Palacký University Olomouc
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The associations between puberty and internalizing and externalizing symptoms in Kosovar adolescents

Souvislosti mezi pubertou a internalizujícími a externalizujícími symptomy u Kosovských adolescentů

Dissertation thesis

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Declaration / Prohlášení

I declare that I have written this present dissertation entitled *'The associations between puberty and internalizing and externalizing symptoms among Kosovar adolescents'* myself, under the supervision of Prof. Dr. Panajotis Cakirpaloglu, DrSc, and I am only using cited literature. Studies two and three, presented in the dissertation, have already been published in peer-reviewed journals. The co-authorship declaration is attached in Appendix 3.

Místopřísežně prohlašuji, že jsem dizertační práci na téma: „Souvislosti mezi pubertou a internalizujícími a externalizujícími symptomy u Kosovských adolescentů“ vypracovala samostatně pod odborným dohledem školitele a uvedla jsem všechny použité podklady a literaturu.

In Olomouc,
8th of March, 2024 Signature.....

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To my family

General introduction

All of a sudden, youth notice that they have begun to grow rapidly and gain more weight, and the voice keeps getting thicker. The face is getting oily, and hair is growing in body areas that were not expected before. In one moment, youth experience emotional turbulence and need to change their sleep routine. Instantly after that, they find themselves involved in deep thinking and "what-if-then" scenarios, increasing curiosity and questioning many things. These changes in the early years of adolescence are typical and constitute puberty.

The experience of puberty is not simply a biological maturation process; it is a multifaceted and dynamic process involving physical, cognitive, psychological and social changes (Dimler & Natsuaki, 2014; Ge et al., 2011; Steinberg, 2017; Susman & Dorn, 2009). For over 50 years, research on adolescence has highlighted the significance of puberty on psychological and social development (Susman & Dorn, 2009). These interactions are universal yet individualized experiences that are influenced by gender, hormone levels, brain maturation, social environment and particularly the developmental context in which young individuals grow up.

Puberty is a normative developmental process every individual goes through around a certain age. Nevertheless, the timing and the progression of the secondary sex characteristics can differ significantly among girls, boys, and adolescents in general. Advancing through the pubertal stage and maturation relative to their peers has psychological and social implications. Therefore, this unique developmental context presents a distinct opportunity for observations on new evidence and advances in understanding the relationship between pubertal timing and pubertal status or stage and internalizing and externalizing problems in Kosovar adolescent girls and boys.

This dissertation consists of two parts: the introductory part or theoretical and empirical part. The first part provides a review of pubertal development, the psychological and social significance of puberty, and its relevance in the context of Kosovo. The second part presents three empirical studies. Study I is a brief report investigating the associations between Body Mass Index and pubertal development indices (such as secondary sex characteristics, and menarche), and whether sex differences exist in the observed relationships. Study II investigates the extent to which pubertal status or stage and pubertal timing are correlated with anxious/depressed, withdrawn/depressed, and somatic complaints in Kosovar adolescents. It also seeks to observe whether there are sex

differences in the observed relationships (moderation effects). This study has recently been published (Krasniqi et al., 2024). Study III investigates the extent to which the pubertal stage or status and pubertal timing are correlated with aggression and delinquent (rule-breaking) behaviours. It also seeks to observe sex differences in the observed relationships (moderation effects) and whether socioeconomic status played a role. The study III was published in 2023 (Krasniqi et al., 2023). During my doctoral studies, I also published a book chapter, that insights into adolescent emotional development during puberty years that has been published in 2021 (Krasniqi et al., 2021), and have co-authored a developmental study during my study period spent in the Adolescent Development Lab (Vazsonyi et al., 2024).

I and my colleagues have been studying the significance of puberty on the psychosocial adjustment of youth in Kosovo for several reasons. Firstly, puberty is a time of significant cognitive and social development, which requires adaption. Secondly, the timing and progression through puberty can vary across cultures, genders, and environments. Given that Kosovo is a post-conflict country and a transitioning country in terms of social, economic, and political aspects, this may present a complex correlate of youth development. Thirdly, there is a lack of research on puberty correlates and their implication for mental health in the context of Kosovo; therefore, our work is one of the first attempts to investigate puberty correlates and psychosocial outcomes in Kosovar youth. Consequently, there is evidence that puberty development is occurring earlier than in previous decades, which may have psychosocial implications for youth from a specific context such as Kosovo. Understanding these dynamics can inform the development of effective intervention programs for youth, including school curricula, and can also guide policymakers in improving adolescent mental health.

Theoretical part: Pubertal maturation and mental health correlates in early adolescence

1 Puberty

The term *puberty* is used to describe the process of the body physical maturation and transitioning from sexual immaturity to sexual maturity (Menzies et al., 2015; Steinberg, 2017). It is accompanied by rapid morphological body changes, physical growth, and hormonal changes that have psychological and social implications (Steinberg & Morris, 2001; Susman & Dorn, 2009). It culminates with the body being ready for sexual reproduction, acquisition of the psychophysical maturity (Spaziani et al., 2021) and transition into the adult roles (Santrock, 2019; Steinberg, 2017; Susman & Dorn, 2009). As such, the onset of puberty is considered one important hallmark of physical and sexual maturation in early adolescence. In addition to puberty, *adolescence* encompasses a wider range of psychological, social and emotional development that lasts for more than a decade (Susman & Dorn, 2009). According to Steinberg (2017), the onset of puberty is marked by three significant universal changes, namely 1) the accelerated body growth, 2) the onset of menarche in girls, and 3) the development of primary and secondary sex characteristics.

1. 1 Puberty-related neuroendocrine changes

Puberty consists of *adrenarche*, which originates from *adrenal glands*, and *gonadarche*, which originates from *gonads* (Landis, 2020). The gonads activate when the hypothalamus starts producing the *Gonadotropin-releasing hormones* (GnRH) in pulses, which travel to the anterior portion of the *pituitary gland* in the brain and stimulates the *Follicle-stimulating hormones* (FSH) and *Luteinizing hormones* (LH) (Landis, 2020, see also Dorn and Susman, 2009). These hormones target the cells in the testes of males and the ovaries in females (Susman & Dorn, 2009). This coordinated loop is known as the Hypothalamic-Pituitary-Gonadal (HPG) axis and is the first sign of puberty onset. Luteinizing hormones and follicle-stimulating hormones stimulate the secretion of sex steroid estrogen in female ovaries, including breast and uterus development (Fechner, 2003). Likewise, in males LH and FSH stimulate the secretion of testosterone in the testes of the males, thus contributing to their enlargement, voice changes and body physical development (Fechner, 2003; Landis, 2020). On the other side, *adrenal glands* produce *adrenal androgens* that contribute to pubic and axillary hair grow, acne, and body odor among others (Susman & Dorn, 2009). This process is known as the Hypothalamic-Pituitary-Adrenal (HPA) axis. According to Landis, males have adrenal and gonadal development six months up to one year later than females.

In addition, the HPA axis coordinated loop further contributes to the maturation of the brain structure, stress response, behaviours, and decision-making (Steinberg, 2017).

Cortisol is the primary hormonal product of adrenarche and can be utilized as a physiological marker of stress (Evans et al., 2018). For instance, Blumenthal and colleagues (2014) study found that among females, pubertal maturation status or stage was positively associated with the residual cortisol values response in the laboratory environment (entering the laboratory was 'a task' to enter in a novel setting and prepare for the series of tasks with the unknown behavioural expectations). Namely, an advanced pubertal status/stage was associated with a greater cortisol response in the laboratory environment. This suggests that exposure to a novel situation, such as puberty, is characterized by cortisol reactivity in novel social situations (Blumenthal et al., 2014). Additionally, other research has shown that 15-year-olds secreted more cortisol than 11-year-olds and 13-year-olds, regardless of gender, and in both laboratory and home context environments (Gunnar et al., 2009). The authors deem that this is suggestive that heightened HPA axis activity is associated with pubertal maturity.

In a study of healthy pubertal children aged 10 to 15 years, researchers measured the levels of LH (Luteinizing hormone), FSH (Follicle stimulating hormone), as well as the sex steroids testosterone and estradiol, in an attempt to understand the relationship between the activation of the HPG axis and the development of pubertal hormones (Peper et al., 2010). The study found that levels of testosterone, estradiol, and LH increased with age in both sexes, while the levels of FSH remained unchanged. Additionally, pituitary volume increased with age, accounting for 12%, 10%, and 8% of the variability in the estradiol, testosterone, and LH levels in girls, respectively. When the pituitary volume was adjusted for age, it was found that pituitary volume accounted for 17% of the variance in FSH levels in girls, but not in boys. The volume of the hypothalamus remained constant with age and did not contribute to any changes in hormone levels. Therefore, the results suggest that pubertal increases in estradiol, LH, and testosterone levels are related to a larger pituitary gland; on the other hand, the associations between FSH and pituitary volume are independent of pubertal development (Peper et al., 2010). Furthermore, previous research has shown that higher levels of DHEA and testosterone are also linked to earlier pubertal timing in both males and females (Omary et al., 2023).

During puberty, hormone fluctuations can influence adolescent behaviors. The levels of total and free estradiol have been positively associated with both aggressive and non-aggressive risk-taking behaviors in girls (Vermeersch et al., 2008). Vermeersch et al. further found that the association between free estradiol and aggressive risk-taking

behaviors was stronger among girls in the middle phase of the menstrual cycle; however, non-aggressive risk-taking behaviors were not related to the cycle. Research has shown that higher levels of androgen (testosterone and dihydrotestosterone) are linked to externalizing behavior in boys (Maras et al., 2003). On the other hand, others did not find a significant link between puberty maturational timing as measured by DHEA and testosterone levels, and adolescent externalizing problems in either sex (Dehestani et al., 2023).

1. 2 Adolescent body growth

The *growth spurt* is the first sign that children are acquiring puberty. Before puberty, both girls and boys have similar body fat and skeletal development, then sex differences emerge (Santrock, 2019). In girls, the onset of pubertal growth occurs around nine years, while in boys, it is around 11 years; girls peak around 11½ years, and boys around 13 ½ years (Santrock et al., 2019). Girls also grow an average of 3.5 inches (8.8 cm) per year while boys grow an average of 4 inches (10 cm) per year (Santrock, 2019). Girls experience a faster accumulation of body fat compared to boys. However, boys experience faster muscular growth compared to girls (Huddleston & Ge, 2003). The rapid pubertal growth spurt results from the production of sex hormones such as estrogen in females and androgen in males, and of gonadal sex steroids (Pyra & Schwarz, 2019). After the peak, the pace of height and weight gain slows until adolescents reach adulthood. Therefore, girls are typically taller at the beginning of adolescence, and then by mid-adolescence, boys will generally reach a similar height to girls of the same age or may surpass them. Approximately 5% to 18% of the growth spurt during puberty accounts for final adult height (Pyra & Schwarz, 2019).

The pubertal maturation typically lasts two to three years from its onset, but the full physical development can take up to four years after the initial onset (Levesque, 2018). For instance in Oelkers and colleagues (2021) study, the duration of puberty in girls was 4.59 years, while in boys it was 4.23 years. In Buckler's (1990) longitudinal study, girls reached peak height velocity on an average of 12.10 years, while boys on an average of 14.12 years. Girls were two years ahead of the boys in both the peak and the age of completing the growth. The average peak in weight in girls was 12.08, while in boys, on an average of 14.27.

1.3 Body Mass Index and pubertal development

Body Mass Index (BMI) is calculated by dividing a person's weight in kilogram (or pounds) by the square of their height in meters and is used as an indirect measure of body fat based on weight in relation to height (stature) (Landis, 2020). Throughout adolescence, and particularly in early years, both sexes tend to experience an increase in BMI rates, with girls typically experiencing a greater increase than boys. This increase in BMI is believed to be attributed to changes in body fat and muscle mass, as well as hormonal changes associated with puberty (Landis, 2020). At birth, the median BMI is as low as 13 kg/m^2, it rises to 17 kg/m^2 at age 1, declines to 15.5 kg/m^2 at age 6, and then subsequently increases to 21 kg/m^2 at age 20 (Cole et al., 2000).

Robust evidence suggests that in girls a higher weight is linked to earlier sexual maturation, including breast development and menarche (Fang et al., 2022; Pyra & Schwarz, 2019; Xi et al., 2023; Biro et al., 2018; Juul et al., 2006; Lee et al., 2007; Rosenfield et al., 2009) and with earlier sexual maturation in boys (Marceau et al., 2011). Testicular enlargement has been found in obese boys, compared to those of normal weight (Busch et al., 2020). Youth living in families with low socioeconomic status (SES) also tend to mature earlier than those in mid and high SES families (Oelkers et al., 2021). Karim and colleagues (2021) study found a higher incidence of obesity among the girls who started menarche on average between 11 and 12 years old compared to those of other BMI categories. Whilst they found that girls with low socioeconomic status backgrounds experienced a delay in the onset of menarche compared to girls coming from middle and high SES.

1. 4 Female sexual maturation

Pubertal onset for girls is within the range 8 and 13 years (Pyra & Schwarz, 2019). Parallel with the growth spurt begins the development of reproductive organs, known as *primary sex characteristics* that are assigned at birth and include the *uterus*, *vagina*, and *ovaries* (Landis, 2020). A momentous in a female's sexual development is the first menstrual bleeding which is known as *menarche* (Marshall & Tanner, 1969). In the first two years the menstrual cycles are irregular and anovulatory (infertile); the first ovulation can occur around the time of menarche, but usually is expected several months after the first menstrual bleeding (Pyra & Schwarz, 2019). On average, menarche occurs between 12 (Biro et al., 2018) and 13.4 years (Marshall & Tanner, 1969). However, it can occur between nine and 14 years of age. An earlier menarche is related to lower birth weight and increased weight gain during infancy and childhood (Juul et al., 2017). Furthermore, menarcheal timing varies among

different ethnic groups. For instance, in one study, non-Hispanic black girls reached menarche at a younger age (a median of 12.06 years) compared to non-Hispanic white (at 12.55), and Mexican American girls (a median of 12.25 years) (Chumlea et al., 2003). Unlike males, females generally reach physical maturity before they become fertile (Steinberg, 2017).

In females, the *development of secondary sex characteristics* involves the growth of the breast, known as *thelarche*; growth of pubic hair known as *pubarche*; appearance *of underarm hair* (axillary), and *skin oil*, among others (Landis, 2020; Pyra & Schwarz, 2019). Puberty begins with breast development which appears as breast 'buds', and continues to develop in several stages during puberty (Fechner, 2003; Landis, 2020). Pubic hair development occurs closely with breast development; while menarche and underarm hair are expected to occur in later stages of pubertal development e.g., middle adolescence (Santrock, 2019; Steinberg, 2017).

Marshall and Tanner (1975; Marshall & Tanner, 1969) described the variations in breast and pubic hair development among girls, known as the Sexual Maturity Scale (SMS), consisting of 5 stages of development. In typically developing girls, breast and pubic hair development are expected to occur as follows. *Stage I* is preadolescence (pre-pubertal) and anticipates the elevation of papilla only, and no appearance of pubic hair. In *stage II***,** breast buds appear, where the breast and papilla elevate as a small mound; whereas a small amount of the pubic hair develops around the labia, slightly pigmented and curled. In *stage III***,** the breast and areola continue to develop and yet they do not separate as two features; whereas the pubic hair develops further and spreads across the pubic junction of the pubes and continues to become darker and curlier. The *stage IV*, the papilla and areola form a secondary mound above breast level, whereas the pubic hair appears as adult type, but it still would not spread to the thighs. And in *stage V,* which is the final, involves the projection of papilla, and an overall development of breast contour; whereas the pubic hair in this stage is in adult quantity and type. In Marshall and Tanner's (1969) study, the first signs of breast or pubic hair development appeared between the ages of 8.5 and 13 years in 95% of the girls. Breast development reached maturity between 11.8 and 18.9 years. In Brix and colleagues (2019) work, girls reported the completed breast development (Tanner stage V) at 15.8 years of age.

The *sequence* of physical development begins with breast development (corresponding to Tanner stage II), followed by pubic hair development and menarche (Santrock, 2019). In Rosenfield and colleagues (2009) study, girls that had higher BMI were more likely to

report breast appearance/development between the ages 8.0 and 9.6, and pubarche between the ages 8.0 and 10.2 than the girls with average BMI. In addition, girls with an elevated BMI were also more likely to experience menarche. The onset of breast development before the age of 8 is broadly considered premature puberty (precocious puberty), while the absence of breast development by the age of 13 and no menarche reported by the age of 15 is considered late maturity (Landis, 2020; Pyra & Schwarz, 2019).

1. 5 Male sexual maturation

Pubertal onset in boys is within the range 9 and 14 years of age (Pyra & Schwarz, 2019). Parallel with the growth spurt begins the development of male reproductive organs known as *primary sex characteristics* that are assigned at birth and include the *penis, testes, and scrotum* (Landis, 2020). Similar to menarche, which marks the onset of puberty in girls, *spermarche* (or oigarche) is the first ejaculation in boys and has been suggested as a proxy of pubertal initiation in boys. However, there is little empirical evidence of this occurrence. Landis suggests that sperm production typically begins between the ages of 12 and 14, and the first ejaculation or spermarche occurs between the ages of 13 and 14 (Landis, 2020). In Neilsen and colleagues (1986) developmental study, boys reported the first spermarche at a median of 13.4 years, and in most cases occurred before the peak height velocity (se also Brix et al., 2019). In contrast to females, males are typically fertile (capable of fathering a child) before they develop an adult-like body (Steinberg, 2017). Enlargement of testicular and penis size before age nine is largely considered early puberty, while the absence of testicular and penis growth by the age of 14 indicates late maturity (Landis, 2020; Pyra & Schwarz, 2019).

In boys, the development of *secondary sex characteristics* includes deepening the voice, the growth of pubic hair (pubarche), beard, axillary hair, and acne (Landis, 2020; Pyra & Schwarz, 2019). Puberty in boys typically begins with testicular growth that continues to develop in several stages while advancing through puberty (Fechner, 2003; Landis, 2020). In addition to testicular growth pubic hair continues to grow and thicken, in parallel with testes and genitals (Fechner, 2003). Other pubertal indices like the growth of beard (chin) and axillary hair and deepening of the voice are expected to peak in the later stages of pubertal development (Santrock, 2019; Steinberg, 2017). Specifically, in Brix et al. (2019) study, boys reported the voice break at 13.1 years, and the first ejaculation at the age 13.4 years. In Busch et al. (2019), voice break was reported at the age 13.6 and was

linked to a higher Body Mass Index (see also Oelkers et al., 2021, for a voice break at 13.26 years).

Marshall and Tanner (1975; Marshall & Tanner, 1970) have described the variations in genital maturation in boys, known as the Sexual Maturity Scale (SMS), which consists of 5 stages. In typically developing boys, the following changes in genitalia and pubic hair are expected to occur in this order. *Stage I* anticipates no changes in the penis, testes, or scrotum size and no growth in pubic hair. *Stage II* involves the growth of the testes and scrotum with some changes in the texture of the scrotal skin. The pubic hair appears at the base of the penis and is slightly pigmented and curled. In *stage III*, there are visible signs of the growth of the penis in length and breadth; in addition, there is a continuous development of the testes and scrotum. The pubic hair gets considerably darker and coarser, and it spreads over the junction of the pubes. In *stage IV*, the penis gets considerably larger in length and breadth with development of glands; the testes and scrotum continue to grow. The pubic hair resembles the adult type. And the *stage V* is the final stage that anticipates the adult appearance of genitalia in size and shape, including the pubic hair. In Marshall and Tanner's (1970) work, genitalia began to develop between the ages 9 ½ and 13 ½ in 95% of the boys. It reached maturity between the ages of 13 and 17, and it reached the adult stage 3 years after it began to develop. The maximum rate of growth (peak height velocity) average was 14 years. Marshall and Tanner's work could not determine the age when the first pubic hair appeared, but it was studied through later maturity stages, with advancing in development an average of 15 years. In Brix et al. (2019), boys reported a completed genital development (based on the Tanner stage) at 15.6 years.

2 Determinants of puberty

A large number of factors, such as genetic, psychological, nutritional, environmental, and familial, largely determine the variations in the onset and progress of puberty. Thus, it is a complex process that interacts with both endogenous (within the individual) and exogenous (due to external circumstances) determinants.

2. 1 Heredity

It has been argued that genetic variations can contribute to between 50 and 75% of the variation in the timing of typical puberty onset (Mancini et al., 2022; Tabassum & Kirmani, 2016). There is some recent evidence of genetic control in the timing of pubertal onset, such as puberty delay (Howard, 2019; Saengkaew & Howard, 2022), precocious puberty

(Mucci & Clemente, 2022), and other disorders related to the transitional period of puberty (Howard et al., 2020). In addition, specific genes are linked to the timing of the first menstrual cycle (Perry et al., 2014).

2. 2 Social environment

Childhood adversities such as childhood sexual abuse (Henrichs et al., 2014), early family adverse social context (Pham et al., 2022), and maternal mental health such as a history of mood disorders (and the presence of a stepfather or the absence of the biological father) (Ellis & Garber, 2000) are associated with an earlier puberty development, with sexual abuse being a significant correlate of early menarche in females (Boynton-Jarrett & Harville, 2012; Henrichs et al., 2014). Girls whose fathers are unemployed are more likely to experience early puberty in comparison with girls whose fathers are employed (Arım et al., 2011). One study by Belsky and colleagues (2007) tested whether family-rearing experiences can predict pubertal timing and development and/or whether children would be differently susceptible to familial-rearing practices. Children of both biological sexes were followed from birth through the eighth grade annually. The findings are conclusive that the family-rearing experiences from both parents predicted the pubertal timing in girls but not in boys, with maternal age of menarche being a stronger predictor of the girl pubertal development, and maternal harsh control predicted an earlier onset of menarche. On the other hand, some other chronic illnesses (Traggiai & Stanhope, 2002), exposure to certain chemicals (Miao et al., 2017), certain genetic conditions, and malnutrition (National Health Service., 2022) are known to delay pubertal maturation.

2. 3 Sociocultural

Girls and boys coming from families with a low socioeconomic background report an earlier pubertal development (Hiatt et al., 2021; Oelkers et al., 2021). Aghaee and colleagues (Aghaee et al., 2020) studied whether there are differences in the onset of puberty in girls coming from intact households (living with both parents in the first six years) versus those coming from non-intact households (otherwise constituted). Girls who were exposed to living in non-intact households before the age of two reported earlier pubertal development; also, they were at a greater risk for earlier menarche, compared to girls who lived in intact households. This study supports that earlier familial stress heightened the risk for early maturation.

Black ethnic/racial groups experience social and economic adversity to a greater extent than White ethnic/racial groups, which increases the likelihood of health disparities. There is robust evidence for pubertal variations among ethnic Black and Hispanic girls and other white racial/ethnic origins in menarche onset as well as in pubertal development indices. Black girls have reported to have been experiencing an earlier onset of menarche in comparison to other White ethnic/racial groups of girls (Hiatt et al., 2021). The evidence also supports the fact that girls from Hispanic racial-ethnic groups also report an earlier age of menarche compared to other non-Hispanic ethnic/racial groups of girls, such as white and Asian girls (Biro et al., 2018). Other pubertal indices vary across ethnic groups. Black and Mexican Americans have also reported an earlier onset of breast development, pubic hair development, and menarche at younger ages compared to White adolescent girls (Wu et al., 2002).

2. 4 Urban and rural residence

It is often found that boys coming from urban areas report an earlier onset of puberty in comparison to those living in rural areas (Sun et al., 2012). Delay in the onset of pubertal development for both sexes in rural areas have also been reported (Facchini et al., 2008). Urban girls and boys also appear taller, more robust, heavier, and stronger than their rural counterparts (Eiben et al., 2005). Adolescents living in rural areas might experience environmental exposures that differ from those of their urban or suburban counterparts. It might also be because urban youth have better living conditions.

2. 5 Weight and size at birth

Studies have suggested that size and weight may be associated with earlier or delayed pubertal onset. Small size at birth (small gestational age) and rapid growth during infancy are related to an earlier onset of puberty in girls and boys, compared with children with an appropriate gestational age (Hvidt et al., 2019). A recent meta-analysis by Vinther and colleagues (2023) investigated the gestational age at birth and the body size from infancy through adolescence. Gestational age was associated with BMI in the first decade of life, with its greatest increase in BMI z-score during early infancy; however, by adolescence, preterm individuals attained comparable levels of BMI to term individuals. In addition, preterm individuals had a lower BMI and a lower risk of being overweight infants, but these differences were attenuating with age. While the BMI was similar between preterm

and term individuals by adolescence, there was a suggestion of a higher likelihood of being overweight in individuals born very preterm.

