned studies. Furthermore, serum PRL level was reported to remain normal in response to the injection of TRH in the fasting males (55). Similarly, in the study conducted by Croxson et al., it was stated that the mean serum concentration of PRL was normal after 7 days of fasting (56). Jung et al. investigated the effects of 36 hours of starvation on the PRL level and its response to TRH in a population of healthy euthyroid males. According to the results, basal PRL had no alteration at the end of the starvation period. Moreover, they observed that the TRH reception had no effect on the response of PRL (57). These findings have been confirmed in the context of Ramadan fasting as well (34, 22). According to the results obtained by Burger in this regard, the PRL response to TRH reception remained unchanged in men and women after 48 hours of starvation (58). In several articles that were done on patients with anorexia nervosa, changes related with PRL were normal or without significant changes (47, 59-67).

Results

Table 1 summarizes the collected data from the reviewed studies, and Table 2 shows the changes in the LH, FSH, and PRL levels. It is worth

mentioning that each of these hormones has been studied in males and females, as presented in Table 1. Indeed, since the role of these hormones varies among males and females, and given that the studied subjects consist of males or females; it is important to know how the changes are made according to the explanation given. The life stage of the individuals studied is also presented in Table 1, because it's also important to pay attention to this.

Table 1. Summarized Data of Reviewed Studies

Researchers	Studies			
	Duration of Fasting	Subjects	Life Stage	Type of Fasting and Disorder
Mesbahzadeh et al. (18)	Ramadan Month	Healthy Males	Fertility	Ramadan Fasting
Al-Chalabi (19)	Ramadan Month	Infertile Males	Fertility	Ramadan Fasting
Pajouhi et al. (20)	Ramadan Month	Healthy Males	Fertility	Ramadan Fasting
Klibanski et al. (21)	10 Days	Obese Males	Fertility	Nutritional Restriction
Azizi (22)	Ramadan Month	Healthy Males	Fertility	Ramadan Fasting
Bogdan et al. (23)	Ramadan Month	Healthy Males	Fertility	Ramadan Fasting
Suryanarayana et al. (24)	27-190 Days	Obese Males	Fertility	Nutritional Restriction
Qadeeri And Khameneh (25)	Ramadan Month	Healthy Males	Fertility	Ramadan Fasting
Cameron et al. (26)	48 Hours	Healthy Males	Fertility	Nutritional Restriction
Cağlayan et al. (27)	Ramadan Month	Healthy Females	Childbearing Age [Footnote2]	Ramadan Fasting
Bakir et al. (28)	Ramadan Month	Healthy Males	Fertility	Ramadan Fasting
Talib et al. (29)	Ramadan Month	Healthy Males	Fertility	Ramadan Fasting
Olson et al. (30)	3 Days	Normal weight Females	Childbearing Age	Nutritional Restriction
Soules et al. (31)	3 Days	Normal Females	Childbearing Age	Nutritional Restriction
Bergendahl et al. (32)	2.5 Days	Young healthy Females	Childbearing Age	Nutritional Restriction
Mansi and Amneh(33)	Ramadan Month	Healthy Male Students	Fertility	Ramadan Fasting
Azizi and Amir Rasouli(34)	Ramadan Month	Normal Males	Fertility	Ramadan Fasting
Röjdmark (35)	56 Hours	Normal Males	Fertility	Nutritional Restriction
Beitins et al. (36)	10 Days	Obese Females	Postmenopausal Age	Nutritional Restriction
Drezgić et al. (37)	21 Days	Obese Females	Childbearing Age	Nutritional Restriction
Veldhuis et al. (38)	5 Days	Normal Males	Fertility	Nutritional Restriction
Tegelman et al. (39)	7 Days	Healthy Males and Females	Fertility/Childbearing Age	Nutritional Restriction
Alvero et al. (40)	72 Hours	Lean Females	Childbearing Age	Nutritional Restriction
Aloi et al. (41)	5 Days	Healthy Males	Fertility	Nutritional Restriction
Abbas and Basalamah(42)	Ramadan Month	Healthy Males	Fertility	Ramadan Fasting
Samuels and Kramer(43)	56 Hours	Healthy Males	Fertility	Nutritional Restriction
Bahreyni et al. (44)	Ramadan Month	Healthy Females	Pre-menarche	Ramadan Fasting
Zangeneh et al. (45)	Ramadan Month	20-40 Aged Females With PCOS	Childbearing Age	Ramadan Fasting
Shahabi et al. (46)	Ramadan Month	Healthy Females	Childbearing Age	Ramadan Fasting
Skałba et al. (47)	-	Females	Childbearing Age	Anorexia Nervosa[2]
Dhungana et al. (48)	-	Female	Childbearing Age	Anorexia Nervosa
Wiegelmann and Solbach (49)	-	Females	Childbearing Age	Anorexia Nervosa
Travaglini et al. (50)	-	Females	Childbearing Age	Anorexia Nervosa
Bergendahl et al. (51)	3.5 Days	Healthy Males	Fertility	Nutritional Restriction
Yarahmadi et al. (52)	Ramadan Month	Healthy Females	Childbearing Age	Ramadan Fasting
Turcato et al. (53)	4 Weeks	Obese Females	Postmenopausal Age	Nutritional Restriction
Johnston et al. (54)	12 to 60 Hours	Healthy Males and Females	Fertility/Childbearing Age	Nutritional Restriction
Carlson et al. (55)	3-9 Weeks	Obese Males	Fertility	Nutritional Restriction
Croxson et al. (56)	7 Days	Euthyroid Males and Females	Fertility/Childbearing Age	Nutritional Restriction
Jung et al. (57)	36 Hours	Healthy Euthyroid Males	Fertility	Nutritional Restriction
Burger et al. (58)	48 Hours	Healthy Males and Females	Fertility/Childbearing Age	Nutritional Restriction
Wakeling et al. (59)	-	Females	Childbearing Age	Anorexia Nervosa
Pirke et al. (60)	-	Males and Females	Fertility / Childbearing Age	Anorexia Nervosa