2. 6 Nutrition

Adequate nutrition is essential to producing the hormones necessary for pubertal maturation. It appears essential to consume a well-rounded and nourishing diet throughout all stages of growth, including infancy, childhood, and puberty, to ensure appropriate growth and regular pubertal progression. A well-balanced diet high in fruits, vegetables, lean meats, and whole grains can support healthy pubertal development (Story & Resnick, 1986).

The odds of being overweight or obese are lower for youth who eat daily breakfast in comparison to those who do not; however, this may be significant for boys only (Veltsista et al., 2010). Another meta-analysis also confirms that skipping breakfast is associated with overweight/obesity (Ma et al., 2020). For instance, Tsai and colleagues (2022) have studied the effects of sugar-sweetened drinks and common drink intake on pubertal maturation in both sexes. The intake of sugar-sweetened beverages was related to earlier puberty in boys (specifically an earlier voice breaking), as well as early onset of puberty in girls. The consumption of probiotic drinks or yogurts was associated with a reduced risk of early puberty as well as a delayed age of menarche. Adolescents coming from households with higher exposure to smoking cigarettes and less parental education were more likely to consume sugar-sweetened beverages. Previously, it has been reported that adolescents have a good understanding of healthy nutritional practices; however, they need more self-discipline and time constraints (Story & Resnick, 1986).

Family meals significantly affect adolescent food preferences, dietary intake, and disordered eating habits. Sharing meals is perceived positively by family members and adolescents, highlighting the importance of regular family mealtimes to encourage healthy eating routines. For instance, the EAT (eating among teens) study observed family experiences and food dietary intakes in adolescents (Neumark-Sztainer et al., 2010). The frequency of family meals was linked to higher intakes of fruits, vegetables, calcium-rich foods, grains, and a lower intake of soft beverages. Also, this was predictive of higher intake of these foods in adulthood (Neumark-Sztainer et al., 2010). The frequency of meals was also protective against disordered eating, with girls after five years decreasing the use of extreme weight-control behaviours. Family meal frequency was associated with positive psychological well-being in overall.

The Health Behaviour School-age Children (HBSC) study in Kosovo (United Nations Population Fund, 2014) aimed to provide an overview of adolescent health and well-being across the county, including eating habits. The study included 4531 adolescents, between the 8th and 10th grade from Gjakova, Ferizaj, Gjilan, Peja, Mitrovica, Prizren, and Prishtina municipalities. Skipping breakfast during class days was a common behaviour among 22.9% of participants; 59.1% had breakfast daily during school days. During the weekends, the percentage of the children skipping breakfast dropped to only 7.2%, and the rest regularly had breakfast during the weekend. In addition, 27.5% reported to consume more than one fruit daily, and 32% of adolescents did report consuming vegetables daily. However, the consumption of rich-sugar beverages was high, with 40% of the respondents reporting drinking one or more each weekday.

3 Secular trends in puberty

Secular trends of puberty refer to the slowly observed continuous shifts in pubertal development indices, menarche, and other milestones of pubertal maturation across generations. Over the past century, there has been a widespread trend toward earlier pubertal development in both sexes (Eckert-Lind et al., 2020; Fudvoye & Parent, 2017; cf. Bundak et al., 2008). Secular trends in development have been continually reported in European youth (Fudvoye & Parent, 2017). Secular trends in peak height velocity were observed for a decrease of 1.2 months per decade between the years 1947 and 1991 (Ohlsson et al., 2019). A decrease in growth spurt and peak height velocity was also reported in Danish girls and boys (Aksglaede et al., 2008), suggesting a secular trend toward earlier sexual maturation.

Secular trends in the decreasing age of menarche have also been observed. Talma and colleagues (2013) investigated the secular trends of menarche among the Dutch girls and those of Turkish and Moroccan descent. They found that the menarche age among Dutch girls decreased from 13.66 years in 1955 to 13.15 years in 1997 and 13.05 years in 2009; Turkish girls experienced a decrease from 12.80 to 12.50 years, while Moroccan girls experienced a decrease from 12.90 to 12.60 years. A decrease in the age of menarche over the last decades has also been reported in European countries such as Croatia (Veček et al., 2012), and the United Kingdom (Morris et al., 2011), while some other studies have not observed the same pattern of the age of menarche among Italian adolescents, with it remaining the same of those in the 60-year time span (Gualdi-Russo et al., 2022). The secular trends in the age of menarche are thought to be related to external factors. For

instance, an increase in the age of menarche was observed to have been associated with the improvements in political and economic situations in Poland between the ages of 1966 and 2012, while an increase in the age of menarche was observed in crisis years (Gomula & Koziel, 2018).

Secular trends in breast development, commonly known as thelarche have also been observed. A recent meta-analysis by Eckert-Lind and colleagues (2020) has evidenced the world secular trends of thelarche, downward by three months per decade from 1977 to 2013. In this study, in Europe the average age of breast development was between 9.8 and 10 years; in the Middle East, was between 9.7 and 10.3 years; in Asia, it was between 8.9 and 11.5 years; in the United States between 8.8 and 10.3 years; and in Africa, between 10.1 and 13.2 years.

Secular trends in the voice break have also been reported. A study conducted by Sørensen and colleagues (2010) assessed secular trends and differences in pubertal development among adolescent boys over the past 15 years, as well as their relationship with BMI. The results confirm a slight decrease in secular trends in their onset of puberty; the development of a testicular volume above 3 ml, higher LH hormone levels, and higher BMI were found to have occurred earlier in the 2006-2008 cohort than in 1991-1993. The age of Spermache has also been reported to have decreased from 14.5 years to 14.03 years between the ages 1995 and 2010, namely 4.3 months per decade, together with a simultaneous increase in BMI (Song et al., 2016). The decline in age in secular trends, namely earlier sexual maturation, has been attributed to improved nutrition and healthcare and changes in environmental characteristics such as exposure to endocrine-disrupting chemicals. Nonetheless, further investigation is required to comprehend the foundations.

4 Cognitive transitions

In addition to biological development, a distinctive sign of the beginning of adolescence includes *changes in cognition* or *thinking***,** as well as a series of changes in the brain structure (the physical form and organization of the brain) and brain function (patterns of brain activity) (Casey et al., 2000; Casey et al., 2008, 2011; Giedd et al., 1999; Juraska & Willing, 2017; Casey et al., 2005).

Adolescents are more prepared for abstract concepts than children. They reflect more on the act of thinking (metacognition), are more likely to view concepts as relative rather than absolute, and think more in various dimensions than they do about a single topic (Dahl, 2004; Keating, 2004; Steinberg, 2017). Adolescents who are developing their

abstract thinking skills can weigh options and formulate *"if-then"* scenarios (Steinberg, 2017). Abstract or *hypothetical thinking* involves thinking more in advanced ways about *hypothetical possibilities* and trying to *reason logically,* which is seldom used before adolescence. Features of a bigger picture are the reasoning about moral and societal norms, interpersonal relationships, concepts of religion, beliefs, self-identity, and friendships.

The fourth stage of cognitive development is known as *formal operational stage*, according to Piaget. It begins between the ages of 11 and 15 and is characterized by *ideal thinking* and more *abstract* than *concrete thinking* (Santrock, 2019; Keating, 2004), and it becomes consolidated during adolescence. The emergence of *hypothetical-deductive reasoning* (logical reasoning) allows adolescents to *generate hypothesis* and evaluate the most effective approaches to issues using hypothetical deductive reasoning i.e., logical reasoning followed by logical thought. The adolescent, a formal operational thinker, develops the hypothesis and then carefully chooses the best course of action to take for resolving the matter (Santrock, 2019). The emotional, behavioural, cognitive, and decision-making processes of adolescents are significantly influenced by hypothetical thinking as well as hypothetical-deductive reasoning.

Metacognition represents the emergence of more sophisticated cognitive skills in early adolescence generally known as *executive functions*, due of prefrontal cortex maturation. Dimensions of the executive functions include attention *and* memory**,** which are components of information processing, cognitive control *(inhibitory control* or *effortful control)*, decision-making, reasoning, thinking critically, and metacognition (Santrock, 2019). Prefrontal cortex maturation has been associated with improvements in emotion regulation and cognitive control (the ability to suppress inappropriate behaviours in favour of goal-directed ones), or the ability to suppress unproductive behaviours in favour of goal-directed ones (Crone, 2009; Miller, 2000), which suggests a linear increase in development from childhood to adulthood (Casey et al., 2008).

To better understand the increased risk of risk-taking behaviours in adolescence, Steinberg and colleagues (2008) investigated the potential various neural underpinnings of sensation-seeking behaviours and impulsivity, taking into account age variations in observed variables. Using behavioural measurements in each construct, 935 individuals between the ages of 10 and 30 participated in the study. The study findings revealed that variations in sensation-seeking behaviours among age groups were associated with pubertal development, and were increasing between the ages 10 and 15, namely in preadolescence and mid-adolescence, before declining or stabilising. The impulsive

behaviours were found to be declining by the time a child reached 10 years old and were found to be unrelated to pubertal development. Authors believe that increases in sensation-seeking behaviours may be linked to increases and then declines in the prefrontal and paralimbic activity during the period following puberty (Steinberg et al., 2007, as cited in Steinberg, 2008). This may also be related to the *dual model system*, which postulates that there is a sharp and dramatic increase in *dopaminergic activity* within the *socioemotional system* around puberty, which may stimulate adolescent risk-taking behaviours and increase reward-seeking behaviours (Steinberg et al., 2008). The temporal gap between the arousal of the *socio-emotional system* that matures earlier in adolescent development to the full maturation of the *cognitive control system* that occurs later in adolescent development, creates a heightened vulnerability in mid-adolescence that creates conditions for exhibiting risk-taking behaviours (Steinberg, 2007, as cited in Steinberg et al., 2008).

Vazsonyi and Ksinan (2017) replicated the Steinberg and colleagues (2008) work on a large cross-cultural sample of 15,839 adolescents and young adults from eleven countries in an attempt to better understand the basic tenets of the *dual model systems.* Specifically, they sought to observe the developmental associations between impulse control and sensation-seeking behaviours, the role of sex, and the extent to which the discrepancy would predict deviant behaviours (vandalism and interpersonal violence). According to the results (which are in line with those of Steinberg and colleagues, 2008), the peak of sensation-seeking behaviours occurred in mid-adolescence when the gap was the largest, and a steeper decrease for sensation-seeking was observed from mid-adolescence to young adulthood (and an increase in impulse control) (Vazsonyi & Ksinan, 2017). Males were higher than females in the rates of impulsivity and sensation-seeking scores in most age groups, and sensation-seeking and impulse control independently predicted deviant behaviours.

4.1 Changes in brain structure

At all ages, the male brain is about 10% larger than the female brain (Giedd et al., 2002). Brain tissues are classified as *gray matter*, *white matter*, and *cerebrovascular fluid* (Giedd et al., 2002). The cell bodies comprise the grey matter and the white matter of myelinated axon fiber (Giedd et al., 2002). Changes in the *brain gray matter* during adolescence are present in the areas of the *cerebral cortex, the sub-cortical basal ganglia, the amygdala,* and *the hippocampus* (Giedd et al., 2002), which are regionally specific

and in a nonlinear pattern of changes. On the contrary, white matter volume increases linearly with age, in all lobes (Giedd et al., 2002; Menzies et al., 2015). As per Casey and colleagues (2005), these variations in white volume during adolescence presumably reflect the continuous myelination of the axons by oligodendrocytes, which improves neural conduction and communication. Thus, both regressive and progressive processes are parallel, which could enhance neural and cognitive processes. Furthermore, there has also been some evidence that white matter volume (mean diffusivity) is reduced among the boys that are in the more advanced pubertal stage (late and post-puberty), compared to the less developing peers (early to mid-puberty), and the changes were not region specific (Menzies et al., 2015).

The brain is separated into four lobes: *the frontal, the parietal, the temporal, and the occipital* (Giedd et al., 2002). The *'executive'* or frontal part of the brain is responsible for tasks like organizing, planning, and paying attention, among other things (Giedd et al., 2002). The frontal gray matter increases through childhood, peaks in 11 years in girls and 12 years in boys, and then declines through adolescence (Giedd et al., 2002). Its peak coincides with the onset of puberty (Giedd et al., 2002); nonetheless, additional research needs to be done to draw more conclusive findings. Furthermore, according to Giedd et al. the thickening of cortical grey matter is thought not to reflect an increase in the number of neurons but to be caused by an increase in the number and thickness of branches and connections on the dendrites and axons of existing neurons, a process called *arborization*. Following this peak of arborization is a *pruning process* whereby the number of branches and connections are selectively cut back (Giedd et al., 2002), and strengthening of remaining synaptic connections (Casey et al., 2000; Giedd et al., 2002). As adolescents get older and transition into young adulthood, the synaptic density of the prefrontal cortex decreases, which corresponds with the ongoing development of cognitive abilities (Casey et al., 2000). Research on non-human and human primate post-mortem studies and paediatric neuroimaging have provided evidence that the prefrontal cortex, especially the *dorsolateral prefrontal cortex* is one of the last brain regions which matures (Casey et al., 2000).

Adolescents experience multiple *pruning* while the cortical white matter increases; pubertal maturation plays a significant role in neuroanatomical changes and cortical reorganization (Juraska & Willing, 2017). Giedd et al. (1999) research findings provide evidence that the white matter volume increased linearly with age, less so in girls than in boys, but there were a non-linear changes in the cortical gray matter. Further in Giedd et al. work, it was found that changes in cortical gray matter were regionally specific, with

developmental curves for the parietal and frontal lobes peaking at about the age of 12 and for temporal lobe at about the age of 16. However, cortical grey matter continued to increase in occipital lobe through the age of 20. If the parietal and frontal gray matter peaks in a proximate one year earlier in females, tied to pubertal development, this may suggest potential influences by gonadal hormones (Giedd et al., 1999), which likely may be related to the youth psychosocial adjustment outcomes.

Amygdala – is an almond-shaped structure that plays a role in the brain's integration of emotional meaning with perception and experience (Giedd et al., 2002). It coordinates the activities of the autonomic and endocrine systems and stimulates the release of adrenaline and other excitatory hormones in the bloodstream; it is also involved in responding to nonverbal signals of anger, avoidance, defensiveness, and fear (Giedd et al., 2002). The size of the Amygdala increases with age among males in adolescence. The observed increase in the volume of the Amygdala among the males presumably may be consistent with the distribution of the sex hormone receptors for these structures; the Amygdala tends to have a predominance for the androgen receptors, while the other part, namely the hippocampus, tends to have a predominance prevalence of the estrogen receptors (Casey et al., 2000), thus influencing the emotional and cognitive processes in a sex-specific manner. Nonetheless, the longitudinal study findings of Goddings and colleagues (2014) prove an increase of the Amygdala volume during puberty in both young females and males. They further found that the most significant increase in Amygdala volume in females was in early puberty before the peak and then declining. In contrast, among males, the increase of the Amygdala volume was observed until the end of puberty (Goddings et al., 2014).

Hippocampus – a horseshoe-shaped region is involved in short-term memory storage and retrieval, and the capacity for these functions undergoes significant changes between the ages of 4 and 18 (Giedd et al., 2002). The hippocampal region stores newly formed memories, before sending them to the cerebral cortex for long-term retention; its volume increases sharply with age in females and less sharply in males (Giedd et al., 2002). In both females and males, the increase in hippocampus volume is associated with progression into puberty (Goddings et al., 2014).

4.2 Changes in brain function

The development of the adolescent brain is malleable. Structural changes reflect changes in brain function, and changes in brain structure are related to cognitive shifts (Casey et al., 2005). *Synaptic pruning* is a vital aspect of the functional development of

the brain, with little impact on overall structure size (Giedd et al., 2002). Children gain an increased capacity for inhibition, mental flexibility, and the ability to switch back and forth on multiple tasks during childhood and adolescence (Keating, 2004). fMRI studies have reported that the period of adolescence is characterized by the more focal and increased magnitude of activation of the brain regions, which are essential for cognitive control in adults (Crone, 2009).

Burnett and colleagues (2011) investigated whether there is an increase in awareness of the 'complex' or 'mixed' emotions with the onset of puberty. Participating girls were presented with several emotional scenarios created to evoke social emotions such as embarrassment and guilt, or basic emotions such as anger and fear. *Social emotions* were defined as those that require an interpretation of another's mental state. The Burnett et al. find that reporting of mixed emotions showed an increase between early and post-puberty for the social emotion scenarios in adolescent girls; however, no change in reporting the mixed emotions responding for basic emotion scenarios (no mental state representation is required to experience basic emotions) across puberty groups (early, mid, and post-puberty). The authors consider the outcomes to be a consequence of neuroanatomical remodeling.

In the Moffit and colleagues (2001) work, males were more likely than females to be exposed to the risk factors or tended to be exposed to more severe risk factors that would enhance their antisocial behaviours. Males were also more likely to experience a greater proportion of neuro-cognitive impairments, uncontrolled temperament features, poor impulse control, and hyperactivity, suggesting that a compromised neuro-cognitive status might be a contributing factor to their antisocial behaviour rates. In addition, neurological lessons may also influence the rates of human violent behaviour and numerous subtypes of aggression are produced by anomalies at the various levels of the neuroaxis (Saver, 2002).

5 Psychological transitions during puberty

Despite the general universality of the onset of bodily changes correlated with pubertal maturation, the sequence and timing of developmental changes throughout the pubertal phase varies among individuals (Susman and Dorn., 2009). Rapid, novel physical changes experienced by adolescents may be stressful events, and they may be accompanied by emotional distress and worries concerning the perceived suitability of adolescent's bodies to their age and whether they will be viewed positively by their peers. Many aspects of

adolescent development, such as greater self-control, emotional and behavioural adjustment, and changes in the parent-adolescent relationship, occur substantially in the pubertal years (Steinberg, 2017).

Youth who undergo early onset and rapid progress in pubertal development, in comparison to their peer counterparts, are more prone to affective and behavioural difficulties. Maturing earlier than the peer counterparts will likely positively contribute to youth self-esteem and increase their confidence and social status. The accelerated growth might be challenging, especially given their challenges with body image, as their physical stage of development may not correspond with the other aspects of development, including cognitive and emotional maturation. Given the discomfort of being different from peers, the disparity between physical/bodily and cognitive development, may result in emotional symptoms of problems such as anxiety and depression (Derose & Brooks-Gunn, 2009). Moreover, an adult-like appearance body, independent of their cognitive maturity, creates new expectations and social pressure, such as engagement in adult-like behaviours long before youths are cognitively capable (Natsuaki et al., 2014). Such challenges might potentiate youth's exposure to emotional and behavioural problems.

On the other hand, falling behind their peer counterparts can have positive and adverse health outcomes. Positive outcomes, in the sense that later progress in pubertal development could act as a barrier against the emergence of risk-taking and other behaviours that compromise one's health. It is disadvantageous, in the sense that delayed pubertal development might unfold youth adjustment problems such as hindering individuation and, in some other cases, the onset of problematic behaviours and emotional problems.

The largest scholarship that has been done in the past decades on the importance of pubertal development in adolescent mental health outcomes has been focused on the three main concepts: **(1) pubertal status or stage, (2) pubertal timing, and (3) tempo of pubertal development indices.** Pubertal status or stage of development refers to the actual degree of physical maturation an individual has reached (Ge et al., 2006; Natsuaki et al., 2014). It refers to the stage of development of primary and secondary sex characteristics and hormone levels for the particular sex (Susman and Rogol., 2004), and is not necessarily related to age. However, due that older adolescents are more likely to reach advanced pubertal status/stage, pubertal status is inherently cofounded with age (Natsuaki et al., 2014). Pubertal timing refers to the maturational degree of pubertal maturation relative to the same-age peers (Susman & Rogol, 2004), irrespective of age. By definition, pubertal timing is not cofounded with age as it is inherently standardized with same sex, same age

peers (Natsuaki et al., 2014). The tempo of puberty refers to the rate or pace at which an individual progresses through the various stages of pubertal development (Susman and Rogol., 2004).

Although the three concepts are related to a myriad of psychological and social outcomes, in this chapter, I focus primarily on pubertal timing and pubertal stage and their implications in adolescent psychological and social development.

It is essential to insight if externalizing and internalizing problems relate to pubertal stage and not timing, or if they relate to pubertal timing, but not pubertal stage/status. The former suggests that advancing (progressing) through puberty status/stages places youth at risk for emotional and behavioral problems. The latter suggests that youth reaching a more advanced pubertal stage/status at an earlier age, can be at the greater risk for the development of externalizing and internalizing problems. Thus, for the research purposes of this dissertation, pubertal transition is conceptualized in both pubertal timing, as well as the pubertal stage or status.

5. 1 Pubertal variations and adolescent internalizing problems

Internalizing problems belong to the pathology subgroup involving disturbances in mood and emotions (Graber, 2004). Internalizing behaviours and disorders are characterized primarily by processes within the self, such as anxiety, somatization, and depression (VandenBos, 2015). For their research understanding, depression itself shall be differentiated between depressive symptoms, depressive syndrome, and depressive disorder (Cantwell, 1990). In Cantwell's (1990), depression, as a symptom, connotes only an element of the depressive syndrome or disorder, namely a sad mood, feeling blue, feeling down in the dumps, or feeling miserable. As a syndrome, depression is typically used to characterize the presence (co-existence) of symptoms that happen simultaneously and are not linked to any particular event. Furthermore, changes in various areas, including motivation, cognition, and psychomotor function are related to a depressive syndrome. Finally, depressive disorder can develop when a depressive syndrome has a minimum duration and a minimum degree of functional capacity (Cantwell, 1990). For its research purpose, this dissertation is mainly a presentation of the relationship between early puberty and symptoms of internalizing problems, and it is neither intended nor aims for a diagnosis.

Ghandour and colleagues (2019) have analyzed the National Survey of Children's Health (NSCH) data to report the prevalence of currently diagnosed depression, anxiety problems, and conduct problems among individuals aged 3 to 17. Among the youths aged

3 to 17 years of age, 7.1% had current anxiety problems, 7.4% had current behavioural/conduct problems, and 3.2% had current depression. The rates of depression through adolescence and around puberty increase more strongly in females compared to males, namely between the ages of 13 and 15 (Angold et al., 1998; Ge et al., 1994; Hankin et al., 1998; Nolen-Hoeksema, 2009; Wichstrøm, 1999). Other results also indicated a sharp increase in the levels of depressive symptoms in mid-adolescence (that corresponds with puberty), with a decline as adolescents move onto adulthood (Ksinan & Vazsonyi, 2019). Poor sleep quality and parental behaviours have often been identified as predictive factors in occurrence of depressive and anxiety symptoms in the early adolescent years (Javakhishvili et al., 2020; Vazsonyi et al., 2021, 2022).

5.1.1 Pubertal development status/stage and internalizing symptom links

In particular, there is robust evidence indicating that advancing through puberty, namely pubertal status or stage, is related to the outcomes in adolescent emotional development (Lewis et al., 2018; Oldehinkel et al., 2011). Particularly, advanced pubertal status/stage is positively associated with depression (Angold et al., 1998; Lewis et al., 2018), anxiety (Reardon et al., 2009a), and somatic symptoms (LeResche et al., 2005; Rhee, 2005), more so in girls compared to boys (Lewis et al., 2018; Reardon et al., 2009; Stumper & Alloy, 2021; Wichstrøm, 1999). Although to a lesser extent, there is also evidence that an advanced pubertal status increases the risk in depressive symptoms also in boys (Ge et al., 2006). In addition, Angold et al. in fact found that pubertal status/stage, rather than pubertal timing, was significant predictor of depression among adolescent girls (cf. Copeland et al., 2019).

Sex differences have also been observed in the meta-analysis. Stumper and Alloy (2021) investigated the recent evidence of 36 studies on the association between pubertal stage/status and depressive symptoms in adolescence as well as the moderators and mediators of these observed relationships. The analysis reveals a consistent gender pattern: girls in an advanced pubertal status/stage are more likely to exhibit depressive symptoms than boys. In boys' depression, evidence indicated depressive symptoms occur independently of the pubertal stage. Reardon and colleagues (2009) meta-analysis suggests that advanced pubertal status (controlling for age) is positively associated with anxiety symptoms among girls and, to a lesser extent, among boys.

Several developmental studies have also provided evidence on the effects of pubertal status/stage in adolescent anxiety and depressive symptoms in early adolescence. Lewis

and colleagues (2018) investigated the effect of breast development versus pubic hair status/stage on depressive symptoms among girls and boys, respectively. The assessment was conducted at the ages of 14.5, 16.0, and 17.5 years. The study results showed a positive relationship between advanced breast development status/stage at age 14.5 years and an increase in depressive symptoms at age 17, compared to girls at lower stages of breast development. However, there was a negative relationship between pubic hair status/stage at 14.5 years and depressive symptoms at age 17 among the boys. The study supports the significance of pubertal status/stage in girls' depressive symptoms, but there is no significance between pubertal pubic hair status/stage and depressive symptoms in boys. This may be indicative of a distinctly sex-specific correlation such as breast development or pubic hair development with depressive symptoms. Patton and colleagues (2008) also found that pubertal status/stage predict depressive symptoms in girls alone.

Susman and colleagues (1991) investigated whether age, pubertal status, and adrenal and gonadal hormones influence the symptoms of internalizing problems among 10- to 14-year-old adolescent girls and boys. They reported no significant relationship between hormones and depressive symptoms and age or pubertal status, neither in boys nor girls. However, a more advanced genital stage in boys was associated with more depressive symptoms. Deardorff and colleagues (2007) investigated the extent to which puberty predicts anxiety symptoms in early adolescence, as well as the extent to which there are sex differences in the observed relationship. 106 girls and boys with European-American backgrounds, were assessed at 9.5 and 11 years of age. Results revealed that a greater pubertal status/stage was significantly positively associated with social anxiety symptoms among girls. However, other anxious symptoms such as harm avoidance, somatic symptoms and separation/panic substiles were nonsignificant among girls and boys.

Prior research has suggested that the interplay between pubertal status/stage and internalizing symptoms may vary by ethnic origin. Hayward and colleagues (1999) reported that pubertal status is a better predictor of depressive symptoms than chronological age in Caucasian but not African-American and Hispanic females. Age was not predictive of depressive symptoms in comparison with the pubertal stage, as Patton and colleagues (2008) found. It suggests that pubertal status/stage is more important and explains for the levels of depressive symptoms than chronological age, nonetheless more research is needed for a consistent conclusion.

Pubertal status/stage is also linked with adolescent *somatic symptoms*. It is often found that advanced pubertal status is commonly associated with headaches, especially among

girls, and musculoskeletal pain, which is more prevalent among boys (Rhee, 2005), and a greater incidence of pain among both sexes (Li et al., 2023). Moreover, overtiredness and pain symptoms have also been found to correlate with pubertal development status/stage, regardless of sex (Janssens et al., 2011). Oldehinkel and colleagues (2011) observed that fear and other somatic symptoms of the girls decreased with increasing of the Tanner stages; however, tiredness was observed to occur more among youth with advanced Tanner stages.

On the other hand, although to a lesser extent of the evidence, a later maturation or progression in pubertal development has been associated with fewer internalizing symptoms, with some mixed evidence. In the Lewis and colleagues (2018) study, girls in the lower stage of breast development scored less on measures of depressive symptoms in comparison with the girls that belonged to the more advanced stage of breast development. In the study by Ge and colleagues (2006) study, a later pubertal development status was associated with a lower incidence of internalizing symptoms among girls and boys.

5. 1. 2 Pubertal timing and internalizing symptom links

Maturing earlier than peer counterparts, e.g., early pubertal timing is also associated with internalizing symptoms depression, anxiety or somatic complaints (Dehestani et al., 2023; Graber, 2013; Hamlat et al., 2014; Kaltiala-Heino et al., 2003; Kowalski et al., 2021; MacSweeney et al., 2023; Pham et al., 2022; Ullsperger & Nikolas, 2017). Particularly, early maturing girls are more at risk for emotional symptoms than boys (Blumenthal et al., 2011; Deardorff et al., 2021; Kowalski et al., 2021). In contrast, the meta-analysis by Ullsperger and Nikolas (2017) found that both early maturing girls and boys are at risk for developing internalizing problems; such effects were not found in on-time and later maturing adolescents.

Other developmental investigations have explored the associations between early pubertal timing and internalizing symptoms. Rudolph and colleagues (2014) assessed the sex variations in the pathways that link pubertal timing and depression in a span of 4 years in girls and boys. Early maturation positively predicted depressive symptoms in girls but not in boys; however, early maturing boys showed an increase in depressive symptoms over the course of development. Furthermore, a positive association between earlier menarche and depressive symptoms among girls in comparison with on-time and late maturing, was also found in the Joinson and colleagues (2011) study. Others did find that

early pubertal timing was positively predicting withdrawal/depression, somatic complaints, rule-breaking behaviours, and aggressive behaviours in girls and boys; however, it was not related to anxious/depressive symptoms among females only (Dehestani et al., 2023). The later the menarche onset was the fewer depressive symptoms were found, which results suggest that later maturational timing might be protective in comparison with early menarche timing and depressive symptoms.

Not only does maturational timing have detrimental effects on internalizing symptoms, but the timing of when adolescents mature might also be context dependent. In their review, Pham and colleagues (2022) assessed the family environmental antecedent associations with the pubertal timing variable. The most consistent finding across the studies the authors reviewed was that the father's absence predicted earlier pubertal timing among the girls, as parental behaviours were directed to a child, and in general family function. The more stressful the family environment is (father absence, parent-child interactions, and parental characteristics), the earlier girls mature. Moreover, girls living with less supportive mothers are more vulnerable toward negative life changes (Ge et al., 1994). Namely, stressful experiences in the family environment accelerate the maturation of the body in girls, which then carries consequences for their well-being. Therefore, the observed links likely indicate the stability of environmental factors, where later events substitute for earlier ones (Pham et al., 2022).

Ethnicity might also account for the association between early pubertal timing and depressive symptoms. An earlier breast development predicts increases in depressive symptoms among White girls, but predicts a decrease in depressive symptoms among Asian girls (Deardorff et al., 2021). Earlier breast development as well was predictive for the anxiety symptoms for Latinas only, and not the White girls (Deardorff et al., 2021).

Early pubertal timing has also been associated with somatic symptoms. Kowalski and colleagues (2021) found no evidence of the associations linking the timing of genital and pubic hair development to somatic complaints in boys. Among the girls, an earlier and faster maturation was related to a small increase in somatic symptoms. Others found that for girls, an earlier pubertal timing has been associated with psychosomatic symptoms, among other internalizing symptoms, but not among boys (Kaltiala-Heino et al., 2003). The early puberty and internalizing symptoms are more prevalent among the girls, but the evidence for the boys is relatively sparse.

Similar to early timing, late maturational timing has also provided mixed results for adolescent health-compromising behaviours. It is often found that later maturation is a

protective factor in adolescent emotional adjustment (Kaltiala-Heino et al., 2003; cf. Joinson et al., 2011). In contrast, Tsai and colleagues (2023) found that boys with a *late onset and with the slow catch-up group* had the lowest psychological well-being in terms of depressive symptoms, self-esteem, and a couple of externalizing symptoms. Later timing of menarche was associated with the decreased affective symptoms of problem scores in Kowalski and colleagues (2021) work.

5. 1. 3 Explanations on sex difference in the prevalence of emotional problems

The research evidence has been consistent in the assertion that the prevalence of affective problems is more common in early maturing girls than in early maturing boys and other maturing groups in general. These effects are believed to be driven by several hormone levels that surge during adrenarche as well as psychosocial mechanisms.

Females are more likely to experience firsts, longer periods of depressive episodes, and a greater recurrence than men (Nolen-Hoeksema, 2009, p. 387). Women reported having experienced new symptoms of depressive mood, or significant worsening of existing symptoms of depressive mood particularly during periods of change in their gonadal hormones during their menstrual periods, postpartum, or menopause (Angold et al., 2002; Nolen-hoeksema, 2009). Because gender differences in depression do not emerge until puberty, early puberty stimulation of gonadal hormones may be linked to increases in the rate of depressive mood in girls (Angold et al., 2002, p. 144; Nolen-Hoeksema, 2009, p. 388). For instance, Graber and colleagues (2006) found evidence that estradiol levels in adolescent girls are associated with a risk for depressive symptoms (breast development is largely controlled by estradiol levels; Lewis et al., 2018).

Due to rapid physical growth and bodily changes, girls become overly worried about *body image issues* that would make them more prone to negative mood (Santrock, 2019). In contrast, advanced physical appearance would be an advantage for male physical development; thus, it would predict fewer emotional problems. In fact, accelerated pubertal development might be considered positive and elicit positive responses from peers and friends (Natsuaki et al., 2014). Furthermore, levels of anxiety, depression and psychological stress appear to be higher among girls than boys due to their dissatisfaction with their social contacts and poor social support (Van Droogenbroeck et al., 2018). Maturational changes and puberty might increase a girls' susceptibility to stressful life events and negatively affect their emotions including depression (Ge et al., 2001).

Girls are also more prone to emotional problems due to their social norms related to *gender role expectations* (Hill & Lynch, 1983), which maintains that girls in particular, are more vulnerable to pressure to conform to culturally sanctioned gender roles. Thus, being more susceptible to peer pressure would further contribute to the rates of internalizing problems for girls compared to boys (Angold et al., 2002; Hill & Lynch, 1983; Nolen-Hoeksema, 2009). As Hill and Lynch. noted, in early adolescence, girl's self-concept changes in two ways (1) they experience greater disruption of the self-concept than males and (2) they become more concerned about their interpersonal aspects of their lives such their physical appearance (Hill & Lynch, 1983, p. 211). As such, Angold et al. further argue that changes in self-perception due to bodily changes and other's reactions to them, may increase the risk for depression (Angold et al., 2002). In addition, females are more likely than men to have close emotional ties with people in their lives, care more about what people think or be more emotionally affected by events in the lives, or other people (Nolen-Hoeksema, 2009). On one hand, social support would protect them from adversity; nevertheless, some females cross the line with excessive concerns about relationships with others, which would silence their needs and make them have less power, as such, increasing the likelihood of depressive problems (Nolen-Hoeksema, 2009).

Duration and reoccurrence of depressed moods are greatly influenced by the extent to which individuals respond to depressive moods, namely how they react (Nolen-Hoeksema, 1991; see Response Style Theory). *Ruminative responses* are a set of repetitive behaviours and thoughts focused on negative symptoms and the potential impact they may have (Nolen-Hoeksema, 1991). Repetitive behaviors include a passive response to stress and a repetitive focus on depressive symptoms instead of working actively to solve the issues or disrupting themselves from this *response style* (Nolen-Hoeksema, 1991). Women tend to engage in ruminative reactions when depressed, thus amplifying their symptoms; whereas men are generally more likely to distract themselves from depressed moods, as such lessening symptoms (Nolen-Hoeksema, 1991). That is, females are at greater risk for internalizing problems due to rumination (Mclaughlin & Nolen-hoeksema, 2011; Nolen-hoeksema, 2009; Nolen-Hoeksema, 1991). Thus, cognitive processes and coping recourses and mechanisms (Mclaughlin & Nolen-Hoeksema, 2011; Nolen-hoeksema, 2009), the intensification of gender roles in early adolescence (Hill & Lynch, 1983), as well as the stressful life events during early puberty (Ge & Natsuaki, 2009; Natsuaki et al., 2014) contribute to the sex disparities in the rates of affective problems.

5. 2 Pubertal variations and adolescent externalizing problems

Externalizing behaviours often labelled as uncontrolled include various hyperactive, impulsive, disruptive, as well as aggressive behaviours (Frick & Thornton, 2017). They are primarily characterized by their acts in the outside world, including acting out, antisocial behaviour, hostility, and aggression (VandenBos., 2015). The prevalence of externalizing problems during adolescence varies. Some evidence suggests that 7.4% of children aged 3 to 17 had current behavioural/conduct problems (Ghandour et al., 2019). Low self-control is often found to positively predict adolescent deviance (Vazsonyi et al., 2006; Vazsonyi & Belliston, 2007). Furthermore, the parent closeness and support are key family processes that contribute to the rates and etiology of violence, across cultures (Vazsonyi et al., 2007).

The European School Survey Project on Alcohol and Other Drugs report (ESPAD, 2015) reported the data for delinquency and rule-breaking behaviours for 96,049 middle-aged adolescents who participated in the ESPAD project from 35 European countries. In this report, more than one in five ESPAD students (23%) had smoked cigarettes prior the age 13 or even younger, with boys being more likely than girls. Nearly half of the students (47%) did report alcohol use before the age of 13, with boys more likely to have consumed it compared to girls. About 3% of students reported having tried cannabis for the first time at the age of 13 or younger, more in boys in comparison to girls. The report proves that the rates of cannabis use have revealed a general increase in both lifetimes and in 30-day use between the ages 1995 and 2015, to 11% to 17% and from 4% to 7%, respectively.

Research supports a male preponderance in increasing rates of prevalence of antisocial behaviours throughout adolescence; however, other emotional problems predominate in women, namely depression or eating disorders (Hill & Lynch, 1983b; Moffitt et al., 2001). Adolescent antisocial behaviour consists of criminal offences such as car theft and rule breaking behaviours; therefore, antisocial problems in adolescence are frequently described in these terms (Moffitt et al., 2001).

Aggression is a behaviour intended to harm others (Farrington, 2004). In addition, the definition typically includes various types of aggression, such as verbal, physical or psychological attack or intimidation, with the intent to create fear and distress, as well to harm the victim (Farrington, 2004). Other forms of aggression include physical versus verbal, reactive versus proactive, and hostile versus instrumental and rates of aggressive behaviours vary in adolescence (Farrington, 2004). Moffit and colleagues longitudinal

work (2001), investigated the rates of aggression and physical violence in females and males, from 3 to 21 years of age, using multi-informant measures such as parents, teachers, and other informant reports, including the youth's self-report ratings. Males surpass females in every measure of physical aggression and of those of violence at any age (within the adolescence period, according to teachers, parents, and informants) and in every setting, except on the measurements of partner violence, where the rates were equal in both genders. Males were more likely to report delinquent problem behaviours and had greater difficulty controlling their anger. Male self-report results indicated they were more likely to conduct violent offences at all ages, from early adolescence to young adulthood. So, the data indicate that males behave more aggressively at all ages and in a variety of circumstances during their two first decades of life. Males engage in more antisocial behaviours than females, with two exceptions: males and females are similar in their antisocial behaviours during adolescence (around the age of 15), and the males and females are most similar in their drug and alcohol-related offences. Males are more likely to be diagnosed with a conduct disorder; however, during the peri-pubertal period, the prevalence of the incidence rises the difference. Thus, puberty potentially contributes to the female's antisocial behaviours and mechanisms, and the circumstances under which this behaviour occurs need to be explored (Moffitt et al., 2001).

5. 2. 1 Pubertal development status/stage and externalizing problems links

Studies on correlates of advanced pubertal stage and externalizing problems in early adolescence have received less attention than studies on the pubertal timing correlates on adolescents' externalizing problems. Advanced pubertal status/stage positively correlates with externalizing symptoms in both sexes (Ge et al., 2002, 2006; Najman et al., 2009) (May et al., 2021). In the Ge and colleagues longitudinal study (2006), both an advanced pubertal status and an earlier pubertal timing were associated with youth's self-reported externalizing symptoms of oppositional defiant disorder, attention deficit disorder, as well as conduct disorder. The same results were also found in the caregiver-reported externalized symptoms. Pubertal status/stage has been positively correlated to the boys' defiant peer affiliation but not to the girls (Ge et al., 2006). In the Najman and colleagues work (2009), as boys and girls advanced through puberty, there was a similar increase in aggressive/delinquent behaviour at a 14-year follow-up.

Tanner Stages were found to be positively related to externalizing problems in girls and boys, such as rule-taking behaviours (Oldehinkel et al., 2011). On the other hand,

Nottelmann and colleagues (1987) found that pubertal developmental status/stage was negatively associated with aggressive and cruel problems in girls. In boys, a combination of lower pubertal stage and greater age (late maturation) was related to adjustment problems, including lower self-image, sadness and anxiety, and poor social and family relationships, but not externalizing behaviours. The Nottelmann et al. study also provided evidence that steroid levels were negatively associated with behaviour problems in boys but not in girls. In contrast, others have found no associations between the pubertal stage/status and externalizing problems (Kanwar, 2020).

A developmental study conducted by Finkelstein and colleagues (1994) estimated the variations in aggressive behaviours that might correlate to pubertal developmental processes. The assessment of aggression included aggression against adults, physical aggression against peers, aggressive impulses, as well as aggressive inhibitory responses. There were decreases in all aggression variables, except for aggressive impulses. At the beginning of puberty, boys were initially more aggressive than girls; however, by the end of the pubertal period, sex differences in aggressive variables had diminished. In addition, the authors did not observe any significant relationship between pubertal development status, height, and weight in any self-reports of the aggressive behaviour variables in either girls or boys. In Najman et al. (2009), females in advanced and late puberty stages were positively associated with the rates of externalizing problems. This pattern was insignificant for the boys. The later pubertal status was related to fewer externalizing symptoms of Attention Deficit Disorder, Oppositional Defiant Disorder, and conduct disorder symptoms (Ge et al., 2006).

5. 2. 2 Pubertal timing and externalizing problem links

Two large meta-analyses have assessed the influences of early pubertal timing and adolescent externalizing symptoms. In the Ullsperger and Nikolas (2017) meta-analytic review, findings were for the negative consequences of the early pubertal timing on youth's externalizing psychopathology at similar rates to boys and girls, although small in magnitude. The effects emerged particularly among early pubertal timing groups and youths' externalizing symptoms. On the other hand, another meta-analytic review work by Dimler and Natsuaki (2015) also emphasizes that earlier pubertal timing is positively associated with externalizing problems in adolescence and early adulthood, with no differences in sex. Other studies found a weak association between pubertal timing and adolescent behavioural problems in boys and girls (Smith-Woolley et al., 2017). Such

inconsistent findings in the results have often been attributed to the monomethod bias, and that the associations between pubertal timing and externalizing problems, depend on the rates (see Dorn et al., 2003, for a review). In the Dehestani and colleagues (2023) work, pubertal timing, as measured by the Pubertal Development Scale of Petersen et al., 1988, significantly positively predicted externalizing problems in early adolescence in both males and females; however, early pubertal timing measured by hormones (DHEA and testosterone) did not predict any mental health problems in either gender.

Several underlying mechanisms have also been investigated to better understand the extent to which early pubertal timing predicts aggressive or delinquent behaviours. It is commonly found that early maturation positively predicts the rates of aggressive and delinquent behaviours, compared with on-time and late-maturing youths, particularly due to affiliations with delinquent peers (Lynne et al., 2007). Delinquent friends functioned as an underlying pathway for the relationship between early pubertal maturation, aggression, and delinquency. Early pubertal timing also positively predicts the rates of externalizing problems and affiliation with defiant peers, particularly in children who live in highly disadvantageous neighbourhoods (Ge et al., 2002); poor neighborhoods and harsh, inconsistent parenting were associated as well with defiant peer affiliation. Child nurturing-involved parenting was associated with a decreased likelihood of deviant peer affiliation. Early maturing youths with insecure parent attachment also display elevated levels of externalizing symptoms compared to their less developing peers (Kanwar, 2021). Such evidence emphasizes the significance of fostering a positive family environment that ameliorates adolescent well-being.

On the other side, more investigation provides evidence that later maturational timing functions as a protective factor in the rates of externalizing problems in both sexes (smoking, alcohol, sexual activity, cannabis and illicit drugs, and substance use, among others) (Ge et al., 2006; Kowalski et al., 2021; Moffitt et al., 2001). Conversely, later maturational timing predicted problem/externalizing behaviours and negative self-image compared to early maturing youths (Dorn et al., 2003; Graber, 2013).

6 Theoretical insights on psychological significance of puberty

Determining how biological and psychological development interact with one another has challenged scholars for decades (Susman & Dorn., 2013). The traditional presumption of adolescence being portrayed as a period of storm and stress (Hall, 1904; '*storm and stress' perspective*) is widely reconceptualized, and now adolescence is generally

conceptualized as a transitional period that may be 'storm and stress' for only a fraction of girls and boys (Susman & Dorn., 2013). These advancements in a better understanding of the period of adolescence have come as a result of empirical work and the reflection of parents, educators, and other developmental scholars that focus on youth development that adolescence is not all storm and stress period. Susman and Dorn, review that the importance of puberty on psychological development has not received much attention from the *classic theories* until the early 1980s. This marked the beginning of a new era of conceptualizing the interdisciplinary research models focusing on adolescence; developmental researchers began to recognize that biological development, particularly in puberty, correlates significantly with psychological development (Susman & Dorn., 2013).

Physical development is marked by an array of psycho-social shifts during the period of puberty. The extent to which adolescents efficiently cope with this multitude of changes depends on their capacity to cope with stress in general and their vulnerability before puberty begins (Derose & Brooks-Gunn, 2009). While most adolescents can successfully navigate the developmental changes accompanying the onset and progression of puberty, a small percentage may find the transitional period stressful, rendering them more vulnerable than their peers (Steinberg et al., 2006). In this small portion of youth, psychological distress arises from the disparity between cognitive and biological/physical development (Ge & Natsuaki, 2009; Negriff & Susman, 2011). This disparity optimizes the maladaptation. Furthermore, these discrepancies between physical and cognitive development are more prominent in those individuals who have pre-existing vulnerabilities, originate from family environments with harsh parenting styles, reside in unfavorable neighborhoods, or belong to an ethnic group (Ge & Natsuaki, 2009).

Various theoretical frameworks have been developed to better elucidate these relationships, illustrating why early and late maturity would contribute to the development of affective and problem behaviours during puberty (Caspi & Moffitt, 1991; Petersen & Crockett, 1985). Below, I will present the *maturational deviance hypothesis*, the *developmental readiness hypothesis*, as well as the *contextual amplification hypothesis*, which are supported by more evidence and are related to the present dissertation context.

6.1 Maturational deviance hypothesis

The off-time hypothesis, also known as *the maturational deviance hypothesis***,** is a theoretical framework built on the assumption that off-time maturation might provoke

distress in adolescents and optimize the onset of emotional and behavioural problems (Caspi & Moffitt, 1991). O*ff-time development (early and late maturation)* elicits insecurity and social stress due to the expectations that a particular event or milestone should occur at a particular time such as the onset of puberty, for instance (Caspi & Moffitt, 1991; Petersen & Crockett, 1985). Conceptually, this hypothesis revolves around the notion that anticipated changes that occur at a particular period of development, e.g., puberty, allow adolescents to acquire new knowledge about their bodily changes, the development of intimacy, and a myriad of other social and cognitive changes that usually require new coping mechanisms for their evolving circumstances. Because it confronts the unknown, any deviation from this 'normative' development of the events, such as an earlier or later onset of the pubertal development, would be stressful, and as such deviation would contribute to increasing psychological distress among youth and other related psycho-social symptoms (Petersen & Crockett, 1985). Early maturing boys and late maturing girls, scored higher in depressive symptoms than adolescents who matured on-time (Wichstrøm, 1999).

A narrower part of this hypothesis is *the gendered-deviation hypothesis*, which would expect some gender differences. It suggests that early pubertal timing will negatively impact girls' psychological adjustment, in comparison with on-time and late-maturing girls; however, a later maturational timing for boys would be associated with some detrimental effects on boys' psychosocial adjustment, in comparison with the boys who mature on-time or earlier. Caspi and Moffit's (1991) findings supported the early timing hypothesis; early maturing girls exhibited the most adjustment difficulties at 13 and 15. Controversy: in the Dorn and colleagues (2003) study, late maturing boys and girls had more adjustment and problem behaviours than their on-time and earlier maturing counterparts.

6. 2 Developmental readiness hypothesis

The *developmental readiness hypothesis* (or stage-termination hypothesis) rests on the assumption that early maturing girls particularly are at greater risk for adjustment problems, e.g., emotional regulation, compared to those who mature later (Brooks-Gunn et al., 1985; Ge & Natsuaki, 2009; Negriff & Susman, 2011; Derose & Brooks-Gunn, 2009). Early biological transitions involve affective and physiological changes, and early on-time and late-maturing youths might be differently prepared to navigate these transitions (Ge et al., 2001). Accelerated pubertal maturation strengthens the physical and cognitive discrepancy in early maturing youth, exposing them to new societal and environmental stressors and

behavioural expectations long before they are psychologically prepared for such challenges (Ge et al., 2001; Ge & Natsuaki, 2009; Negriff & Susman, 2011). Hence, such early development increases the likelihood that youths will experience elevated levels of internalizing symptoms of problems such as anxiety, depression, and somatic symptoms (Negriff & Susman, 2011).