Continues of Table 1.				
Beumont et al. (61)	-	Females	Childbearing Age	Anorexia Nervosa
Beumont et al. (62)	-	Females	Childbearing Age	Anorexia Nervosa
Isaacs et al. (63)	-	Females	Childbearing Age	Anorexia Nervosa
Mecklenburg et al.(64)	-	Females	Childbearing Age	Anorexia Nervosa
Macaron et al. (65)	-	Males and Females	Fertility / Childbearing Age	Anorexia Nervosa
Buvat et al. (66)	-	Females	Childbearing Age	Anorexia Nervosa
Vigersky et al. (67)	-	Females	Childbearing Age	Anorexia Nervosa

Table 2. Changes in LH, FSH, and PRL Levels

Researchers	Parameter	Changes
Mesbahzadeh et al. (18)	LH	Unchanged
Mesbahzadeh et al. (18)	FSH	Unchanged
Al-Chalabi (19)	LH	Unchanged
Al-Chalabi (19)	FSH	Unchanged
Al-Chalabi (19)	PRL	Unchanged
Pajouhi et al. (20)	LH	Within Normal Limits
Pajouhi et al. (20)	FSH	Within Normal Limits
Pajouhi et al. (20)	PRL	Within Normal Limits
Klibanski et al. (21)	LH	Unchanged Unchanged in Response to GnRH Injection
Klibanski et al. (21)	FSH	Reduced Increased in Response to GnRH Injection
Azizi (22)	LH	Unchanged
Azizi (22)	FSH	Unchanged
Azizi (22)	PRL	Unchanged Basal PRL Normal Response of PRL to TRH
Bogdan et al. (23)	LH	Unchanged
Bogdan et al. (23)	FSH	Unchanged
Suryanarayana et al. (24)	LH	No Adverse Effects on LH Level
Suryanarayana et al. (24)	FSH	No Adverse Effects on FSH Level
Qadeeri And Khameneh (25)	LH	No Adverse Effects on LH Level
Qadeeri And Khameneh (25)	FSH	Reduction No Adverse Effects on Reproductive Health
Cameron et al. (26)	LH	Reduction
Cameron et al. (26)	FSH	Reduction
Cağlayan et al. (27)	LH	No Adverse Effects on LH Level
Cağlayan et al. (27)	FSH	No Adverse Effects on FSH Level
Cağlayan et al. (27)	PRL	Within Normal Limits
Bakir et al. (28)	LH	No Significant Changes
Bakir et al. (28)	FSH	No Significant Changes
Bakir et al. (28)	PRL	No Adverse Effects on PRL Level
Talib et al. (29)	LH	No Significant Changes
Olson et al. (30)	LH	No Adverse Effects on LH Level
Soules et al. (31)	LH	Preservation of Physiological Pattern
Soules et al. (31)	FSH	No Adverse Effects on FSH Level
Bergendahl et al. (32)	LH	No Significant Changes
Mansi and Amneh (33)	LH	Unchanged
Mansi and Amneh (33)	FSH	Within Normal Limits
azizi and Amir Rasouli (34)	LH	No Significant Changes
azizi and Amir Rasouli (34)	FSH	No Significant Changes
azizi and Amir Rasouli (34)	PRL	Unchanged Basal PRL Normal Response of PRL to TRH
Röjdmark (35)	LH	Reduction
Röjdmark (35)	FSH	Unchanged