Early pubertal development poses a particular risk to adolescent females (Sattin & Magnusson, 1990). According to the *pubertal status hypothesis,* when puberty occurs, it increases the risk for depression, irrespective of whether the timing is early or late (Lewis et al., 2018). A general pattern thus far observed is that advanced pubertal status/stage increases levels of anxiety and depression to a greater extent in females than in males (Angold et al., 1998; Lewis et al., 2018; McGuire et al., 2019). In contrast, positive relationships between the genital stage or older age and internalizing symptoms were found in boys, but not in girls (Susman et al., 1991). It appears that prior to puberty, both boys and girls express the same levels of internalizing symptoms (Hankin et al., 1998); nonetheless, during the ages of 11 and 12, boys express higher levels of depression and anxiety symptoms, but this pace declines in the middle adolescence years (cf. Moffitt et al., 2001). Furthermore, girls experience lower levels of depression and anxiety around ages 11 and 12, and this pace seems to increase from early to mid-adolescence while, in contrast, stabilizing for boys (Hankin et al., 1998).

6. 3 Contextual amplification hypotheses

The potential mechanisms that attenuate, ameliorate, or strengthen the relationships between pubertal development and adolescent psychosocial adjustment underscore the imperative for additional investigations. Under the *contextual amplification hypothesis – vulnerability stress model* (Ge & Natsuaki, 2009), the context in which transitioning through puberty occurs amplifies or potentiates the adverse effects of such transition, particularly in girls. Unlike the *off-maturational timing* hypothesis and *developmental readiness hypothesis*, *the framework of contextual amplification* seeks to shed light on the context from which young people develop, such as an unfavorable context or an unsupportive home environment, which may cause maladjustment and the symptomatology of health-compromising behaviours (Ge et al., 2011; Ge & Natsuaki, 2009; Susman & Rogol, 2004).

The interactive nature of puberty and context links arise from the theoretical concept of the interaction between a person and the environment that determines psychosocial adjustment (Ge et al., 2011). Instead, biological changes should not be examined alone, but in the psychosocial context within which the developing individual is embedded. Particularly among girls, the effect of pubertal timing should be examined within the context of the behaviours that occur, including stressful life experiences (Ge et al., 2011). Early maturing girls engage in unhealthy, risk-taking, and dangerous behaviours under some conditions that optimise access to older friends, as well as opposite-sex relationships. Stattin and colleagues (2011) found that early-maturing girls had a tendency to link more with older and norm-breaking friends outside the school but not inside the school, suggesting that the context interferes with the extent to which early-maturing girls select older peers. Next, girls who spent time in a leisure setting (the context that would provide opportunities for affiliation with more advanced and more problematic peer groups) predicted the delinquent behaviours of girls who spent time in this environment and were actively engaged with boys and peers (Stattin et al., 2011). In Kretschmer and colleagues (2014) work, earlier pubertal timing positively predicted delinquent behaviours similarly in both sexes. Nevertheless, the spare activities mediated the associations between pubertal development and delinquency. For girls, hanging out outside was a feature of early maturers that predicted the risk of delinquency. In boys, sports/games were spare activities that predicted a decrease in delinquency because the earlier and faster-maturing boys were less likely to engage in sports/games, a spare time activity type linked to lower delinquency risk.

Early maturing youths from disadvantageous neighbourhood are more likely to affiliate with deviant peers (boys more than girls) (Ge et al., 2002). Additionally, earlier maturing youths with harsh parenting practices are also more likely to exhibit externalizing problems (Ge et al., 2002). The context of deviant peer affiliation and harsh parenting practices potentiate the risk of early maturing youths engaging in defiant behaviours. The effects of early pubertal timing on adolescent aggressive behaviours were moderated by the harsh and positive parenting practices in Chen and Raine's work (2018). Disadvantageous neighbourhood predicts the levels of depressive symptoms among the early maturing girls who live in a non-Hispanic neighbourhood but not in Hispanic ones (White et al., 2012; see also White et al., 2013 for the boys). Furthermore, in the longitudinal research by Hamlat and colleagues (2014), early pubertal timing interacted with stressful life events, predicted the increase in depressive symptoms only for Caucasian girls and African American boys, but not for Caucasian boys and African American girls. The results

and associations were specific to the depressive symptoms, and not to the social anxiety symptoms.

7 The Kosovar developmental context

Kosovo is predominantly collectivist society. It is common for family members to include children, parents, grandparents, and often a wider relative, that is, uncles. Kosovar culture emphasizes hospitality, living together, collective thinking, interdependence, good behaviour, and honor. Some empirical review in the Kosovar context suggests that this may positively promote mental health and resilience (Kelmendi & Hamby, 2022). An essential component of collectivism is the principle of group tie and reciprocal obligated individuals; while individualistic cultures have a core premise based on their principle of individual autonomy (Oyserman et al., 2002). Most extended families have patriarchal structures with the head of the family having strong moral authority (Hofstede et al., 2010), thus collectivist cultures are correlated with patriarchal beliefs. Freedom and autonomy are strongly embedded in individualist cultures, while orientation towards and interdependence are embedded within collectivist one. Western cultures tend to be more individualistic, whilst Eastern cultures tend to be collectivist. While the two cultural premises have different points of view, it is common that studies focusing on cultural influences emphasize the importance of culture in emotional, cognitive, and social development, thus both being strong correlates of mental health among individuals (Humphrey et al., 2020; Humphrey & Bliuc, 2021).

Kosovo is a post-conflict country, a society that is characterized by *patriarchal values* about gender roles where violence is accepted as a form of conflict resolution (Kelmendi & Hamby, 2022). For instance, Kelmendi and colleagues (2019) found evidence of the co-occurrence of IPV and child maltreatment based on a sample of late Kosovar adolescents. Traditional gender roles (feminine roles), which are linked to some extent with patriarchal values, have been found to be associated with adolescent poor mental health, particularly girls' anxiety, for instance (Aparicio-García et al., 2018).

The Kosovar society has undergone substantial and rapid social and economic transitions over the past two decades, particularly since the last war in 1998/1999. The changes are evident in the family structure, economic development, and cultural shifts from collectivism to individualism (Shahini et al., 2015; Tawil, 2009; The World Bank, 2017). These developments have manifested themselves in many ways including working independently rather than relying in one family's income, increased levels of both education

and employment among women (Shahini & Landsman, 2008). Family changes include the transition from an extended family to a nuclear family (parents and children) (Flere & Klanjšek, 2013; Kadriu, 2019). Following the 1998/1999 war in Kosovo, many Kosovar families moved from villages to big cities for better job opportunities and education (Shahini & Landsman, 2008). Changes in family composition also constitute an additional stressor for family members, thus increasing their vulnerability to mental health problems. In addition, patriarchal societal norms about gender expectations are still present nowadays (Balkans Policy Research Group., 2019). A report from the Kosovo Agency of Statistics (KAS), evidences that the unemployment rate was 25.0% (Kosovo Agency of Statistics, 2020). Economic hardship is associated with a whole host of deleterious consequences, including a lack of proper nutrition, and family stressors, which further might potentiate overall well-being among individuals (Fanaj, 2020).

Research evidence suggests that *socioeconomic elements* are related to young people's mental health. In the Reiss (2013) systematic review, children and adolescents coming from socioeconomically disadvantageous families (low-income families) were two to three times more likely to develop mental health problems. In Arenliu and colleagues (2016) study, an increase in education level and income significantly decreased depressive scores, and unemployment increased depressive scores in comparison to being employed, in both Kosovar females and males, aged 15 and older. In addition, in the epidemiologic study of Shahini and colleagues (2015a), Kosovar youth with less educated parents were at a particular risk for emotional and behavioural problems. In Kamberi and colleagues (2019), it was found that anxiety symptoms were higher among young females, compared to males, and this is relevant for both females who lived in an extended family and those living in a nucleus one. In addition, Kamberi et al. found that anxiety symptoms were significantly related to family income (father's employment). This evidence suggests that low economic status and unemployment are linked to negative impacts on youth psychosocial development in low-income countries such as Kosovo, and their overall well-being. It also stresses the importance of further research to better elucidate the extent to which income might relate to multiple dimensions of mental health at this young age.

Not only is socioeconomic status related to adolescent mental health, but also to physical health. Empirical evidence suggests that low SES has been found to be associated with increases in overweight categories, compared to adolescents coming from average or higher high SES backgrounds (Sherwood et al., 2009), earlier sexual development (Oelkers et al., 2021), as well earlier pubertal timing in both sexes (Sun et

al., 2017). Furthermore, pubertal development is positively associated with internalizing problems (Lewis et al., 2018; Reardon et al., 2009). Given the continuous exposure of Kosovar youth to different collective traumas, including war-related trauma, economic hardship, and cultural transformations, this gap identified in the literature would advance our understanding of pubertal correlates in Kosovar youth emotional and behavioural adjustment which the present work addresses.

Research has provided evidence that 11 years following the end of the war that paternal PTSD was positively associated with children's anxiety and depressive symptoms (Schick et al., 2013). In addition, many family members expressed symptoms of PTSD, faced the loss of family members due to death or simply being missing, and experienced poverty; all of these factors negatively impacted the mental health of children and adolescents (Shahini et al., 2015). For instance, Duraku and colleagues (2023) recently found that Kosovar youth born after the war scored higher on measures of PTSD symptoms and lower on several perceived support measures (social, significant other, and family) than their parents. This finding was particularly evident in youth who had parents with PTSD in comparison to ones without. These adolescents were more likely to report negative mood and cognition or emotional arousal; they were also more likely to report experiencing sudden accidental death or sudden violent death in comparison to their peers. This provides evidence of an *intergenerational transmission* from parents to children of wartime trauma decades following exposure. In addition, research has also indicated that adolescents from collectivist cultures are more conservative, conforming as well as sensitive about sexual and social norms (Hedge et al., 2022). Thus, this cultural context might also make it less likely for youth to share information about pubertal development/maturation for instance; in other words, Kosovar youth might be less likely to talk about puberty in comparison to youth from individualistic cultures like Great Britain or the United States.

An intensification of *gender-related expectations* emerges in early adolescence (Hill & Lynch, 1983). Hill and Lynch assert that, compared to males, girls appear to experience a greater disturbance in self-concept, which has some detrimental effects on their self-esteem and self-consciousness. In addition, compared to boys, girls seem to be more self-conscious about their physical appearance and interpersonal elements of their lives. Early adolescence is also when girls start acting more conventionally, described as gender-appropriate (Hill & Lynch, 1983). For instance, girls are more discouraged from engaging in externalizing behaviours such as fights compared to boys; boys, however, are more

encouraged to control their emotions compared to girls (Hill & Lynch, 1983). Building on the work of Hill and Lynch, Natsuaki and colleagues (2014) have postulated that internalizing psychopathology is more likely when early maturation and feminine gender role identity operate together. They further argue that understanding gender role identity (defined as culturally shaped expectations of how females or males should behave; Galambos, 2004, as cited in Natsuaki et al., 2014) would provide a better understanding of psychopathology in early adolescence that corresponds to puberty, especially in terms of gender differences. In other words, morphological body changes for the specific sex create expectations for culturally '*appropriate*' behaviors and identification through them. A more mature morphological appearance than peers would create stress in girls due to the feeling of '*being different'*, in relation to an adult-like morphological body, which would put pressure on girls to act *'adult-like'*, in accordance with their physical appearance. This bodily morphological transformation in girls (the attainment of a curvier body) can influence her identification, as determined by society, with the role of a sexually mature woman. At the same time, earlier physical maturation than normally expected before cognitive maturity and coping skills that control emotions and the pressure to culturally conform to culture-related gender expectations put girls at risk of developing ineffective coping skills (ruminative coping, for instance), which increases the risk of the prevalence of emotional problems in stressful situations. *Gender role identity* is defined as the extent to which people identify with societal norms on sex-appropriate behaviours or gender roles (Natsuaki et al., 2014). Early puberty and feminine gender role identity interact together and thus increase the possibility of internalizing symptoms. As such, early maturing girls are faced with this gender identity crisis, which is a unique developmental task to negotiate her identity and integrate these inner and outer changes (Natsuaki et al., 2014).

Gender role identity can further relate to masculinity and femininity. It is often found that boys endorse higher on masculinity items compared to girls, and girls endorse higher on femininity items compared to boys (Mora, 2012; Wichstrøm, 1999). In Mora (2012), puberty was a social achievement linked to masculine enactment that was influenced by the dominant gender expectations of peers at school and their communities. Namely, by showing their tolerance of pain and physical power, the boys signaled they were entering puberty according to their societal norms (Mora, 2012). In the Wichstrom (1999) study, boys scored higher than girls on masculine items and girls scored higher on femininity items across all ages of adolescence. Girls also scored higher in depressive symptoms

between the age 13 and 14 and femininity positively correlated with depressed mood, and no correlation were found for the masculinity.

7. 1 The study rationale

Scholarly documenting correlations between puberty development and psychosocial adjustment of Kosovar adolescents is relatively sparse. Even less work has been done on evidencing the extent to which Body Mass Index is associated with puberty development; and the extent to which pubertal development relates to internalizing and externalizing symptoms in early adolescence. Given that prior evidence implies that puberty development and psychosocial development, largely depend on the context (Ge et al., 2001, 2011; Natsuaki et al., 2014), such investigation will provide valuable understanding on the relationship between BMI and puberty, as well as the relationships between pubertal development and emotional and behaviour in Kosovar developmental context.

First - Kosovar scholarship on the association between BMI and pubertal development is seldom. Given the prior evidence elsewhere on the associations between BMI and menarche (Lazzeri et al., 2018; Biro et al., 2013; 2018) and pubertal development in girls (Biro et al., 2013) and boys (Busch et al., 2019), in the **first brief report study** we investigated the extent to which BMI is associated with puberty development in adolescent girls and boys. Among the girls, we tested the extent to which BMI is associated with growth, breast development, pubic hair development, skin changes as well menarche. In boys, we tested the extent to which BMI is associated with growth spurt, pubic hair development, skin changes, voice changes and facial hair. We also observed whether there are sex differences in pubertal development, i.e., whether girls or boys differ in their pubertal development categories (see Petersen et al., 1988).

Second - sex differences in the rates of emotional and behavioral problems emerge in middle adolescence, with girls showing a higher incidence of emotional problems compared to the boys (Hankin et al., 1998; Hankin & Abramson, 1999; Nolen-Hoeksema, 2009; Vazsonyi & Ksinan, 2017). In addition, the rates of externalizing problems such as delinquency and aggression are found to be higher among adolescent boys compared to girls (Moffitt et al., 2001). Thus**, in the second study**, we provide some evidence the extent to which internalizing symptoms, namely anxiety/depressed, withdrawn/depressed, and somatic complaints vary across adolescent sex, irrespective of pubertal development stage or status and pubertal timing. Furthermore, in the third study, we provide evidence of the extent to which externalizing symptoms namely delinquency (rule-breaking) and

aggressive behavior, vary across adolescent sex, irrespective of pubertal development stage or status and pubertal timing.

Third - pubertal transition presents developmental challenges for adolescents who find it challenging to adjust to all the simultaneous changes that come with puberty. We did conceptualize pubertal transition as *advanced pubertal status or stage* and *early pubertal timing.* Particularly, puberty stage has been positively associated with anxious and depressive symptoms in girls (Angold et al., 1998; G. Lewis et al., 2018; Marceau et al., 2012; Patton et al., 2008; Reardon et al., 2009a; Stumper & Alloy, 2021), and to a lesser extent in boys (Ge et al., 2006). Pubertal stage has also been positively associated with somatic symptoms in both sexes (Rhee, 2005). Furthermore, variations in *pubertal timing,* e.g., maturing earlier than their on-time and later peer counterparts posits a risk for the onset of internalizing problems in both sexes (Ullsperger & Nikolas, 2017), as well particularly among the early maturing girls compared to early maturing boys (Blumenthal et al., 2011; Deardorff et al., 2021; Graber, 2013) and with on-time and late maturing youth.

Built upon this mixed large evidence, in the second study, we tested the extent to which advanced pubertal status or stage would be associated with the rates of internalizing symptoms, namely *anxiety/depressed, withdrawn/depressed,* and *somatic complaints* in adolescent girls and boys. We also texted the extent to which observed relationship varied across adolescent sex (moderation effects). In addition to pubertal development status, we also tested the extent to which early pubertal timing would be associated with internalizing problems, namely anxious/depressed, withdrawn/depressed, and somatic complaints in Kosovar adolescents, in comparison to on-time or late maturing youth. We also tested the extent to which the observed relationships varied across adolescent sex (moderation effects).

Fourth - pubertal transition (as noted that we conceptualized as both advanced pubertal stage and early pubertal timing) may present developmental challenges for adolescent behavioral adjustment. Particularly, research posits that pubertal status is positively associated with externalizing symptoms in both sexes (Flannery et al., 1993; Ge et al., 2006; Hemphill et al., 2010; May et al., 2021; Najman et al., 2009), However others found no significant associations between pubertal status or stage and externalizing problems (Kanwar, 2020). Furthermore, maturing relative to their peer counterparts, e.g., early pubertal timing posits a risk for externalizing problems among both girls and boys (Kanwar, 2020; Ullsperger & Nikolas, 2017. cf. White, 2013). Early maturing boys and

girls exhibit higher externalizing problems compared to their on-time or late maturing counterparts (Graber et al., 1997b; Kanwar, 2020; Kowalski et al., 2021).

Built upon this mixed large evidence, in the third study, we tested the extent to which advanced pubertal stage or status is associated with the rates of externalizing symptoms, namely delinquency or rule breaking and aggressive symptoms in Kosovar early adolescents. It also tested the extent to which the observed relationships vary across adolescent sex (moderation effects). In addition to pubertal development status, we also tested the extent to which maturing relative to their peer counterparts e.g., early pubertal timing would be associated with the rates of externalizing behaviours, namely rule breaking and aggressive symptoms, in comparison to on-time or late maturing youth.

We tested the associations between pubertal status and pubertal timing with internalizing and externalizing problems to better understand 1) whether advancing through puberty puts youth at risk for internalizing and externalizing symptoms; or 2) whether reaching a more advanced pubertal stage at an earlier age (pubertal timing relative to their peer counterparts) is associated with a greater risk for internalizing and externalizing symptoms of problems.

Fifth - a large evidence supports the assumption that an earlier maturation can exert the strongest effects among the girls, particularly those who live in adverse contexts (see Ge et al., 2011, *contextual amplification hypothesis*). An investigation of the sex differences in the observed relationships are of unique importance considering that early maturation elicits more negative effects for girls than boys (Angold et al., 1998; Ge et al., 2001; Joinson et al., 2011; G. Lewis et al., 2018; Reardon et al., 2009), implying that transitional years may be gender-dependent and context-dependent. As such, psychological and social adaptation to novel experiences that come with puberty is difficult for those who transition puberty in a stressful social environment (Ge et al., 2011; Ge & Natsuaki, 2009). On the other side, the stressful experience of an early pubertal development may be ameliorated by a supportive and nurturing environment. Particularly, Ge et al. further argue that behavior is a characteristic of psychosocial context, sex, socioeconomic status (SES), and past and present experiences. In support of this assertion, observing the associations between pubertal development and psychosocial adjustment in Kosovar youth is of particular relevance. As elaborated in the previous sections, Kosovar youth have been exposed to different collective traumas, which have likely impacted their physical and psychological wellbeing. In addition to the war-related trauma, these youth

have been witnessing ethnic tensions and conflicts, thus placing them at exceptionally high risk for emotional problems (Shahini & Landsman, 2008).

We did not, however, test the direct effects of trauma in our interested variables; however, we believe that exposure to those events could have accounted for our study results. Especially since the *contextual amplification hypothesis* theoretical framework, posits that pre-existing vulnerabilities before puberty onset and also living in a stressful environment may exacerbate the puberty and internalizing and externalizing links, particularly among girls (Ge et al., 2011; Ge & Natsuaki, 2009). Furthermore, Derose and Brooks-Gunn (2009) suggest more diverse research in the samples from various ethnic backgrounds and socioeconomic groups would provide more precise evidence of what affective experience is during the puberty transition in girls and boys.

Finally - our studies aim to make a modest contribution to the puberty psychosocial correlates in several ways. **Primarily,** we aim to advance our understanding of the associations between BMI and puberty development indices in Kosovar adolescents, which is novel observation in this developmental context. **Secondly,** evidencing the puberty correlates in emotional and social development in Kosovar youth is exceptionally important considering the socio-cultural and economic transition in the past two decades. **Thirdly,** the three studies present the first investigation in an attempt to highlight the significance of puberty processes and Kosovar adolescent psychosocial development, as such, will provide evidence of the extent to which there are similarities and differences with other cultures. **Finally,** the three studies aim to make a modest contribution to adolescent developmental science, and thus diversity in science.

7. 2 Background studies in Kosovo

In their epidemiologic study, Shahini and colleagues (2015) found sex differences in internalizing and externalizing problems among Kosovar adolescents, with girls experiencing higher anxious/depressive symptoms and boys engaging in rule- breaking behaviours. In addition, older boys had a greater incidence of externalizing problems compared to younger ones. For the DSM-oriented scales, there were sex differences in affective problems (girls>boys), anxiety problems (girls>boys), as well as conduct problems (girls<boys) and obsessive-compulsive problems (girls>boys). Hopelessness and self-esteem also significantly correlate with emotional difficulties, more in girls compared to boys (Fanaj et al., 2015).

The ESPAD report - European School Survey Project on Alcohol and Other Drugs (Hibell & Guttormsson, 2011), has provided some more evidence of the occurrence of externalizing problems in Kosovar adolescents. In the use of cigarettes Kosovo fell into the low-prevalence countries together with Albania, Iceland, Montenegro, and Norway (at around 12%). 22% of Kosovar adolescents reported that they had ever used alcohol, 2% did report their cannabis use once in their lifetime, 3% did report other illicit drugs than cannabis, 3% reported lifetime use of tranquilizers or sedatives without prescriptions, and 1% did report the use of inhalants. In contrast, a very high percentage (around 70%) from other European countries did report having tried alcohol at least once during their lifetime. In Kosovo, 5% of adolescents reported to have used illicit drugs, comparatively lower than most other European countries (Hibell & Guttormsson, 2011, from the ESPAD report). At the international level, the report highlights that the occurrence of drug use is lower compared to other countries; however, at the national level, the prevalence can still be considered moderate to high. For instance, in Tahiraj and colleagues (2016) study of 980 adolescents, 16% of the boys reported daily smoking, and 9% of the girls reported daily smoking. They, however, did find a greater tendency for alcohol use at similar rates in boys and girls (harmful drinking 41% was reported among boys, and 37% among girls). 17% of the boys and 9% of the girls reported having used illicit drugs. However, Carkaxhiu and colleagues (2011) report that compared to boys, girls are more likely to smoke cigarettes and boys are more likely to use other drugs (cf. United Nations Population Fund, 2014). In addition, in Haskuka and colleagues (2018) work, the associations between suicide ideation and suicide attempt and tobacco, alcohol and cannabis use, were higher among the countries with a low prevalence of substance abuse and weaker among the countries with a high prevalence of substance abuse.

In the United Nations Population Fund (2014) report, 4571 Kosovar adolescents reported their health-compromising behaviours. 15.7% of the overall sample had smoked once during their lifetime, 84.3% never smoked a cigarette, and 4.7% are active smokers. The United Nations Population Fund considers that smoking habits among Kosovar youths are at low levels compared to their European peers' counterparts. Along with that, 15% have drunk alcohol, and 2.6% have smoked cannabis once in their lifetime (higher than the reports from the ESPAD 2011). Regarding to sexual initiation, boys reported a higher percentage of sexual activity (25.5%, they had their first sex intercourse) compared to girls (4.5%, they had their first sex intercourse), and age initiation was 14. Nevertheless, 23.8% of adolescents have been involved in physical violence in the past 12 months, less

females than males. The report also has some statistics about somatic symptoms. Girls reported more headaches than boys (30.7%), compared with boys (19%). The older the adolescent girls were more likely they were to experience headaches. This is indicative that advancing through puberty and menarche experience might alter girls' development. About anxiety symptoms (51.2%) felt anxious in the past six months. The report maintains that the prevalence of risk-taking behaviours and other related problems is lower than other international peers.

7. 3 BMI and mental health correlates

In the report by the United Nations Population Fund (2014), the average boy's weight was 48.9 kg, and for girls it was 46.4 kg. Selimi and colleagues (2019) found that the average height of the Kosovar female late adolescents (19.91 years old) was 172.21±6.14 cm, while the Body Mass Index was 20.47 kg/m^2. In the Gardasevic (2019) study, adolescent boys were 179.52±5.96 cm tall, and girls were 165.72±4.93 cm tall.

In their cross-sectional research, Tishukaj and colleagues (2017), assessed the Body Mass Index rates in a convenient sample of 14 and 15-year-old Kosovar adolescents from Pristina and Decan Municipalities. In addition, they also did assess waist circumference and skinfold. They found significant findings on the prevalence of overweight and obesity rates among boys at 28.2% and a lower percentage among girls at 18.9%. The excess body fat was in 18.2% of the girls and 15.9% of the boys, with no significant differences in the rural versus urban participants. The body fat content was higher among female adolescents. Girls were shorter, lighter, and had a lower waist circumference, a higher sum of the skinfold, and a higher body fat percentage than boys, but the BMI values showed no difference across both sexes. 7.3% of the total sample was underweight, 68.6% were of a normal weight, and 24.0% were overweight/obese. Bronikowski and colleagues (2015) found similar rates of underweight (7.0%), but normal weight (82.6%), and overweight (10.4%). More girls were underweighting (9.5%) than boys (4.5%). Slight sex differences were found in normal weight among girls (84.9%) and boys (80.3%); also, a lower percentage of girls were overweight (5.6%) than boys (15.2%). According to Ahmeti and Stankovska (2016), out of 401 Kosovar adolescent participants, 57% had a BMI less than 18.5 kg/m^2, 43% had a BMI of 18.5-25kg/m^2, and 8% had a BMI index over 25 kg/m^2. They also found a significant positive relationship between BMI, bulimic symptoms, and depressive symptoms, suggesting that BMI might have negative psychological implications. In addition, others have also found that body dissatisfaction

positively predicted eating-disordered behaviours in Kosovar adolescents (Kadriu et al., 2014).

Furthermore, Boshnjaku and colleagues (2016) have reported an average menarche of 13.35 years among Kosovar adolescent females. Nevertheless, in the first study presented in this work (Krasniqi et al., brief report), we observed an average menarche at 12.35 years. If these differences in reporting the age of Menarche represent the evidence at the Kosovar national level, there is an assumption that there is a decline in the secular trends of the declining age of Menarche observed in other nations.

**Note: the references of the chapter, are in the end.*

Empirical part: Puberty and internalizing and externalizing symptoms in Kosovar adolescents

In the following chapter, I report the three empirical studies, two of which have been published in the last two years. The first one is a brief report, and the other two are original research articles.

The second and third papers can be cited as follows:

Krasniqi. E., Vazsonyi, A. T., Cakirpaloglu, P. (2024). Internalizing symptoms among Kosovar adolescents: The pubertal correlates in girls and boys. *Journal of Child and Adolescent Trauma.* https://doi.org/10.1007/s40653-024-00610-z

Krasniqi. E., Vazsonyi, A. T., Cakirpaloglu, P. (2023). Externalizing symptoms among Kosovar adolescents: The pubertal correlates in girls and boys. *International Journal of Adolescence and Youth*. 20, 1. https://doi.org/10.1080/02673843.2023.2286249

Study I: Brief report: Pubertal development and its correlates in Kosovar youth

Abstract

Introduction/hypothesis: The present study tested pubertal development among early Kosovar youth, and whether BMI positively predicted puberty-related body changes, in females and males. It was hypothesized that BMI would positively predict, growth spurt, breast development, pubic hair, skin changes and onset of menarche, as well as the higher score of total PDS (indicating more developed status/or greater maturity) among females. Likewise, BMI would positively predict growth spurt, pubic hair, skin changes, voice changes and facial hair, as well as the total PDS (indicating more developed status/or greater maturity) among males. Previous research has provided evidence that low SES, stress as well as country-level social transitions might impacts the Body Mass Index, a known correlate of pubertal development. *Methods*: Data were collected from N=1,342 early adolescents (665 females; M age =13.26 years, SD=1.27; 677 males; M age =13.19 years, SD=1.31) in Kosovo. Measures included background variables, BMI as well as the Physical Developmental Scale. *Results:* The BMI was positively associated with growth spurt, breast development, experiencing menarche, as well as the total PDS score, except for two specific puberty-related changes that are body hair and skin change in females. Similarly, BMI was positively associated with growth spurt, facial hair, voice change as well as the total PDS score, except skin change in males. *Conclusion:* The present paper provides evidence that the BMI was positively associated with pubertal indices in both Kosovar males and females, with few exceptions. The study highlights the evidence that pubertal/biological changes were largely consistent with ones found in other developmental contexts.

8. 1 Introduction

Pubertal maturation is a hallmark of adolescent development. Numerous factors are associated with the onset of pubertal development, including BMI (Lazzeri et al., 2018; Durda-Masny et al., 2019), in both boys and girls - accelerated breast development (Biro et al., 2013) and pubic hair (Abou El Ella et al., 2020) among girls in comparison to average BMI. BMI is associated with earlier onset of the voice break (Busch et al., 2019) and the growth of pubic hair (Tomova et al., 2015) in boys. Conversely, boys with low BMI are less advanced in pubertal development and are delayed in pubertal timing, in comparison with on time maturing peers (Oehme et al., 2021). Earlier onset of puberty has also been found in youth growing up in low SES contexts (Oelkers et al., 2021), thus highlighting the importance of considering SES for understanding pubertal development. Kosovo has experienced a profound shift over the past two decades from collectivism to individualism, which has manifested itself in a number of ways, including working independently rather than relying in one's family income, increased levels of education and employment among women, and a shift to residing as a nuclear family (parents and children only), rather than living in an extended family (Flere & Klanjšek, 2013; Kadriu, 2019; Shaqiri, 2018). One study found out the mean recalled age of menarche to be 13.5 years of age in Kosovar women (Boshnjaku et al., 2016). However, little is known about the secular trends of Menarche in Kosovar youth. In addition, a recent Kosovar Agency of Statistics (2020) report indicated extremely high rates of unemployment (25%). To date, it is largely unknown the extent to which these profound sociocultural changes have affected adolescent pubertal development, which the present study sought to address.

8. 2 The present study

The present study sought to better understand the extent to which sociocultural changes in Kosovo have impacted pubertal development and its correlates among boys and girls in Kosovo. In addition, we have observed whether there are secular trends, in the onset of menarche.

The study tested three hypotheses:

1) It was expected that BMI would be positively associated with growth spurt, breast development, pubic hair, skin changes and onset of menarche in girls.
2) It was expected that BMI would be positively associated with growth spurt, pubic hair, skin changes, voice changes and facial hair in boys.
3) It was expected that girls would enter puberty earlier than boys.

8. 3 Methods

8. 3. 1 Procedures

The study was reviewed and approved by the Ministry of Higher Education of Kosovo. At participating schools, parents were sent a consent document, informing them of the study and requesting their consent for their child to participate in the study. A total of 1,478 consent forms were returned to schools; due to missing two or more puberty measure variables, the final study sample included 1,342 adolescents. Data were collected between November 2019 and March 2020; students who also completed an assent document, completed an anonymous, 40-minute self-report paper and pencil survey during school hours.

8. 3. 2 Measures

Demographics variables

Descriptive statistics of frequency and mean age were used of reporting age, sex, and socioeconomic status (SES).

Kosovar youth were between the ages of 11 to 15 years in age, in 6^{th} through 9^{th} grades, approximately equally divided by sex; most were ethnic Albanian (95.6%) youth across seven municipalities, namely Gjakova, Fushe Kosova, Gjilan, Mitrovice, Malisheve, Prizren, and Peja.

Age. Students rated the following question: How old are you? Response options included 11, 12, 13, 14, 15 or 16 years old.

Sex. Participants selected their sex from a single question, what is your sex? Responses included 1 **=** boy, and 2 = girl.

SES. Parental job was used to represent adolescent's family socioeconomic status (SES), based on both mothers and fathers, ranging from 1 = "owner/professional official/high degree" to 7 = "unemployed". Responses were reversed coded and then averaged, so that a higher score indicated higher SES.

Pubertal Developmental Scale

Puberty was assessed by using 5 items from the Pubertal Developmental Scale (Petersen et al., 1988). The first three items ask about body growth in height, pubic hair, and skin changes, followed by the items for facial hair, deepening of the voice for boys only, and breast development and menarche (reported by month and age) for girls only. Except for the menarche question (a dichotomy), the five questions were rated on a 4-point Likert-type scale, ranging from 1 = no development to 4 = development already completed. Pubertal Developmental score was computed by summing across the five items to obtain a total score; the sum of the scores on the five indicators was divided by

five to preserve the original metric (1-4). The measure was internally consistent (females $\alpha = 0.67$; males $\alpha = 0.74$).

Body Mass Index

Body Mass Index (BMI) was calculated using weight in kg and height in m reported by participants: BMI = weight (kg)/[height (m)]^2.

8. 3. 3 Plan of Analysis

Five pubertal categories were developed based on Petersen and colleagues (1988): prepubertal, beginning of pubertal, mid pubertal, advanced pubertal and post pubertal. Classification into one of five pubertal categories (prepubertal, beginning of pubertal, mid pubertal, advanced pubertal and post pubertal) is based on the level of development reported on the three indicators of the pubertal changes thought to be most salient for each sex. For girls this included pubic hair growth, breast development, and menarche; for boys, they included development of pubic hair, facial hair, and voice changes. For girls, category *prepubertal* (1) is assigned if girls report no development in any of the three indicators (i.e. received a combined score of '3' for the three indicators). 2) *beginning of pubertal*: if girls report no menarche along with some development of either breast or pubic hair but not both of them (i.e. a combined score of '3' for the last two indicators). *3) mid-pubertal:* if girls report no menarche along with some development of either breast and pubic hair or more development on at least one of these characteristics (i.e. a combined score of '4' or more for more breast and body hair). 4) *Advanced pubertal:* if girls report menarche in combination with less than complete breast and/or pubic hair (i.e. a combined score of '7' or less on these two indicators). 5) *Post pubertal*: if girls report menarche along with completed development for both pubic hair and breast (e.g. a combined score of '8' on these two indicators).

For boys, 1) *prepubertal category* is assigned if boys report no development on any of these three characteristics (a combined score of '3'). 2) *Beginning of pubertal*: if boys report initial development on one or two characteristics, or more development in one characteristic but no development on the other two (i.e., a combined score of '4' or '5'). 3) *mid-pubertal*: if boys report beginning development on all three or advanced development on one or two combined with little or no development on the others (i.e., a combined score of '6' or '7' or '8'). 4) *advanced pubertal*: if they report advanced development on all three or beginning development on one combined with advanced or completed development on another or completed development on the third (e.g., a combined score

of '9' or '10' or '11'). 5) *post pubertal*: if boys report completed development of pubic hair, facial hair, and voice (i.e., a combined score of '12').

To determine early, on time, and late categories, first, scores of the pubertal development scale were standardized (changing into the distribution with a mean of 0, and standard deviation of 1) for each age: 11, 12, 13, 14, and 15 (few cases of 16 were also collapsed with the age 15 group). Then, early was defined to be having pubertal development scores greater than 1 (1); on time = scores between -1 and 1 (2); and late = scores below -1 (3) (see Flannery, Rowe, & Gulley, 1993; Steinberg, 1987). Initially, descriptive statistics of the main study variables were computed, followed by correlations. Next, a series of regressions were completed to test the main study hypotheses. This included six sets of regressions for girls focused on growth spurt, breast development, pubic hair, skin changes, onset of menarche, and the total PDS; the same approach was used for boys focused on growth spurt, pubic hair, skin changes, voice changes, facial hair, and the total PDS. Across all models, age and family SES were entered in the first step as control variables, followed by BMI. All analyses were carried out using SPSS 26.

8. 4 Results

Descriptive statistics of the study variables are reported in Table 1. On average, girls reported a lower BMI than males (M = 20.74; t = 4.36, $p < .001$). The average age of menarche for girls was 12.35 years. Table 1 also reports the means and standard deviations of five characteristics of pubertal development as well as the total pubertal development score. Table 2 includes frequencies of the five-category pubertal maturity classification while Table 3 includes early, on time, and late maturation frequencies by sex. Most girls were "on time" (68.4%) as well as males (65.2%); but some were also "early" (17.8% of girls and 16.1% of boys), and late (13.8% of girls and 18.6% boys).

The largest proportion of boys were represented in "mid pubertal" status (55%), 25.4% in "early pubertal" and 2.7% "prepubertal", whereas 16.7% were in "advanced pubertal status." Among girls, the great majority represented "advanced pubertal" (68.3%) status, also 10.2% were in "mid pubertal," and small percentages were represented in "early" (4.4%), "prepubertal" (3.3%), or "post pubertal" categories (3.3%). There were significant mean-level differences in BMI according to early, on time, and late classification. For girls, the average BMI for "on-time" category was M = 19.95 (SD = 3.72) and for "early" category was M = 20.00 (SD = 2.59), both significantly higher than the average for "late" developing group (M = 18.28, SD = 2.59) at $p < .001$, but not significantly different from each other. Similarly, for boys, the average BMI for "on-time" group was M = 20.00 (SD

= 4.82) and for "early" it was M = 21.51 (SD = 3.92), both significantly higher than the average for "late" developing group (M = 19.10, SD = 3.70) at $p < .001$, but not significantly different from each other.

Correlations of study variables are reported in Table 4. BMI was positively associated with all the pubertal development indices, ranging from r = .09 (for skin changes) to r = .31 (having a menarche).

Results from a series of regressions are reported in Table 5, by sex. For girls, BMI significantly predicted growth spurt, as well as breast development, having a menarche as well as the total pubertal development, controlling for age and family SES; however, BMI did not significantly predict two specific puberty-related changes, body hair and skin change. The overall model explained 6.4% in growth spurt, 23.6% in body hair, 17.1% in breast development, 7.9% in skin change, 53.3% in having menarche, and 39.2% in pubertal development. From these amounts of variance, BMI uniquely explained 1% in growth spurt, 1.5% in breast development, 4.9% in menarche, and 2.2% in pubertal development; no significant additional variance was explained by BMI in the remaining outcomes.

For boys, BMI significantly predicted growth spurt, body hair, facial hair, voice change as well as the total pubertal development, controlling for age and family SES; BMI did not significantly predict skin change. The overall model explained 12.5% in growth spurt, 13.4% in body hair, 11.5% in facial hair, 13.3% in skin change, 17.3% in voice change, and 26.9% in pubertal development. From these amounts of variance, BMI uniquely explained 3.5% in growth spurt, 2.1% in body hair, 1.1% in facial hair, 1.2% in voice change, and 2.7% in pubertal development; no 1.5% in breast development, 4.9% in menarche, and 2.2% in pubertal development; no significant additional variance was explained by BMI in skin change.

8. 5 Discussion

The present study investigated correlates of pubertal development in a sample of Kosovar youth; BMI was positively associated with the development of secondary sex characteristics. Findings confirmed that pubertal indices in Kosovo, as well the mean age of menarche appear to be consistent with findings made in other developmental contexts (Marshall, 1975; Petersen et al., 1988, Biro et al., 2018; Durda-Masny et al., 2019). The mean age of menarche in our sample, 12.35 years old, suggests a decrease in female pubertal landmark, in comparison with the recalled mean age of 13.5 years in Boshnjaku

and colleagues (2015) findings. Age of menarche 12.25 years was also reported in Biro and colleagues (2018) work, in girls from other developmental contexts.

Expectation whether BMI would be positively associated with puberty indices and the onset of menarche among girls was supported, except for skin changes and body hair. Findings supporting these expectations were also found in previous investigations for the positive relationship between BMI and advanced menarche (Kaplowitz et al., 2001; Durda-Masny et al., 2019) breast development (Biro et al., 2013; Biro et al., 2018) and growth spurt (Durda-Masny et al., 2019). Findings also provided no support for the links between BMI and skin changes and body hair, despite the fact it was significantly correlated with total PDS indices score. One possible explanation is that skin changes (acnes) are considered to occur in late adolescence, and our sample included early adolescent age, therefore the absence of the association might be due to age specific changes and cross-sectional investigation. Pubic hair development found also to be a characteristic that develops relatively in late puberty among boys (Ma et al., 2011). Other findings (Sas & Reich, 2019) confirmed that older adolescents reported higher prevalence in acne than those in early adolescence years; it also found that acne prevalence did not significantly differ between teenagers with different BMI, although specific levels on acnes, were more prevalent in adolescent with higher BMI.

The expectation that BMI would be positively associated with puberty indices among boys, was supported, except for skin changes. Previous investigations also found positive relationship between BMI and advanced pubic hair development (Tomova et al., 2015) and voice changes (Juul et al., 2007) among boys, but controversy normal and high BMI did predict equally pubertal timing in boys (Oehme et al., 2021). Skin changes appear to have a later onset and be more present in older adolescents. Finally, frequencies of the five-category pubertal maturity classification evidence that largest portions of boys represent ‘mid-pubertal’ development stage, while majority of girls represents ‘advanced development’ pubertal stage, providing support for the third hypothesis; Kosovar girls entered puberty earlier than boys.

8. 6 Conclusions

Study findings supported that BMI was positively associated with puberty-related body changes among Kosovar youth, except of body hair and skin changes among girls, and skin changes among boys. This was consistent with evidence from other developmental contexts. There is a decrease in the secular trends in Kosovar adolescent girls, namely menarche that is occurring earlier. This also implies that despite exposure to war conflict, disadvantages,

and hardship, puberty changes unfold similarly with other developmental contexts. The present study is not without limitations. Due to its cross-sectional nature, findings cannot inform causality, developmental phenomena, and/or the sequence of pubertal events. Future longitudinal work needs to further address these questions. Additionally, the study only relied on self-reports, thus, study findings are subject to mono-method bias. Future work should consider adding multiple sources of information, including a pediatrician or teacher. Finally, because data were collected in seven municipalities, findings may not be representative, and thus, be generalizable for Kosovar youth.

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Data availability:

The datasets generated during and/or analyzed during the current study are available from the corresponding author, on reasonable request.

Conflict of interest disclosure

The authors declare no conflict of interest.

Ethics approval statement

The study followed all ethical guidelines of Helsinki declaration. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent from parents and adolescents were obtained.

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Table 1

Means and Standard Deviations of Study Variables for Boys and Girls

	Mean	SD	Min; Max
Girls (N = 665)			
Age	13.26	1.27	11; 16
Family SES (parental education)	3.59	1.68	1; 7
BMI	19.76	3.52	8.15; 40.97
Pubertal indices:			
1. Growth spurt	2.76	0.70	1; 4
2. Body hair (underarm and pubic hair)	2.62	0.88	1; 4
3. Breast development	2.58	0.70	1; 4
4. Skin change	2.10	0.85	1; 4
5. Menarche (%yes)	71%		0; 1
Pubertal Development (Cronbach's alpha = 0.67	2.63	0.62	0.80; 4
Age of menarche	12.35	1.05	9; 14.75
Boys (N = 677)			
Age	13.19	1.31	11; 16
Family SES (parental education)	3.59	1.71	1; 7
BMI	20.74	4.56	9.23; 51.88
Pubertal indices:			
1. Growth spurt	2.57	0.81	1; 4
2. Body hair (underarm and pubic hair)	2.57	0.76	1; 4
3. Facial hair	1.76	0.72	1; 4
4. Skin change	2.03	0.88	1; 4
5. Deepening of the voice	2.39	0.87	1; 4
Pubertal Development (Cronbach's alpha = 0.74	2.26	0.57	1; 3.80

Table 2.1

Frequency Distributions of Boys and Girls Across Pubertal Categories

	Boys (*N* = 676)		**Girls** (*N* = 659)	
	n	*%*	*n*	*%*
1. Prepubertal	18	2.7	22	3.3
2. Early pubertal	172	25.4	29	4.4
3. Mid pubertal	372	55	67	10.2
4. Advanced pubertal	113	167	450	68.3
5. Post pubertal	1	0.1	22	3.3
*6. Unclassified (for girls)			69	10.5

* This is a new category that did not fit with Petersen's original five categories; it represents a status with no menarche but advanced-to-post pubertal development on two other indicators (breast development and pubic hair.

Note that 6 cases of girls had missing data on the menarche question and were excluded. Similarly, there was a single case in the boys' sample who had missing data on two of the three items and was excluded for this categorization analysis.

Table 2.2

Frequency Distributions of Boys and Girls across Pubertal Timing Categories

	Girls (N = 659)		Boys (N = 676)	
	N	%	N	%
Early	117	17.8	109	16.1
On time	451	68.4	441	65.2
Late	91	13.8	126	18.6

Table 3

Correlations of Study Variables

Variables	1	2	3	4	5	6	7	8	9
1. Age									
2. Family SES	.04								
3. BMI	.23***	.04							
4. Growth spurt	.21***	.06	.14**						
5. Body hair	.49***	.07	.16***	.32***					
6. Breast development	.41***	.06	.22***	.26***	.48***				
7. Skin change	.28***	.01	.09*	.19***	.33***	.31***			
8. Menarche	.60***	.12**	.31***	.19***	.41***	.41***	.27***		
9. Pubertal Development	.60***	.11**	.28***	.51***	.73***	.69***	.60***	.77***	
10. Age of menarche	.31***	-.02	-.11*	-.06	.04	-.09	-.01	.03	-.04

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

B. Boys

Variables	1	2	3	4	5	6	7	8
1. Age								
2. Family SES	.06							
3. BMI	.08*	.08						
4. Growth spurt	.29***	.02	.19***					
5. Body hair	.30***	.09*	.16***	.38***				
6. Facial hair	.29***	.05	.09*	.33***	.34***			
7. Skin change	.33***	.11**	.05	.24***	.30***	.33***		
8. Voice change	.40***	.04	.12**	.42***	.40***	.44***	.40***	
9. Pubertal Development	.46***	.09*	.17***	.68***	.68***	.68***	.67***	.77***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4

Regression analyses for five pubertal development indices as well as the total pubertal development predicted by age, SES, and BMI

A. Girls

Predictors	1. Growth spurt		2. Body hair		3.Breast development		4. Skin change		5. Menarche		6.Pubertal development	
	β	SE	β	SE	β	SE	β	SE	Exp (b)/OR	SE	β	SE
Step1:												
Age	0.23***	0.02	0.48***	0.03	0.39***	0.02	0.28***	0.03	3.95***	0.12	0.60***	0.08
Family SES	0.05	0.02	0.06	0.02	0.05	0.02	0.01	0.02	1.26**	0.07	0.08*	0.06
Step 2:												
BMI	0.10*	0.01	0.06	0.01	0.13**	0.01	0.03	0.01	1.23***	0.04	0.15***	0.03
R^2	0.064		0.236		0.171		0.079		0.533		0.392	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. OLS regression is used for all dependent variables except for menarche, where logistic regression was used, and instead of R^2, Nagelkerke R^2 is reported.

B. Boys

	1. Growth spurt		2. Body hair		3. Facial hair		4. Skin change		5. Voice change		6. Pubertal development	
	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Step1:												
Age	0.30***	0.03	0.33***	0.02	0.32***	0.02	0.35***	0.03	0.40***	0.03	0.49***	0.08
Family SES	0.01	0.02	0.07	0.01	0.02	0.02	0.08*	0.02	0.01	0.02	0.06	0.06
Step 2:												
BMI	0.19***	0.01	0.15***	0.01	0.10**	0.01	0.04	0.01	0.11**	0.01	0.16***	0.02
R^2	0.125		0.134		0.115		0.133		0.173		0.269	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Study II: Internalizing symptoms among Kosovar adolescents: Pubertal correlates in girls and boys

Abstract

Pubertal status/stage of maturation and pubertal timing have been linked with emotional symptoms of problems among youth, particularly in vulnerable developmental contexts at risk for stress exposure. The present study tested the extent to which pubertal status/stage of maturation and pubertal timing were associated with anxious/depressed, withdrawn/depressed, and somatic complaint symptoms in Kosovar adolescents. It also tested whether sex moderated these relationships. Data were collected from N=1,342 Kosovar adolescents (665 girls; M age =13.26 years, SD=1.27; 677 boys M age =13.19 years, SD=1.31). Regression analyses provided evidence that pubertal status/stage was positively associated with rates of anxious/depressed, withdrawn/depressed, and somatic complaint symptoms in girls, but only with withdrawn/depressed symptoms in boys. Additionally, pubertal timing was positively associated with anxious/depressed, and somatic complaint symptoms in girls; no significant links were found for boys. The present study provided evidence that advanced pubertal status/stage as well as timing is positively associated with internalizing symptoms in girls; however, only pubertal status/stage was positively associated with withdrawn/depressed symptoms in boys. The study highlights the importance of pubertal development for internalizing symptoms in a developmental context known for high stress exposure, particularly for girls.