Beitins et al. (36)	LH	No Significant Changes
Beitins et al. (36)	FSH	No Significant Change
Drezgić et al. (37)	LH	No Disturbances in Gonadotropins Secretion
Drezgić et al. (37)	FSH	No Disturbances in Gonadotropins Secretion
Veldhuis et al. (38)	FSH	Unchanged
Tegelman et al. (39)	LH	No Significant Changes
Tegelman et al. (39)	FSH	No Significant Changes

Continuous of Table 2.		
Tegelman et al. (39)	PRL	Reduction
Alvero et al. (40)	LH	No Significant Changes
Alvero et al. (40)	FSH	No Significant Changes
Aloi et al. (41)	LH	Reduction
Aloi et al. (41)	FSH	No Significant Changes
Abbas and Basalamah (42)	LH	Suitable Effects on Gonadotropins
Abbas and Basalamah (42)	FSH	Suitable Effects on Gonadotropins
Samuels and Kramer (43)	FSH	Minor Changes No Significant Changes in Response to GnRH Injection
Bahreyni et al. (44)	LH	No Significant Changes
Bahreyni et al. (44)	FSH	No Significant Changes
Zangeneh et al. (45)	LH	No Significant Changes
Zangeneh et al. (45)	FSH	No Significant Changes
Shahabi et al. (46)	LH	Unchanged
Shahabi et al(46)	FSH	Unchanged
Skałba et al. (47)	LH	No Significant Changes
Skałba et al. (47)	FSH	No Significant Changes
Skałba et al. (47)	PRL	No Significant Changes
Dhungana et al. (48)	LH	Unchanged
Dhungana et al. (48)	FSH	Unchanged
Wiegelmann and Solbach (49)	LH	Within Normal Limits
Wiegelmann and Solbach (49)	FSH	Within Normal Limits
Travaglini et al(50)	LH	Low Levels of Basal LH
Travaglini et al(50)	FSH	No Significant Changes in Basal FSH Levels
Bergendahl et al. (51)	LH	Suppression of LH Secretion in Younger Men No Suppression in Older Men
Yarahmadi et al. (52)	LH	No Significant Changes in Gonadotropin Levels
Yarahmadi et al. (52)	FSH	No Significant Changes in Gonadotropin Levels
Turcato et al. (53)	LH	No Significant Changes
Johnston et al. (54)	PRL	Unchanged Basal PRL
Carlson et al. (55)	PRL	No Significant Changes in Basal PRL Normal PRL Response to TRH
Croxson et al(56)	PRL	Unchanged Basal PRL
Jung et al. (57)	PRL	Unchanged Basal PRL Normal PRL Response to TRH
Burger et al. (58)	PRL	Unchanged Basal PRL Normal PRL Response to TRH
Wakeling et al. (59)	PRL	Normal Basal PRL
Pirke et al. (60)	PRL	Unchanged
Beumont et al. (61)	PRL	Normal Basal PRL
Beumont et al. (62)	PRL	Unchanged Basal PRL
Isaacs et al. (63)	PRL	Normal Basal PRL
Mecklenburg et al.(64)	PRL	Within Normal Limits
Macaron et al.(65)	PRL	Normal Basal PRL
Buvat et al.(66)	PRL	Within Normal Limits
Vigersky et al.(67)	PRL	Normal Basal PRL