9. 1 Introduction

One in seven adolescents (14%), ages 10 to 19 years of age, experiences a mental health problem, such as anxiety or depressive symptoms, also expected to be present later in life (Venkatesan, 2023). Research has shown that these problems peak during middle adolescence years around the age 13, particularly among the girls (Angold et al., 1998; Ge et al., 1994; Hankin et al., 1998). It has also shown that developmental changes, particularly in early adolescence, impact an adolescent's emotional adjustment (Susman & Dorn, 2013). More specifically, *pubertal status/stage* (Ge et al., 2002, 2006; Lewis et al., 2018), the degree of physical maturation of the current morphological development, as well as *pubertal timing* (Deardorff et al., 2021; Hoyt et al., 2020; Ullsperger & Nikolas, 2017), maturational onset relative to same age peers (Susman & Dorn, 2009), have been found to be positively associated with emotional adjustment difficulties. This latter evidence has been found to a greater extent among girls than boys (Deardorff et al., 2007; Patton et al., 2008; Stumper & Alloy, 2021). Other work has shown that timing asynchrony was associated with depressive symptoms among girls, less do for boys (Stumper et al., 2020). Finally, historical data have provided consistent evidence of a downward trend of age of pubertal onset (Eckert-Lind et al., 2020; Mul et al., 2001), thus increasing the urgency to better understand the puberty-internalizing symptoms links. The present study was particularly interested in better understanding these links among Kosovar youth.

The social and cultural environment where adolescents develop might further uniquely contribute to when puberty occurs as well as how it impacts internalizing symptoms. For instance, an earlier onset of puberty has also been found in youth growing up in low SES contexts (Oelkers et al., 2021), thus highlighting the importance of considering SES for understanding pubertal development. Furthermore, other work has shown that growing up in a disadvantaged low SES context is also positively associated with internalizing symptoms (Leventhal & Brooks-Gunn, 2000). Historically, Kosovar youth have been chronically exposed to different collective traumas, which have likely had an impact on their physical and psychological development. The exposure by Kosovar children and adolescents to mass trauma through the Balkan war has been well documented; this work has shown that this exposure has long lasting impacts on physical and mental health, including depressive symptoms (Eytan et al., 2015; Fanaj, 2020). In addition to the exposure to war, these youth have been chronically witnessing ethnic tensions and conflicts, still high today, thus placing them at exceptionally high risk for emotional

problems (Shahini & Landsman, 2008). In a post war Kosovo, many family members expressed symptoms of PTSD, faced the loss of family members due to death or simply being missing, and experienced poverty; all of these factors negatively impacted the mental health of children and adolescents (Shahini et al., 2015). Research has provided evidence that 11 years following the end of the war that paternal PTSD was positively associated with children's anxiety and depressive symptoms (Schick et al., 2013).

Duraku and colleagues (2023) recently found that Kosovar youth born after the war scored higher on measures of PTSD symptoms and lower on a number of perceived support measures (social, significant other, and family), than their parents. This finding was particularly evident in youth who had parents with PTSD in comparison to ones without. These adolescents were more likely to report negative mood and cognition, or emotional arousal; they were also more likely to report experiencing sudden accidental death or sudden violent death in comparison to their peers. This provides evidence of an intergenerational transmission from parents to children of wartime trauma, decades following exposure. In addition, research has also indicated that adolescents from collectivist cultures are more conservative, conforming as well as sensitive about sexual and social norms (Hegde et al., 2022). Thus, this cultural context might also make it less likely for youth to share information about pubertal development/maturation for instance; in other words, Kosovar youth might be likely to talk about puberty in comparison to youth from individualistic cultures like Great Britain or the United States. Therefore, the present investigation sought to better understand the extent to which the unique developmental context of Kosovo might influence the observed links between measures of puberty and internalizing problems.

More specifically, the present study sought to test the extent to which different measures of puberty were associated with measures of internalizing symptoms among Kosovar youth; in addition, it tested the extent to which these links were moderated by sex. The study also tested the extent to which socioeconomic status was associated with pubertal development status/stage, pubertal timing, and measures of internalizing symptoms.

9. 2 Body Mass Index, Puberty, and Internalizing Symptoms

Previous research has provided evidence of a high prevalence of overweight ethnic Albanian children and adolescents living in Kosovo, Albania, FYR Macedonia (North Macedonia) as well Montenegro (Tarp et al., 2018). The underlying mechanisms of the

relationship between Body Mass Index and pubertal development are not fully understood, however, research indicates that there is a positive association between pubertal development and higher BMI (Kaplowitz et al., 2001). Girls with a higher BMI are more likely to start their menses earlier (Kaplowitz, 2008), and they also reached breast stage 2 development at younger ages (Biro et al., 2013). Boys with greater BMI also entered puberty at younger ages (Sørensen et al., 2010; Tomova et al., 2015). BMI is associated with internalizing symptoms, although to a greater extent among girls than boys (Ames et al., 2015; Needham & Crosnoe, 2005). Research has also found that heavier than average as well as underweight girls, but also obese boys, report higher levels of depressive symptoms (Cortese et al., 2009) and overall internalizing problems, in comparison to average BMI groups (ter Bogt et al., 2006). Others have found no associations between BMI and depression (Swallen et al., 2005).

9. 3 Pubertal Development and Internalizing Problems

Advanced pubertal status/stage has been found to be positively associated with depression (Angold et al., 1998; Lewis et al., 2018; Huerta & Brizuela Gamino, 2002), anxiety (Reardon et al., 2009) and somatic symptoms (LeResche et al., 2005; Rhee, 2005) among youth, more so among girls than boys (Marceau et al., 2012). Early pubertal timing also has been associated with depression (Barendse et al., 2022; Deardorff et al., 2007; Hamlat et al., 2020), and anxiety symptoms (Barendse et al., 2022; Senia et al., 2018), in comparison to ones who mature on time or late. In addition, early pubertal timing is also more prevalent in girls in comparison to the boys (Blumenthal et al., 2011; Deardorff et al., 2021) and positively associated with internalizing symptoms in both boys and girls (Ullsperger & Nikolas, 2017). However, Angold (1998) found that pubertal status/stage, rather than pubertal timing, was a significant predictor of depression among adolescent girls (cf. Copeland et al., 2019). Others found similar positive associations between both pubertal status/stage as well as pubertal timing and internalizing symptoms in girls and boys (Ge et al., 2006).

Particular social and environmental circumstances might exacerbate the associations between pubertal status/stage or pubertal timing and externalizing symptoms. For instance, Ge and colleagues (Ge et al., 1994) found evidence that increased environmental stress was uniquely associated with depressive symptoms in girls at age 13, but not boys. Similarly, Ge and colleagues (2001) found that advanced pubertal status/stage girls who had stressful life experiences were more vulnerable to depressive symptoms. Adversities

that occur during life such exposure to poverty, might accelerate the pubertal development that in turn is positively associated with internalizing problems.

9. 4 The Kosovar developmental context

Kosovar girls report elevated levels of internalizing problems in comparison to boys (Fanaj et al., 2015; Jetishi & Muqaj Froku, 2016; Shahini et al., 2015). Estimates of internalizing problems among Kosovar adolescents by Shahini and colleagues (2015) were 25.5% (some of the highest were anxious/depressed (19.4 %), withdrawn/depressed (22.1 %), and somatic complaints (14.9%)). Considering that Kosovo has been going through tremendous socio-economic and cultural transitions over the past two decades (Latifi, 2014; Shahini et al., 2015; Tawil, 2009; The World Bank, 2017), this calls for research to better understand the extent to which these unique changes have impacted youth emotional adjustment. Post-war Kosovar period of transition has impacted family economic conditions, with unemployment rates of 20.5% (Kosovo Agency of Statistics, 2022). Economic hardship is associated with a whole host of deleterious consequences, including a lack of proper nutrition, and family stressors, which further might potentiate youths' overall well-being. In addition to that, Kosovo has experienced a profound shift over the past two decades from collectivism to individualism, which has manifested itself in a number of ways, including working independently rather than relying in one's family income, increased levels of both education and employment among women, and a shift to residing as a nuclear family (parents and children only) rather than living in an extended family (Flere & Klanjšek, 2013; Kadriu, 2018; Shaqiri, 2018). Following the 1998/1999 war in Kosovo, many Kosovar families moved from villages to big cities for better job opportunities and education (Shahini & Landsman, 2008). As such, emotional struggles might further negatively impact youth psychologically. The contextual amplification hypothesis proposed by Ge and Natsuaki (2009) highlights that experiencing early pubertal transitions in a disadvantaged context greatly increases the risk for adjustment difficulties among adolescents. In addition, as suggested by Duraku (2023), the indirect intergenerational transmission of trauma through family members or parents has had and continues to have an impact on the affective state of Kosovar youth until today. Thus, the present study seeks to shed some new light on whether these social, cultural, and economic transitions might have impacted adolescent emotional adjustment among Kosovar boys and girls.

9. 5 Theoretical grounding

Several theories have been developed in an attempt to explain why transitioning through puberty is associated with internalizing problems. Notably, the empirical evidence supports that the association between pubertal development and internalizing symptom links might have some contextual explanation, namely simply where youth reside (Angold et al., 1998; Ge et al., 2001; Ge & Natsuaki, 2009). According to Lewis and colleagues (2018: *pubertal status hypothesis*), puberty simply increases the risk of depression, independent of its timing. Next, *developmental readiness hypothesis* (also known as the stage termination hypothesis), posits that early maturational timing heightens the risk for adolescents to experience internalizing problems, particularly among early maturing girls (Negriff & Susman, 2011; Petersen & Crockett, 1985). Early maturing youth, and particularly girls might have an insufficient level of cognitive maturation to deal with the very novel bodily changes as well as societal behavioral expectations. The asynchrony between cognitive and biological maturity as well as social pressures (positive as well as negative) might be responsible for creating a gap among these three critical components, resulting in increased levels of emotional problems in early maturing adolescents. The *contextual amplification hypothesis* proposes that experiencing early pubertal transitions in a disadvantageous context increases the risk for psychopathology symptoms (Ge & Natsuaki, 2009). Therefore, it was expected that advancing through puberty would be positively predicting rates of internalizing symptoms. In addition, it was expected that early maturing youth would score higher on measures of internalizing symptoms, in comparison to adolescents who mature on time and/or late. These relationships were particularly salient in the present study as Kosovar youth reside in a developmental context characterized by exposure to collective trauma, poverty, ethnic tensions, as well as both undiagnosed and untreated parental mental health problems following the war.

9. 6 The present study

Given some of the inconsistent evidence as well as gaps in the previous literature, the present study sought to test the extent to which pubertal status/stage and early pubertal timing was associated with anxious/depressed, withdrawn/depressed as well somatic complaints symptoms in youth. At the same time, the tested also tested whether sex differences existed in internalizing problems. The present study extended the work by Shahini and

colleagues (2015) as well Fanaj and colleagues (2015), which found that Kosovar girls reported more internalizing problems in comparison to boys. Likewise, the study sought to advance this previous work by focusing on whether advanced pubertal status/stage of maturation or timing of puberty was positively associated with emotional problems in Kosovar youths, novel observation in the Kosovar developmental context.

The study was guided by the following research questions:

1) Is pubertal status or stage positively associated with rates of internalizing problems, namely anxious/depressed symptoms, withdrawn/depressive symptoms, and somatic complaint symptoms in Kosovar adolescents?

2) Is early pubertal timing positively associated with the rates of internalizing problems, namely anxious/depressed symptoms, withdrawn/depressive symptoms, and somatic complaint symptoms in Kosovar adolescents, in comparison with on-time or late maturing youths?

3) Are there sex differences in rates of internalizing symptoms independent of maturational timing and pubertal status/stage of development?

The study tested the following hypothesis:

1) It was expected that pubertal status or stage would be positively associated with the rates of anxious/depressed and withdrawn/depressed and somatic compliant symptoms; however, it was expected that the relationship would be stronger in girls in comparison to boys.

2) It was expected that early pubertal timing would be associated with higher rates of anxious/depressed symptoms, withdrawn/depressed symptoms, and somatic complaint symptoms, in comparison to on-time or late-maturing youth. Again, it was expected that this relationship would be stronger in girls in comparison to boys.

3) It was expected that girls would indicate higher levels of internalizing symptoms, in comparison to boys, namely anxious/depressed symptoms, withdrawn/depressive symptoms, and somatic complaint symptoms.

9. 7 Methods

9. 7. 1 Procedure

Data was collected in N=1,342 early adolescents (665 girls; M_{age}=13.26 years, *SD*=1.27; 677 boys M_{age}=13.19 years, SD=1.31). The study was reviewed and approved by the Ministry of Higher Education of Kosovo; each school principal from the seven largest municipalities had to review and decide on participation. At participating schools, parents were sent a consent document, informing them of the study and requesting their consent for their child to participate in the study. Consent forms were returned to the schools. Of approximately 2,000 consent documents, 1,478 were returned. The remainder were missing either due to parental refusal to participate in the research, or due to failure to return the consent forms to school. Thus, the total recruited sample included 1,478 early adolescents: due to missing data, the final study sample consistent of N=1,342 adolescents. Data were collected in school classrooms of each municipality, between November 2019, and March 2020. Participants completed an assent document prior to participation; next, they completed an anonymous self-report paper and pencil survey during school hours, which lasted approximately 40 minutes. The study followed all ethical guidelines of Helsinki declaration of 1975, as revised in 2008.

9. 7. 2 Sample

Participants were 11 years old (13.7%), 12 years 14.2%), 13 years (25.4%), 14 years (32.0%), and 15+ years old (14.8%). The sample included 6th (13.7%), 7th 14.2%), 8th (25.4%), and 9th grade students (46.7%) who were of ethnic Albanian (95.6%) as well other ethnic groups living in Kosovo (4.4%). Final percentage sample divided regionally, was from Peja (9.2%), Prizren (14.7%), Malisheve (12.4%), Mitrovice (17.9%), Gjilan (11.8%), Fushe Kosove (12%), and Gjakove (22.0%).

9. 7. 3 Measures

Demographics variables

Study variables included age, sex, municipality, socioeconomic status (SES), grade, and ethnicity.

SES. Parental employment was used to assess family socioeconomic status (SES), based both on mother's and a father's employment, ranging from 1 =" owner/professional official/high degree", 2 = "small business owner/professional/IT/ large farm owner/military officer'', 3="semi-professional worker/skilled craftsman'', 4="cleric staff sales representatives/artist/other military personnel'', 5="machine operator/semi-skilled worker such cook, waiter or janitor'', and 6 = "laborer or service worker", and 7 = "unemployed".

Responses were reversed coded and then averaged, so that the higher scores indicated higher family SES.

Pubertal Developmental Scale. Puberty was assessed by using Pubertal Developmental Scale (Petersen et al., 1988). The self-report scale consists of 5 items, which focus on the development of secondary sexual characteristics. The first three items ask about body growth in height, pubic hair and skin changes, which are for both sexes. Then it is followed by the items for facial hair, deepening of the voice for boys only, and breast development and menarche for girls only. Except menarche question (a dichotomy), the five pubertal items use 4 rating points Likert scale starting from 1 there is no development, 2 developments have barely begun, 3 development was definitely underway, and 4 development was already completed. The girls were asked also to indicate whether they experienced menarche or not. Those who experienced menarche, reported it in months and in years. The measure was internally consistent (girls $\alpha = 0.67$; boys $\alpha = 0.74$), indicating acceptable reliability. The pubertal development score was computed by summing across the five items to obtain a total score; the sum of the scores on the five indicators was divided by five in order to preserve the original (1-4) metric.

Body Mass Index. Body Mass Index (BMI) was calculated using weight in kg and height in m reported by participants: BMI = weight (kg)/ [height (m)]^2.

Youth Self Report (YSR). Participants completed the YSR instrument, consisting of 112 items (Achenbach & Rescorla, 2007). However, the present study only focused on internalizing problems, namely the *withdrawn/depressed subscale* (8 items; sample item: '*I am unhappy, sad, or depressed'*), the *anxious/depressed subscale* (13 items; sample item: '*I cry a lot'*), and the *somatic compliants subscale* (10 items, sample item: '*I have nightmares'*). The anxious/withdrawn item *'I think about killing myself'* was excluded from the assessment, due to being sensitive question for young participants. The Albanian version was used with permission from official ASEBA's package representatives for Kosovo (Shahini et al., 2015). The participants responded to the items on a 3-point Likert type scale, by choosing 3 options, (0) *not true at all* (1), *somewhat true*, and *very true* (2) in a six-month lapse. The internalizing broad-band measurement was internally consistent among girls (internalizing broadband α=.81; anxious/depressed α=.81; withdrawn/depressed α=.61; and somatic complaints α=.75 respectively) and boys (internalizing broad-band scales α=.79; anxious/depressed α=.69; withdrawn/depressed α=.45 and somatic complaints α=.70, respectively). The Youth Self Report has been established as a reliable instrument for assessing internalizing problems among Kosovar youths (see Shahini et al., 2015); its

validity and reliability have been well documented by Achenbach and Rescorla (2001). Fairly significant agreement between adolescent self-reports and parent reports in internalizing symptoms have been reported (Thomas et al., 1990).

9. 7. 4 Plan of Analysis

Five pubertal categories were developed based on Petersen and colleagues (1988): prepubertal, beginning of pubertal, mid pubertal, advanced pubertal and post pubertal. Classification into one of five pubertal categories (prepubertal, beginning of pubertal, mid pubertal, advanced pubertal and post pubertal) is based on the level of development reported on the three indicators of the pubertal changes thought to be most salient for each sex. For girls this include: pubic hair growth, breast development and menarche, whereas, for boys, they are: development of pubic hair, facial hair and voice changes. For girls, category *prepubertal* (1) is assigned if girls report no development in any of the three indicators (i.e. received a combined score of '3' for the three indicators). **(**2) *beginning of pubertal*: if girls report no menarche along with some development of either breast or pubic hair but not both of them (i.e. a combined score of '3' for the last two indicators). (3) *midpubertal:* if girls report no menarche along with some development of either breast and pubic hair or more development on at least one of these characteristics (i.e. a combined score of '4' or more for more breast and body hair). (4) *Advanced pubertal:* if girls report menarche in combination with less than complete breast and/or pubic hair (i.e. a combined score of '7' or less on these two indicators). **(**5) *Post pubertal*: if girls report menarche along with completed development for both pubic hair and breast (e.g. a combined score of '8' on these two indicators).

For boys, (1) *prepubertal category* is assigned if boys report no development on any of these three characteristics (a combined score of '3'). (2) *Beginning of pubertal*: if boys report initial development on one or two characteristics, or more development in one characteristic but no development on the other two (i.e. a combined score of '4' or '5'). (3) *mid-pubertal*: if boys report beginning development on all three or advanced development on one or two combined with little or no development on the others (i.e. a combined score of '6' or '7' or '8'). (4) *advanced pubertal*: if they report advanced development on all three or beginning development on one combined with advanced or completed development on another or completed development on the third (e.g., a combined score of '9' or '10' or '11'). (5) *post pubertal*: if boys report completed development of pubic hair, facial hair, and voice (i.e., a combined score of '12').

To determine early, on time and late categorization, first, scores of the pubertal development scale were standardized (changing into the distribution with a mean of 0, and standard deviation of 1) for each age: 11, 12, 13, 14, and 15 (few cases of 16 were also collapsed with the age 15 group). Then, early was defined to be having pubertal development scores greater than 1 (1); on time = scores between -1 and 1 (2); and late = scores below -1 (3) (see Flannery, Rowe, & Gulley, 1993; Steinberg, 1987).

The first step of the analyses was to calculate descriptive statistics of the study variables for boys and girls separately, followed by computation of bivariate Pearson's correlations. Next, a series of Ordinary Least Squares (OLS) regressions were run to test the study hypotheses. Due to high correlations between pubertal timing and Pubertal Development, their effects were tested in separate regressions. The following regressions were tested for boys and girls separately: 1) where the dependent variable was anxious/depressed symptoms, 2) with withdrawn/depressed symptoms as the dependent variable, and 3) somatic complaints being the dependent variable. First step of each regression included family socioeconomic status as the independent variable, then in the next step, BMI, and pubertal timing (or alternatively, pubertal development) were added. Analyses were conducted using SPSS 26.

9. 8 Results

Descriptive statistics of the study variables are reported in Table 1. The average age of menarche in girls was 12.35 years. T-tests were conducted to statistically test mean-level differences in each type of internalizing symptoms/domains by sex. Findings from these tests indicated that there were significantly higher levels of internalizing symptoms among girls compared to boys (t = -12.46, $p < .001$, for Anxious/depressed; t = -10.40, $p < .001$, for Withdrawn/depressed; and t = -7.17, $p < .001$, for Somatic complaints).

Table 2 presents bivariate Pearson's correlations of the study variables. Family SES was positively associated with the total pubertal development status/stage in girls as well as in the boys ($r = .10$, $p = .041$), however, it was unrelated to any of the three internalizing symptoms/outcomes. Despite this fact, the effect of family SES was controlled for, in subsequent regressions. Being an early matured compared to late (but not on time) was related to higher BMI for both sexes ($r = .30$, $p < .001$). Being an early mature compared to late was also related to higher rates of anxious/depressed, and somatic complaints among girls ($r = .24$ and .22. respectively, $p < .001$) and with withdrawn/depressed in boys ($r = .13$, $p = .023$). Being *early* compared to *on-time* was related to only somatic

complaints in girls, however to much lesser extent (r = .09, p = .042) than it was compared to *late*; and in boys, it was related to withdrawn/depressed symptoms (r = .09, p = .032). Pubertal development status/stage was positively associated with each internalizing symptom in girls (r = .31, .26, .22, p < .001, for anxious/depressed, withdrawn/depressed, and somatic complaints, respectively) but only with withdrawn/depressed among boys (r = .08, p = .043). As expected, all the internalizing symptoms were positively and highly correlated with each other in both sexes.

Table 3 reports results from regression analyses predicting internalizing symptoms by BMI, pubertal timing, and pubertal development status/stage, with family SES used as a control variable. Due to high correlations between pubertal timing and pubertal development, their effects are tested in separate regressions. The effects of pubertal timing are modeled using dummy-coded variables, one representing the coefficients of *on-time* and the other *late* groups compared to *early* group. For girls, the results showed that being late in maturation in comparison to early was negatively associated with anxious/depressed symptoms as well as somatic complaint symptoms (β = -0.17, for both). Being *on-time* in comparison to *early* was also positively associated with somatic symptoms (β = -.10). BMI was unrelated with these two internalizing symptoms controlling for pubertal timing; however, it was positively associated with withdrawn/depressed symptoms (β = .15); this positive relationship was also found in the second regression, controlling for the effect of pubertal development status/stage (β= .08). Pubertal development status/stage of maturation was significantly and positively associated with each measure of internalizing symptoms among girls, controlling for BMI and family SES (βs = .31, .24, and .22, respectively). Overall, the model explained 9.8% of variance in anxious/depressed symptoms, 7.4% in withdrawn/depressed symptoms, and 4.9% in somatic complaint symptoms.

For boys, regression analysis results provided evidence that there were no significant associations with either BMI or pubertal timing; the only significant relationship found was for pubertal development status/stage of maturation which was positively with associated withdrawn/depressed symptoms (β = .13). This model explained 1.9% of variance, the largest across these six different models.

9. 9 Discussion

The present provides evidence that pubertal status/stage was positively associated with rates of anxious/depressed symptoms, withdrawn/depressed symptoms, and somatic

complaint symptoms in girls; it was also positively associated with rates of withdrawn/depressive symptoms only in boys. In addition, the evidence indicated that early maturational timing was positively associated with anxious/depressed and somatic complaint symptoms in girls, but not in boys.

Overall the rates of internalizing symptoms (independent of status/stage and maturational timing) of anxious/depressed symptoms, withdrawn/depressed symptoms, and somatic complaint symptoms appeared higher among girls in comparison to boys, consistent with previous work that was carried out in the same developmental context (Fanaj et al., 2015; Shahini et al., 2015), but also with work from other contexts (Ge et al., 1994; Hankin et al., 1998). Early maturing girls with adult-like features oftentimes are exposed to societal pressure on how they would be expected to behave at a certain age, which would make them prone to emotional problems due to the asynchrony between physical and cognitive development (Natsuaki et al., 2014). Many societies would expect that early maturing boy's appearance might be an advantage of male physical development, therefore advanced pubertal development status among boys, and early timing would predict fewer emotional problems. In fact, accelerated pubertal development might be considered positive and elicit positive responses from peers and friends.

The beginning of adolescence is marked by an increase pressure and demand for conformity to cultural gender norms from peers, parents or others (see Hill & Lynch, 1983, gender intensification hypothesis). Kosovar families still follow patriarchal values related to family roles (e.g., females responsible for childbearing, and household while men would be dominant and be held responsible for incomes for instance) (Latifi, 2014). Traditional gender roles (feminine roles) which are linked to some extent with patriarchal values, have been found to be associated with adolescent poor mental health, particularly girls' anxiety, for instance (Aparicio-García et al., 2018). The mean age of menarche was 12.35 years in the present study; this was slightly younger than the one reported by Boshnjaku and colleagues, which was 13.5 years (Boshnjaku et al., 2016), but also similar to reports from neighboring countries such Montenegro, 12.15 years (Ščepanovič et al., 2019) or reports on girls from the United States, 12.25 years (Biro et al., 2018).

Consistent with the first study hypotheses, based on correlations, advanced pubertal status/stage was positively associated with anxious/depressed symptoms, withdrawn/depressed symptoms, and somatic complaint symptoms in girls, but only with withdrawn/depressive symptoms in boys. These findings were also made in regression analyses. These findings about girls namely that advanced pubertal status was positively associated with anxiety and

depressive symptoms was consistent with previous work (Ge et al., 2001; Angold et al., 1998; Lewis et al., 2018; Reardon et al., 2009, Huerta & Brizuela-Gamino 2002; Deardorff et al., 2007; Coley & Rudolph., 2009); the findings for boys was also consistent with previous evidence (Ge et al., 2001; Ge et al., 2006; Richardson et al., 2006). In fact, Conley and Rudolph (2009) also found no associations between advanced pubertal stage and depressive symptoms in boys. The evidence appears to support the *pubertal status hypothesis* which suggests that advancing through puberty (independent of pubertal onset/timing) places girls at risk for depressive symptoms (Lewis et al., 2018). These effects are thought to be driven by several hormone levels that surge during adrenarche as well as psychosocial mechanisms. First, it has been suggested that there is peak in adolescent female depressive symptoms in mid adolescence around ages 12 or 13 years (Angold et al., 1998; Ge et al., 1994; Hankin et al, 1998). Get al. 1994 found evidence that depressive symptoms in girls covaried with stressful life events. Maturational changes and puberty might increase a girl's susceptibility to stressful life events and negatively affect their affective state, including depression (Ge et al., 2001). Girls might also be at greater risk for rumination than boys (e.g., see the Response Style Theory by Nolen-Hoeskema, 1991), which might in part explain sex differences in internalizing symptom rates. In addition, poor emotional control and high levels of family conflict have been reported to be predicting the in rates of depressive symptoms in girls (Patton et al., 2008). Finally, Graber and colleagues (2006) found evidence that estradiol levels in girls are associated with risk for depressive symptoms (breast development is largely controlled by estradiol levels; Lewis et al., 2018).

Early maturational/pubertal timing was positively associated with anxious/depressed symptoms and somatic complaint symptoms in girls only, in comparison to late maturing girls. This partially supported the second study hypothesis. On-time pubertal timing was also associated with fewer somatic complaint symptoms in comparison with early maturing girls. The evidence from the present study is consistent with previous research which found a positive association between pubertal timing and internalizing symptoms in girls, but not boys (Conley & Rudolph, 2009; Blumenthal et al., 2011; Graber et al., 1997). The evidence was also consistent with previous work which found a positive link between early pubertal timing and somatic complaint symptoms in girls (Rhee, 2005; see also Kløven et al., 2017). A higher incidence of somatic complaint symptoms in girls than boys, might be attributed to some extent to the interplay between stress and hormonal changes being more evident in girls (Williams & Zahka, 2017), or particular hormones in girls. Another potential explanation includes that some particular physical symptoms,

such as headaches, are more prevalent among early maturing girls, while musculoskeletal pain is more common among boys (Rhee, 2005). Our findings support the *developmental readiness hypothesis* (stage termination hypothesis) assertation, that early maturational timing posits greater risk for emotional adjustment problems, particularly in girls.

Navigating through puberty is a new challenge for adolescents, due to its rapid physical changes, changes that are manifested by emotional and psychosocial changes in adolescent girls and boys. Pubertal development in fact seems to exacerbate the observed physical and cognitive asynchrony in youth. This maturational disparity hinders emotional adjustment due to adolescents simply not being well prepared to adjust to both the profound cognitive and physical changes, consistent with the maturational disparity hypothesis (Ge & Natsuaki, 2009) and the developmental readiness hypothesis (Negriff & Susman, 2011). As a result, early puberty contributes to elevated levels of affective problems during early adolescence. Next, it is possible that the early pubertal timing-internalizing problems relationship unfolds due to girls' individual vulnerabilities, including low self-regulation skills, for instance (Crockett et al., 2013). Likewise, levels of anxiety, depression, and psychological stress appear to be higher among girls than boys, due to their dissatisfaction with their social contacts and poor social support (Van Droogenbroeck et al., 2018). Girls appear to be susceptible to peer pressure during puberty, which might indirectly contribute to the present study findings. Conley and Rudolph (2009) found a positive association between early pubertal timing and heightened risk for depression in girls exposed to high levels of peer stress. In this sense, growing up in the Kosovar patriarchal culture might have contributed to some of the observed sex differences; culturally, accelerated pubertal development in boys is almost an expectation, while for girls accelerated bodily changes are a liability thereby contributing to increased internalizing symptoms.

This view has been elaborated by Hill and Lynch (1983), namely the intensification of the gender role expectations hypothesis, which maintains that both boys and girls experience increased pressures to conform to culturally sanctioned gender roles. Such expectations might partially address some of the observed differences in the present study. Next, an additional explanation might include that four genetically vulnerable girls, normal hormonal cycling might trigger dysregulation of neurotransmitter systems, leading to increases in depressive symptoms (Nolen-Hoeksema & Hilt, 2009). Therefore, the interactions between hormonal changes and psychosocial experiences increases the likelihood on elevated depressive symptoms, more so among girls than boys (Frank &

Young, 2000). That is, much of the adolescent emotional adjustment depends on the cognitive, hormonal, and social reaction following the early onset of puberty, thus foretelling either a positive or negative emotional development. In addition, the ongoing economic and social transformations in the Kosovar contexts, defined by ongoing collective trauma, might also have contributed to study findings. Ge and colleagues (2001) found that when early maturation was accompanied by recent stressful life events, this placed girls at higher risk for developing depressive symptoms. Considering that collective trauma and rapid societal changes in Kosovo have occurred over the past two decades, these stressful life events might also have indirectly affected girls' levels of internalizing symptoms. Finally, no association was found between SES and pubertal timing in the present study; evidence from other developmental contexts, however, has provided evidence that youth with lower SES is associated with earlier breast development (thelarche) and a longer duration of puberty (Oelkers et al., 2021).

9. 10 Conclusion

The current study findings provided evidence that advanced pubertal development status/stage was positively associated with internalizing problems in girls, namely anxious/depressed symptoms, withdrawn/depressed symptoms, and somatic complaint symptoms, but only with withdrawn/depressed symptoms in boys. The results also showed that early maturing girls scored higher on measures of anxious/depressed symptoms, and somatic complaint symptoms, in comparison to on-time or late maturing girls. Thus, early maturation poses a risk for affective problems in mostly for girls in the present study. The rates of unemployment in Kosovo, ongoing societal transitions from a collectivist culture to a more individualistic one, as well as direct or indirect chronic exposure to stressful life events for adolescents, are likely to have impacted study findings (see Ge & Natsuaki, 2009; Ge et al., 2001).

The study results support the *pubertal stage hypothesis* (Lewis et al., 2018) which posits that advancing through puberty increases the risk of internalizing problems in adolescents, particularly for girls. The results were also consistent with the developmental readiness hypothesis (Negriff & Susman, 2011; Petersen & Crockett, 1985), which holds that early maturational timing, particularly for girls, heightens the risk of internalizing problems, in comparison with on time or late maturing youth. Finally, based on the contextual amplification hypothesis (Ge & Natsuaki, 2009), it was expected that experiencing puberty in a high-risk context (e.g., low SES, experiences and history of ethnic violence,

following war trauma and intergenerational trauma), would further exacerbate risk for internalizing problems, in particular.

The present study leads to the following main conclusions: (1) pubertal status/stage plays an important role in the development of internalizing problems among Kosovar youth, particularly for girls; (2) early pubertal timing was identified as a risk factor for internalizing symptoms in girls, but not boys; (3) on-time and late maturation seem to function as a protective mechanism for Kosovar girls; (4) internalizing problems appeared to be more prevalent among girls than boys; and (5) the unique contextual characteristics of Kosovo, defined by relatively low socioeconomic status, a history of ethnic tensions and violence, and a history of war as well as subsequent trauma, particularly among parents or grandparents, might have indirectly impacted the emotional well-being among youth, and therefore, placed them at greater risk for internalizing problems.

9. 11 Limitations

The present study contributes to an understanding of the role of early pubertal development on internalizing problems risk, however, a number of limitations should be noted. Due to cross-sectional nature of the study, it cannot provide evidence of causality; in other words, the study cannot contribute to an understanding about developmental changes or processes in either physical development or internalizing problems, or about the direction of the effects. In this sense, the study is very limited in its ability to provide information about the sequence of pubertal events (whether breast development precedes pubic hair, and vice versa), or pubertal tempo (navigating puberty slower or faster than their counterparts), both associated with internalizing problems.

A further study limitation includes the sole reliance on self-reports which therefore introduces the potential for monomethod bias. In other words, the observed relationships might be inflated due to shared method variance. Future work needs to employ multiple informants such measuring the pubertal development indices from a trained medical team, or also assessment of the hormone levels that contribute to adolescent sexual maturation during early phase of puberty, in addition to the self-report measures of pubertal development. At the same time, a moderate amount of agreement has been found between adolescent self-reports and parent ratings measuring internalizing symptoms (e.g., Neill, 2016; Wang et al., 2014). Future work should be longitudinal in nature as well as include multiple informants, to overcome mono-method bias.

Another study limitation is the use of Body Mass Index to measure obesity. Previous work has shown that BMI does not always capture excess body fat, also related to different body types and sizes (Romero-Corral et al., 2008; Nuttall, 2015).

A further limitation concerns low reliabilities of the withdraw/depressed subscale in both female and male participants. However, similar size estimates have been found (0.52-0.64) in previous work (Verhulst et al., 2003); boys withdrawn/depressed symptom scale (0.54) and girls (0.62; Gribel et al., 2016). Despite the fact that these scales had low reliability, based on construct and face validity considerations, a decision was made to use them in the present investigation. A low reliability simply indicates that the observed associations among constructs might attenuated due to low reliability of some of the measures, or in other words, the actual associations might be slightly larger given higher reliability estimates.

It is also not possible to comment about the extent to which the effects of early pubertal timing and pubertal status/stage persist developmentally into late adolescence, or early adulthood, or whether they wane with age. Next, the study was based on a large convenience sample of Kosovar youth; this means that the sample was not representative of Kosovar youth more generally speaking. Due to the large sample size and the focus on an understudied Kosovar adolescent population, these unique features might in part at least outweigh important study limitations. Future work would need to include a representative sample of ethnic Albanians and other ethnic youth (e.g., Roma youth) living in Kosovo to observe the extent to which ethnicity might impact pubertal development, internalizing problems as well as the relationship between the two.

It is also important to note that the present investigation did not test a number of known correlates of puberty as well as internalizing problems nor did it test competing, alternative study hypotheses It is possible, thus that the early onset of internalizing problems would accelerate the onset of BMI and physical development among youth, and the early puberty and internalizing problems link might additionally be moderated by other variables, such as low parental attachment, for instance. Finally, despite these limitations, the study fills an important gap about scholarship focused on adolescence from Kosovo.

9. 12 Contribution and implication for practice

The study findings point to several important practical implications, informing policy making and decisions as well as program development and delivery that facilitate positive

mental health and wellbeing. Early pubertal timing was found to be a correlate of internalizing symptoms among girls; in addition, advanced pubertal status (and not pubertal timing) was positively associated with withdrawn/depressive symptoms among boys. These are novel observations in the Kosovar context, which identifies risk related to early pubertal development and associated adjustment problems. With emotional problems peaking in mid-adolescence (Hankin et al., 1998; Lewis et al., 2018), psychological therapeutic interventions should target youth during middle adolescence. More specifically, psychological services might target and provide support to girls that present features of early puberty (adult-like morphological body features, or rapid progress through puberty), exhibit body discomfort, or even are victims of bullying due to appearance changes tied to puberty.

Study findings also potentially inform school policies and programs; these might include psychoeducational interventions focused on sexual and reproductive health (sex education curricula), to better inform adolescents about their expected bodily changes. Previous work has shown that when adolescents have prior knowledge about their expected bodily changes, they are less likely to develop negative attitudes about them (Belgrave, 2009), and thus, potentially also less likely to feel anxious or depressed about them. The Ministry of Education of Kosovo, the Kosovo Institute of Public Health, with support by the United Nation Population Fund (UNFPA), has provided updated manuals about adolescent sexual and reproductive health to teachers (see Begolli et al., 2021; Berisha et al., 2021). In fact, a recent meta-analysis has shown that digital evidence-based mental health programs for adolescents might help relieve anxiety, enhance protective factors, and promote well being among youth (Wright et al., 2023). Such programs can be delivered at relatively low cost, making this a very tangible approach to support youth in LMICs (low- and middle-income countries).

Beyond schools, the present study findings also provide some potential recommendations for parents. Parents of early maturing girls might consider improving their relationship with their teenager, specifically focused on improving both closeness and support. Previous work has shown that when mothers increase their support towards their early maturing daughters, this contributes to down regulating negative emotions and up regulating positive ones (Lougheed et al., 2016).

Finally, future work should consider studying more diverse samples including understudied groups in Kosovo (e.g., Roma and other ethnic minority groups groups), to better understand pubertal experiences among all adolescents.

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Data availability:

The datasets generated during and/or analyzed during the current study are available from the corresponding author, on reasonable request.

Conflict of interest disclosure

The authors declare no conflict of interest.

Ethics approval statement

The study followed all ethical guidelines of Helsinki declaration. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent from parents and adolescents were obtained.

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Table 1

Means and Standard Deviations of Study Variables for Boys and Girls

	Mean	SD	Min; Max
Girls (N = 665)			
Age	13.26	1.27	11; 16
Family SES (parental education)	3.59	1.68	1; 7
BMI	19.76	3.52	8.15; 40.97
Pubertal indices:			
1. Growth spurt	2.76	0.70	1; 4
2. Body hair (underarm and pubic hair)	2.62	0.88	1; 4
3. Breast development	2.58	0.70	1; 4
4. Skin change	2.10	0.85	1; 4
5. Menarche (%yes)	71%		0; 1
Pubertal Development (alpha = 0.67)	2.63	0.62	0.80; 4
Pubertal timing:			
1. Early (%)	17.8		
2. On time (%)	68.4		
3. Late (%)	13.8		
Internalizing symptoms:			
1. Anxious/depressed (12 items, alpha = 0.81)	0.55	0.38	0; 1.92
2. Withdrawn/depressed (8 items, alpha = 0.61)	0.63	0.36	0; 2
3. Somatic complaints (10 items, alpha = 0.75)	0.37	0.32	0; 1.80
Boys (N = 677)			
Age	13.19	1.31	11; 16
Family SES (parental education)	3.59	1.71	1; 7
BMI	20.74	4.56	9.23; 51.88
Pubertal indices:			
1. Growth spurt	2.57	0.81	1; 4
2. Body hair (underarm and pubic hair)	2.57	0.76	1; 4
3. Facial hair	1.76	0.72	1; 4
4. Skin change	2.03	0.88	1; 4
5. Deepening of the voice	2.39	0.87	1; 4
Pubertal Development (alpha = 0.74)	2.26	0.57	1; 3.80
Pubertal timing:			
1. Early (%)	16.1		
2. On time (%)	65.2		
3. Late (%)	18.6		
Internalizing symptoms:			
1. Anxious/depressed (12 items, alpha = 0.69)	0.32	0.26	0; 1.58
2. Withdrawn/depressed (8 items, alpha = 0.45)	0.44	0.28	0; 1.63
3. Somatic complaints (10 items, alpha = 0.70)	0.25	0.26	0; 1.70

Note. Alpha refers to the Cronbach's alpha.

Table 2

Correlations of Study Variables by sex

A.Girls

Variables	1	2	3	4	5	6	7	8
1. Age								
2. Family SES	.04							
3. BMI	.23***	.04						
4. Pubertal development	.62***	.10*	.28***					
5. Timing: Early1	-.04	.05	.02	.51***				
6. Timing: Early2	.04	.09	.30***	.87***				
7. Anxious/depressed	.30***	.00	.09*	.31***	.07	.24***		
8. Withdrawn/depressed	.31***	-.01	.15***	.26***	.03	.09	.69***	
9. Somatic complaints	.17***	.01	.06	.22***	.09*	.22***	.62***	.51***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Timing = pubertal timing; reference category for pubertal timing, for "Early1" is on time, whereas for "Early2" is late.

B.Boys

Variables	1	2	3	4	5	6	7	8
1. Age								
2. Family SES	.06							
3. BMI	.08*	.08						
4. Pubertal development	.41***	.10*	.18***					
5. Timing: Early1	.04	.04	.04	.65***				
6. Timing: Early2	.07	.05	.30***	.92***				
7. Anxious/depressed	.08*	.03	.06	.04	-.05	.04		
8. Withdrawn/depressed	.15***	-.01	.04	.08*	.09*	.13*	.50***	
9. Somatic complaints	.05	.03	.02	.04	-.03	.06	.54***	.37***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Timing = pubertal timing; reference category for pubertal timing, for "Early1" is on time, whereas for "Early2" is late.

Table 3

Regression analyses for internalizing symptoms predicted by SES, BMI, pubertal timing, and pubertal development status by sex.

Girls

A.Pubertal timing

Predictors	1. Anxious/depressed			2. Withdrawn/depressed			3. Somatic complaints		
	β	SE	p	β	SE	p	β	SE	p
Step1:									
Family SES	0.01	0.01	.913	-0.01	0.01	.836	0.01	0.01	.789
Step 2:									
BMI	0.06	0.01	.108	0.15	0.01	<.001	0.04	0.01	.375
Pub. timing: On time	-0.08	0.04	.097	-0.03	0.04	.561	-0.10	0.04	.042
Pub. timing: Late	-0.17	0.06	.001	-0.04	0.06	.413	-0.17	0.05	.001
R^2	0.026			0.024			0.021		

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Reference category for pubertal timing variables is "early."

B. Pubertal development

Predictors	1. Anxious/depressed			2. Withdrawn/depressed			3. Somatic complaints		
	B	SE	p	β	SE	P	β	SE	p
Step1:									
Family SES	0.01	0.01	.913	-0.01	0.01	.836	0.01	0.01	.789
Step 2:									
BMI	-0.01	0.01	.976	0.08	0.01	.041	-0.01	0.01	.863
Pubertal development	0.31	0.01	<.001	0.24	0.01	<.001	0.22	0.01	<.001
R^2	0.098			0.074			0.049		

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Boys

A.Pubertal timing

Predictors	1. Anxious/depressed			2. Withdrawn/depressed			3. Somatic complaints		
	β	SE	p	β	SE	p	β	SE	p
Step1:									
Family SES	0.03	0.01	.442	-0.01	0.01	.861	0.03	0.01	.451
Step 2:									
BMI	0.05	0.01	.218	0.03	0.01	.507	0.01	0.01	.880
Pub. timing: On time	0.06	0.03	.269	-0.10	0.03	.062	0.04	0.03	.465
Pub timing: Late	-0.02	0.04	.716	-0.10	0.04	.070	-0.04	0.04	.442
R^2	0.011			0.001			0.007		

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Reference category for pubertal timing variables is "early."

B. Pubertal development

Predictors	1. Anxious/depressed			2. Withdrawn/depressed			3. Somatic complaints		
	β	SE	p	β	SE	p	β	SE	p
Step1:									
Family SES	0.03	0.01	.442	-0.01	0.01	.861	0.03	0.01	.451
Step 2:									
BMI	0.05	0.01	.206	0.01	0.01	.731	0.01	0.01	.831
Pubertal development	0.04	0.01	.328	0.13	0.01	.002	0.05	0.01	.274
R^2	0.006			0.019			0.003		

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Study III: Externalizing problems among Kosovar adolescents: Pubertal corelates in boys and girls

Abstract

Pubertal timing and pubertal developmental status or stage have been associated with the rates of externalizing problems among youth, particularly in vulnerable developmental contexts including cultures undergoing rapid transformations. The present study tested the extent to which pubertal timing and pubertal developmental status were associated with delinquent and aggressive behaviors, in girls and boys. It also tested whether sex moderated these relationships. Data were collected from N=1,342 Kosovar adolescents (665 girls; M age =13.26 years, SD=1.27; 677 boys M age =13.19 years, SD=1.31). No associations were found for the relationship between pubertal timing and externalizing problems in boys and girls. Findings provided support for a positive association between pubertal developmental status/stage and both delinquent and aggressive behaviors, in both girls and boys. The study highlights that pubertal timing and pubertal status/stage have important yet independent effects on externalizing problems.

10. 1 The Kosovar Developmental Context and Puberty

Kosovar society has been going through substantial social and economic transitions over the past two decades, particularly since the last war in 1998/1999. Changes are evident in the family structure, economic development as well the cultural shifts from collectivism and individualism (Shahini et al., 2015), with patriarchal societal norms about gender expectations still present nowadays (Balkans Policy Research Group., 2019; Kelmendi & Hamby, 2022). The war left Kosovo in a devastated state with a floundering economy, missing job opportunities, and still remains one of the poorest countries in Europe (Mehmeti, 2013). A recent report from Kosovo Agency of Statistic (2020) indicated that unemployment rates among population are 25.0%, particularly among the young people These higher rates of unemployment adversely impact mental health and well-being of youth. In the post war years (1999 and onwards), families continued migrating from rural areas to the big cities, for a better job opportunity; these changes are also included a shift from traditional extended families (parents, grandparents, aunties) to nuclear ones (parents and children; Shahini & Landsman, 2008). Changes in family composition also constitute an additional stressor for adolescents, thus increasing their vulnerability.

Studies in the Kosovar context have shown that externalizing problems are more prevalent among boys than girls (Kraja & Ahmeti, 2015; Shahini et al., 2015), however little is known about Kosovar adolescent bodily development. The associations between pubertal development and externalizing problems can be better understood within the context that the observed behaviors occur, such social conditions, for instance. Low SES has been shown to be associated with increases in overweight categories, in comparison with adolescents coming from average or higher high SES backgrounds (Sherwood et al., 2009), earlier sexual development (Oelkers et al., 2021), as well earlier pubertal timing in both sexes (Sun et al., 2017). On the other hand, socio-demographic characteristics, such poverty in neighborhoods or low SES, can be associated with aggressive behaviors among adolescents (Bozzini et al., 2021; Van Oort et al., 2011).

Puberty begins with the development of secondary sexual characteristics, which are unique to each sex. This also includes changes in height, skin, and growth of pubic hair. In girls, developmental changes also include breast development and the onset of menarche. In boys, the voice continues to deepen, and growth of facial hair begins (Petersen et al., 1988; Susman & Dorn, 2009). Although these changes are universal, the

particular timing at which they occur varies across individuals; for some, these changes develop earlier or later in comparison to peers. Two key concepts of pubertal development have been found to be associated with psychosocial adjustment outcomes among adolescents, namely *pubertal status or stage (*namely maturational changes with no particular reference to age), and *pubertal timing (*maturational changes relative to same age peers*;* Ge et al., 2006). Both changes and advances in pubertal status/stage and in pubertal timing have been associated with externalizing problems in both boys and girls (Dimler & Natsuaki, 2021; Ge et al., 2006; Ullsperger, 2020).

Very limited research has been carried out on Kosovar youth in general; this also includes work on pubertal development and associated bodily changes as well as the relationship between pubertal development and measures of psychosocial adjustment. This is an important gap because of the unique Kosovar socio-cultural and economic developmental context which provides a unique opportunity to gain a better understanding of the extent to which idiosyncratic contextual factors might impact both pubertal development as well as associated measures of adjustment and developmental outcomes.

The present study sought to test the extent to which measures of pubertal development were associated with externalizing problems among Kosovar youth (both boys and girls) and the extent to which the links between pubertal development and externalizing problems were moderated by sex. In addition, the present study tested whether socioeconomic status was associated with pubertal development status/stage and externalizing problems as well as pubertal timing and externalizing problems.