Discussion

According to the present study, the explained results indicate that there are no adverse and dangerous effects of Ramadan fasting on LH, FSH, and PRL levels. As you can see, there are many studies in this field of nutritional and medical sciences. And the results also differ according to the above mentioned studies. The expressed differences must be considered. It is necessary to mention this item that the studied hormones play a major role in regulating normal human health. And it also mentioned in the above sections. Several studies in this area have been carried out by researchers suggesting the importance of considering the levels of these hormones in fasting during Ramadan or nutritional restriction. According to the stated studies, and also tables, Ramadan fasting effects on the levels of LH and FSH hormones are in the following:

1. Results that indicate the absence of change in LH and FSH hormones levels (18, 19, 22, 23, 33, 46).
2. Changes of above hormones are in normal range or they have no adverse effects on

reproductive health (20, 33). And fasting in the holy month of Ramadan can improve gonadotropin levels (42).
3. Changes in levels of hormones are not noticeable (28, 29, 44, 45, 52).

Similar to the above three categories, Ramadan fasting effect is also classified on the PRL hormone (19, 20, 22, 27, 34), with regards that PRL response to TRH is normal (22, 34).

As shown in the above studies, effects of nutrition restriction on LH and FSH levels can be classified into three groups (three groups related to effects of Ramadan fasting on LH and FSH hormones levels). That is, they were either unchanged or minor changes (21, 35, 38, 43). But, in addition to the above cases, there are some results like reduced levels of LH and FSH (21, 26, 35, 41).Also, changes related with above hormones in some studies indicate that there are no significant changes (30-32, 36, 37, 39, 40, 53), while some results confirmed that suppression of LH pulse amplitude and mean LH levels can occur during nutritional deprivation (43). Also, Klibanski et al. conducted a study on obese males and found that LH response related to GnRH receiving had not considerable changes. Similarly in a study by Samuels and Kramer mentioned finding was true about mean FSH response to GnRH and was confirmed. But it should mentioned that Klibanski et al. expressed that FSH response into GnRH was about increasing FSH levels (21, 43). As well as, both above hormones were reduced or normal or no significant changes in patients with anorexia nervosa (47-50). And with regard to the next parameter, i.e. PRL, results of reviewed studies showed that effects of nutrition restriction on the PRL without significant changes (56). And there is also a lack of change and be in normal range in this index as well (54, 55, 58). Also, the PRL response to TRH is declared normal (55, 57, 58). However, findings of a study indicated that prolactin level was reduced in nutritional restriction (39). Also changes related with this parameter were normal or unaltered in patients with anorexia nervosa (59-63).

Conclusion

The findings indicated that fasting in Ramadan month has not undesirable and unacceptable effects on LH, FSH, and PRL levels. In the present study that was conducted on investigation influence of Ramadan fasting on above hormones levels, in addition to influence of fasting in Ramadan month on LH, FSH, and PRL levels, it was reviewed how influence of restriction in nutrient materials receiving on above parameters levels and also influence of anorexia nervosa on mentioned indexes in patients with this disorder (above cases are examples in receiving of inadequate nutrient materials). It must be stated that either reviewed studies or other studies, there are contradiction results that it's better to consider these results. Finally, it can't consider fasting in Ramadan month as a problematic and harmful factor in studied indexes, and it seems that fasting in Ramadan month is harmless for the mentioned hormones level.

Footnotes

Footnote1. Anorexia nervosa is a psychological disorder that people have abnormal nutrient habits and severity limitation in obtaining energy and nutrient materials. This disorder characterized by fear of becoming fat and low body weight (68).

Footnote2. Childbearing age refers to the period of women's life aged between 14 and 15 years to 44 years of age (69-72).

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