10. 2 Body Mass Index, Pubertal Development, and Externalizing Problems

Research provides evidence that BMI is positively associated with earlier onset and timing of sexual maturation among girls (Biro et al., 2018; Juul et al., 2006; Lee et al., 2007; Rosenfield et al., 2009) and boys (Marceau et al., 2011). Comparatively lower levels of BMI have been found to be associated with less advanced sexual development and delayed pubertal timing in boys (Oehme et al., 2021). In addition, Oelker and colleagues (2021) found that lower SES was associated with earlier thelarche (breast development) in overweight/obese girls, providing evidence of how low SES is associated with indices of pubertal development. On the other hand, higher BMI (being overweight) has been found to be associated with externalizing problems in both boys and girls (Drosopoulou et al., 2021; ter Bogt et al., 2006), and with higher physical aggression in boys (Tso et al., 2018).

10. 3 Pubertal Development and Externalizing Problems Links

Pubertal status/stage has been linked with rates of externalizing behaviors in both boys and girls (Najman et al., 2009., Ge et al., 2002; 2006). In particular, Ge and colleagues (2006) tested the association between pubertal stage, based on the PDS, and externalizing problems in a community sample of 867 youth, ages 10 to 12 years. They found a positive relation between pubertal stage and externalizing problems, in both boys and girls. A large cross-sectional study on Dutch youth also revealed that Tanner Stages were positively associated with externalizing problems in both girls and boys, such as rule-breaking behaviors (Oldehinkel et al., 2011). Conversely, Nottlemann and colleagues (1987) found that pubertal development stage was negatively associated with aggressive and cruel behaviors in girls. In boys, a combination of lower pubertal stage and greater age (late maturation) was associated with adjustment problems, including lower self-image, sadness and anxiety, poor social and family relationships, but not externalizing behaviors. The study also provided evidence that steroid levels were negatively associated with behavior problems in boys, but not in girls. Thus, adolescents who experience pubertal development later tend to be more prone of adjustment problems, particularly boys. In contrast, other work has found no significant associations between pubertal stage/status and externalizing problems (e.g. Kanwar, 2020).

Similarly, early pubertal timing has been shown to have a consistent association with externalizing problems (Graber et al., 1997; Ullsperger & Nikolas., 2017; Dimler & Natsuaki, 2014, 2021; Kanwar, 2020; Kowalski et al., 2021; Marceau et al., 2011), including aggression (Lynne et al., 2007; Ullsperger, 2020) and rule-breaking behaviors (Susman et al., 2007; Ullsperger, 2020), with mixed evidence about sex differences (Cui et al., 2012; Ge et al., 2006). Susman and colleagues (2007) found that pubertal timing in boys was associated with rule breaking behaviors; for girls, it was only associated with relational aggression. However, other work has not provided support for these associations with externalizing problems in boys (e.g., White et al., 2013) or with aggression in girls (Graber et al., 2006). Previous research has also provided evidence that high stress environments, such as neighborhoods characterized by high rates of poverty, for instance, might exacerbate the link between early puberty and externalizing problems (Ge et al., 2002). Based on the somewhat mixed findings from previous scholarship, more research is needed to better understand the extent to which the unique Kosovar developmental context might impact the link between measures of puberty and externalizing problems.

Thus, it was hypothesized that (1) early pubertal timing would be positively associated with externalizing problems, namely delinquent behaviors and aggressive behaviors, in comparison to on-time or late maturing youth; it was also expected that this link would be stronger in boys in comparison to girls (moderation effect), (2) advanced pubertal status/stage would be positively associated with externalizing problems, namely both delinquent and aggressive behaviors. It was also expected that the observed relationship would be stronger in boys in comparison to girls. It is important to understand whether externalizing problems are associated with pubertal status/stage, but not timing, whether they are associated with pubertal timing, but not pubertal status/stage. The former would indicate that advancing through puberty places youth at risk for developing externalizing problems, while the latter would indicate that youth reaching a more advanced pubertal stage at an earlier age might be at greater risk for developing externalizing problems.

10. 4 Theoretical framework

The developmental readiness hypothesis holds that early maturational timing among adolescents can increase the risk for behavioral problems in adolescents, particularly among girls (Negriff & Susman, 2011; Petersen & Crockett, 1985). In addition, accelerated sexual development, namely pubertal development, strengthens the asynchrony between physical and cognitive development, as well the asynchrony between chronological age and the current status of physical development which in turn makes youth more vulnerable to engage in externalizing behaviors. The gap between the physical and cognitive development due to cognitive and physical disparities, early maturing youth have limited knowledge and support, on ways which facilitate navigating those earlier changes than their peer counterpart, which results in detrimental developmental outcomes. In addition, the puberty and externalizing problem links, might be exacerbated or diminished depending on the environmental conditions or circumstances which includes the family, the neighborhood, as well as the larger cultural context; this is sometimes referred to as the *contextual amplification hypothesis* (see Ge & Natsuaki, 2009, for a comprehensive review).

10. 5 Methods

10. 5. 1 Procedure

Data were collected from N=1,342 early adolescents (665 girls; M_{age}=13.26 years, *SD*=1.27; 677 boys M_{age}=13.19 years, SD=1.31) across seven municipalities in Kosovo.

The study was reviewed and approved by the Ministry of Higher Education; school principals from selected schools in the seven largest municipalities across the country (Pejë, Prizren, Gjakovë, Fushë-Kosovë, Gjilan, Malishevë, and Mitrovicë), reviewed the study and independently decided participation. At participating schools, parents were sent a consent document, informing them of the study and requesting their consent for their child to participate in the study. Consent forms were returned to the schools. Of approximately 2,000 consent documents, 1,478 were returned. The remainder were missing either due to parental refusal to participate in the study, or due to failure to return the consent forms to school. Thus, the total recruited sample included 1,478 early adolescents: due to missing data, the final study sample was reduced to N=1,342 adolescents. Data were collected in school classrooms of each municipality, between November 2019 and March 2020. Participants also completed an assent document prior to participation. The survey consisted of an anonymous self-report paper and pencil instrument which was completed during school hours, approximately 40 minutes. The study followed all ethical guidelines of Helsinki declaration.

10. 5. 2 Measures

Demographics variables

Descriptive statistics (frequency and mean age) were used for reporting age, sex, and socioeconomic status (SES).

Participants were 11 years old (13.7%), 12 years 14.2%), 13 years (25.4%), 14 years (32.0%), and 15+ years old (14.8%). The sample included 6th (13.7%), 7th 14.2%), 8th (25.4%), and 9th grade students (46.7%) who were mostly of ethnic Albanian (95.6%) ethnicity, approximately equally divided by sex, namely 665 girls and 677 boys.

SES. Parental employment was used to assess family socioeconomic status (SES), based both on mother's and a father's employment, ranging from 1 =" owner/professional official/high degree", 2 ="small business owner/professional/IT/ large farm owner/military officer'', 3="semi-professional worker/skilled craftsman'', 4="cleric staff sales representatives/artist/other military personnel'', 5 ="machine operator/semi-skilled worker such cook, waiter or janitor'', and 6 =" laborer or service worker" and 7 = "unemployed". Responses were reversed coded and then averaged, so that higher scores indicated higher family SES.

Pubertal Developmental Scale (PDS). Puberty was assessed by using Pubertal Developmental Scale (Petersen et al., 1988). The self-report scale consists of 5 items, which focus on the development of secondary sexual characteristics. The first three items ask about body growth in height, pubic hair and skin changes, which are for both sexes. Then it is followed by the items for facial hair, deepening of the voice for boys only, and breast development and menarche for girls only. Except menarche question (a dichotomy), the five pubertal items use 4 rating points Likert scale starting from 1 there is no development, 2 developments have barely begun, 3 development was definitely underway, and 4 development was already completed. The girls were also asked to indicate whether they experienced menarche or not. Those who experienced menarche reported it in months and in years. The measure was internally consistent (girls $\alpha = 0.67$; boys $\alpha = 0.74$), indicating acceptable reliability. PDS scores were computed by summing across the five items to obtain a total score; the sum of the scores on the five indicators was divided by five in order to preserve the original (1-4) metric.

Body Mass Index (BMI). The Body Mass Index was calculated using weight in kg and height in m reported by participants: BMI = weight (kg)/ [height (m)]^2.

Youth Self Report (YSR). The Youth Self Report (Achenbach & Rescorla., 2007) included 112 items. The present study focused on two subscales, namely aggressive behaviors (17 items, consisting in items such '*I physically attack people*'), and delinquent or rule-breaking behaviors (15 items, consisting in items such *'I break rules at home, school or elsewhere'*), both part of externalizing problems scales. The Albanian version was used with permission from official ASEBA's package representatives for Kosovo (see Shahini et al., 2015, for its use in Kosovar youth). Participants rated the items on a 3-point Likert type scale, selecting from (0) *not true at all* (1), *somewhat true,* and *very true* (2). In the current study, items part of the two measures were averaged to compute the two scale scores, ranging from 0 to 3. Raw items mean scores have regularly been used for some time in work which focuses on behavioral constructs rather than diagnostic criteria or thresholds (e.g., Phares & Compass, 1990). In addition, whether using a sum or mean score will not affect associations among variables, whether based on correlations or regression analyses, as rank ordering is identical.

The two scales were internally consistent as was the larger externalizing broad-band scale, both for girls (aggressive behaviors α=.82; rule breaking or delinquent behaviors α=.69; and externalizing broadband scale α=.83;) as well as boys (aggressive behaviors α=.78; rule breaking or delinquent behaviors α=.69; and externalizing broadband scale α=.81;).

The Youth Self Report has been established as a reliable Instrument for assessing externalizing problems among Kosovar youths (see Shahini et al., 2015). Adolescent self-reports and parent reports of externalizing problems are generally found to be modestly associated (Rescorla et al., 2013).

10. 5. 3 Plan of Analysis

To determine pubertal timing, namely early, on time, and late categories, first, scores of the Pubertal Development Scale were standardized (changing into the distribution with a mean of 0, and standard deviation of 1) for each age: 11, 12, 13, 14, and 15 (few cases of 16 were also collapsed with the age 15 group). Then, early was defined to be having pubertal development scores greater than 1 (1); on time = scores between -1 and 1 (2); and late = scores below -1 (3) (see Flannery, Rowe, & Gulley, 1993; Steinberg, 1987).

In a first step, descriptive statistics of the study variables were computed for boys and girls, followed by computation of bivariate Pearson's correlations. Next, a series of Ordinary Least Squares (OLS) regressions were completed to test the study hypotheses. Due to high correlations between the PDS score and pubertal timing, regression would be carried out separately for each measure. Each regression included socioeconomic status as a control variable on an initial step, followed by BMI, and finally, the PDS score or pubertal timing was added. Analyses were conducted in SPSS 26.

10. 6 Results

Descriptive statistics of the study variables are reported in Table 1. T-tests were completed to test for mean-level differences in measures of externalizing problems by sex; significant sex differences were found for delinquent ($t = -7.77$, $p < .001$), but not for aggressive behaviors ($t = -1.53$, $p = .127$). Table 2 presents Pearson' s correlations of study variables which included both the PDS score and the pubertal timing. Although pubertal timing was not associated with either delinquent or aggressive behaviors in both boys and girls, the PDS score was positively associated with both measures for girls ($r = .20$ and .33, for delinquent and aggressive behaviors, respectively) as well as boys ($r = .21$ and .15, for delinquent and aggressive behaviors, respectively). As expected, the two measures of externalizing problems were highly correlated. In girls only, BMI was also positively associated with each externalizing problem ($r = .08$ and $r = .11$, for delinquent and aggressive behaviors, respectively).

Results from regression analyses are reported in Table 3. Because pubertal timing was unrelated to delinquent or aggressive behaviors, regression analyses were only carried out using the PDS score. The PDS score was positively associated with both delinquent (β = 0.16) as well as aggressive behaviors (β = .12). The model explained 3.0% in delinquent and 2.2% in aggressive behaviors. For boys, the PDS score was positively associated with both delinquent (β = 0.20) as well as aggressive behaviors (β = .14); the model explained 4.3% in delinquent and 2.7% in aggressive behaviors. Neither socioeconomic status nor BMI uniquely explained variance or was significantly associated with either measure of externalizing problems; this was found in the analyses focused on girls as well as boys.

10. 7 Discussion

The present findings replicate evidence that advanced pubertal status measured by the PDS score was positively associated with delinquent and aggressive behaviors in both Kosovar boys and girls, whereas early pubertal timing was unrelated to either. Thus, this provided evidence that it is important to consider both pubertal status as well as pubertal timing separately when testing them as correlates of adolescent externalizing problems.

The evidence showed that boys scored significantly higher on delinquent behaviors in boys in comparison to girls, which is consistent with previous work (Bartels et al., 2015). In addition, Shahini and colleagues (2015) also found sex differences in rates of rule-breaking behaviors in Kosovar boys in comparison to girls, where boys reported higher rates as compared to girls (for similar evidence on alcohol or substance use, see Carkaxhiu et al., 2011; Tahiraj et al., 2016). Certain behaviors which involve risk taking during puberty, might provide an explanation for these findings. A greater tendency for alcohol consumption has been found in Kosovar girls and boys (Tahiraj et al., 2016), but girls smoke more cigarettes, while boys are more likely to use drugs (Carkaxhiu et al., 2011).

The first study hypothesis that early pubertal timing would be associated with elevated levels of externalizing problems of delinquent and aggressive behaviors in both boys and girls was not supported. This was consistent with previous findings by Susman and colleagues Susman and colleagues (2007), who found no support for a positive association between pubertal timing and aggressive behaviors in boys or a positive association between pubertal timing and delinquent behaviors in girls. Similarly, other work has also provided evidence that pubertal timing was unrelated to aggressive behaviors in girls (Graber et al., 2006), or with externalizing problems in boys (White et al., 2013). On the other hand, some other work did find evidence of a link between pubertal timing

and externalizing problems (Ge et al., 2006; Kowalski et al., 2021). These discrepancies warrant some explanation. Pubertal events are inextricably linked with the contextual, social, and cultural environment. It is known that girls understand better and have clearer expectations about their bodily developmental changes, based also on communicating with their parents (Belgrave, 2009). Despite the fact that early onset of puberty might negatively impact perceptions of girls' bodies, thus increasing psychological distress, particularly in societies where being thin is considered the ideal (Natsuaki et al., 2014), several external supports, including maternal support and communication, might promote better adjustment outcomes, including mental health (Branje et al., 2012). On the other hand, for boys, an adult-like physical appearance might even be an asset, increasing self-esteem, which might act as a protective factor against engaging in aggressive or delinquent behaviors. Thus, the developmental readiness hypothesis which asserts that early pubertal timing places youth at greater risk for adjustment problems, particularly early female adolescents, was not supported.

The second study hypothesis that advanced pubertal developmental status/stage measures by the PDS score would be associated with greater externalizing problems, namely delinquent and aggressive behaviors, was supported for both boys and girls, consistent with previous evidence (Ge et al., 2002, 2006; Najman et al., 2009; Oldehinkel et al., 2011). Najman's work (2009) reports similar increases of aggression and delinquency in boys and girls as they progress through puberty. Pubertal status has also predicted substance use in boys in other work (Castellanos-Ryan et al., 2013) as well as alcohol initiation, both in boys and girls (May et al., 2021). The present study findings are different from some previous work which found no support for a relationship between pubertal status/stage and aggressive or delinquent behaviors (e.g., Finkelstein et al., 1994; Nottelmann et al., 1987). The PDS score was positively associated with externalizing problems in Kosovar adolescents, both in boys and girls. Advancing though puberty presents numerous challenges to adapt to bodily changes as well as the role expectations; these adaptation processes might contribute to a greater likelihood of engaging in aggressive or delinquent behaviors. In addition, the observed rates of externalizing problems among Kosovar youth might be related to low socioeconomic status as well as economic development (Mehmeti, 2013); in addition, they might also be related to the numerous stressors resulting from very large social transitions. The contextual amplification hypothesis proposed by Ge and Natsuaki (2009) speaks to this very issue, namely youth who experience pubertal transitions in a particularly disadvantaged developmental context are at substantially

greater risk for poor adjustment. In addition, a lack of parental oversight and monitoring might further exacerbate the opportunities to do so (DeVore & Ginsburg, 2005). Boys and girls are more likely to engage in risk taking behaviors in the presence of peers, particularly when they are more advanced in pubertal development; thus, advanced pubertal development is also associated with a greater susceptibility to peer influences (Kretsch & Harden, 2014). Furthermore, during puberty, said it was a sensation seeking increases while impulse control decreases, thus greatly increasing the likelihood of engaging in norm violating and deviant behaviors (Vazsonyi & Ksinan, 2017; Warren & Brooks-Gunn, 1989). Not surprisingly, rates of aggressive and violent behaviors have been shown to be comparatively higher in pubertal stages III and IV (measured by Tanner stage criteria); and the odds of violent behaviors in mid- to late-puberty are three times higher than in the early puberty, independent of age (Hemphill et al., 2010).

No evidence was found that SES was associated with externalizing problems; this was consistent with previous work in the same developmental context, which found that SES was unrelated to rule-breaking behaviors (Tahiraj et al., 2016). However, some work has shown that lower SES is associated with earlier puberty in girls (Oelkers et al., 2021). Contextual challenges during pubertal transitions could play a role in puberty and externalizing problems interactions. Contextual amplification hypothesis asserts that transitioning through puberty at earlier age, in disadvantageous contexts increases the risk for youths' adjustment behaviors (Ge & Natsuaki, 2009). The inherently challenging societal transitions in Kosovo (e.g., from collectivism to individualism; Shahini et al., 2015) and high rates of poverty (Mehmeti, 2013), might have played an indirect role in the present study findings. In addition, neither sex, nor pubertal status, or hormones are sufficient to be able to capture the complex influences on pubertal development that are known to have an impact in aggressive behaviors (Finkelstein et al., 1994).

It is important to highlight that scholarship on Kosovar adolescents to date has not focused on pubertal development. In addition, no national level data have been collected about pubertal development of adolescents, thus making it more challenging to contextualize the present study findings. This also makes it more challenging to draw comparisons with youth in different developmental contexts. The present investigation found the mean age of menarche to be 12.35 years which appears to be substantially lower than the one reported by Boshnjaku and colleagues (2016), namely 13.5 years. If this observed change is indicative of the age of menarche nationally, then this evidence might be consistent with the observed secular trends of declining age of menarche elsewhere. In addition, it might also be

consistent with age of menarche observed elsewhere, as Biro and colleagues (2018) recently reported a median age of 12.25 years for girls in the United States; this would also mean that to some extent, age of menarche not context dependent.

It is also important to note that brain structure and function change during adolescence and puberty. The prefrontal cortex of the brain region is responsible for planning ahead, weighing risks versus rewards as well as controlling impulses (Steinberg, 2017). On the other hand, the limbic system is responsible for processing novel experiences, including social information and reward as well as punishment (Steinberg, 2017). Conversely, limbic and motor systems mature earlier in comparison to the prefrontal cortex largely responsible for impulse control (Susman & Dorn, 2009). It is this delayed development which places adolescence at particularly heightened risk for poor decision-making, impulsive behavior, and thus also externalizing behaviors. With regard to structural brain development, adolescents experience considerable pruning, while the cortical white matter increases; pubertal development plays an important role in cortical reorganization and neuroanatomical changes (Juraska & Willing, 2017). The same findings related to loss of volume has also been made in rats (Juraska & Willing, 2017). In fact, Giedd and colleagues (1999) find that the volume of white matter increased linearly with age, less so in females in comparison to males, but a non-linear changes in the cortical grey matter. The changes in cortical gray matter were regionally specific, with developmental curves for the frontal and parietal lobe peaking at about age 12 and for the temporal lobe at about age 16, whereas cortical gray matter continued to increase in the occipital lobe through age 20. If the frontal and parietal grey matter peaks approximately one year earlier in girls, tied to pubertal development, then this suggests potential influences by gonadal hormones (Giedd et al., 1999), which is likely also associated with observed behaviors and adjustment problems.

Lastly, puberty is a complex neuro-endocrine process, and a continuum of events, across different bodily systems influenced by hormone levels. Some behavioral changes might also be associated with changes in hormone levels at puberty. For instance Vermeersch and colleagues (2008) found a positive association between total and free Estradiol and both aggressive and non-aggressive risk taking behaviors in girls. The relationship between free and total Estradiol and aggressive risk-taking behaviors was stronger for the girls in the middle phase of the menstrual cycle, while non-aggressive risk-taking behaviors were unrelated to cycle effects. In addition, higher levels of androgen (testosterone and dihydrotestosterone) were associated with externalizing behavior in boys (Maras et al., 2003). Based on this evidence, hormonal effects cannot be ruled when trying to better

understand how puberty is associated with problem behaviors and should therefore also be considered in future investigations.

10. 8 Study limitations

The cross-sectional study findings contribute to a better understanding of the associations between early sexual maturation and externalizing problems in Kosovar adolescents, a gap identified in Kosovar scholarship. The large sample and the developmental context are certainly study strengths; however, several limitations require some discussion. First, data were cross-sectional in nature and therefore no causality can be inferred. Related to this, because data were only assessed at one point of time, developmental processes including sequences of pubertal indices, tempo or Peak Height Velocity could not be investigated. Each of them is important and known to contribute independently to the associations between puberty and psychosocial adjustment in adolescents. Thus, additional longitudinal work is needed. Another limitation is related to measurement. It was not possible to assess ejaculation, or Oigarche among boys, a known proxy for pubertal development among boys much like menarche among girls; however, this challenge and limitation is a common problem in the literature. A further study limitation includes the sole reliance on self-reports which therefore introduces the potential for monomethod bias. In other words, the observed relationships might be inflated due to shared method variance. Future work needs to employ multiple informants which might include physician reports or parent reports in order to address some of the main study constructs. Next, because the present investigation relied exclusively on adolescents attending school, a sample selection bias likely limits the generalizability of the present study findings. For instance, students not attending schools or not attending different types of schools, such apprenticeships or technical training, were not included in the present investigation. In this sense, the present results based on this sample provide a very modest first step on understanding puberty among Kosovar youth, by no means nationally representative of the Kosovar developmental context. Future work clearly needs to address this limitation by sampling youth across different educational tracks as well as accessing youth that might be not enrolled in structured school settings and simply working, for instance, as well as youth from across the country. Lastly, due to the fact that only specific adjustment correlates were considered and tested, a number of other known correlates were not, thus likely further limiting the implications of the present work.

10. 9 Conclusions

The current investigation extends previous knowledge about adolescents from causal role by showing that accelerated pubertal development presents a risk for the development of externalizing problems. Specifically, advanced pubertal stage/status posits a higher risk for both sexes, and early pubertal timing posits no risk for either girls or the boys in the study. The following conclusions can be made: a) advanced pubertal development is an important factor in understanding variability in externalizing problems among Kosovar youth; b) early pubertal timing was unrelated to externalizing problems in the present sample, thus additional replication evidence is needed to contextualize study findings; 3) pubertal timing and pubertal development have important, yet independent effects on behavioral adjustment during pubertal transitions in Kosovar boys and girls; and finally, 4) although not directly tested in this study, a series of contextual stressors prior to puberty, due to growing up in a highly disadvantaged socio-economic context, characterized by constant transitions, might also have contributed to the present study findings. Future work will need to try to assess this question in greater detail by potentially carrying out cross-cultural comparative studies to better understand these potential effects.

The current work fills important gaps in the literature to better understand the extent to which pubertal development is associated with externalizing problems among Kosovar adolescents. Findings highlight the need for a closer look at other cofounding variables, including parental and peer influences, to more fully understand the associations between puberty and externalizing problems.

Data Availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author, on reasonable request.

Conflict of interest

The authors declare no conflict of interest.

Ethical Statement

The study followed all ethical guidelines of Helsinki declaration. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent from parents and adolescents were obtained from all participants included in this study.

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Table 1

Means and Standard Deviations of Study Variables for Girls and Boys

	Mean	SD	Min; Max
Girls (N = 665)			
Age	13.26	1.27	11; 16
Family SES (parental education)	3.59	1.68	1; 7
BMI	19.76	3.52	8.15; 40.97
Pubertal indices:			
1. Growth spurt	2.76	0.70	1; 4
2. Body hair (underarm and pubic hair)	2.62	0.88	1; 4
3. Breast development	2.58	0.70	1; 4
4. Skin change	2.10	0.85	1; 4
5. Menarche (%yes)	71%		0; 1
Pubertal Development Scale (PDS) (alpha = 0.67)	2.63	0.62	0.80; 4
Pubertal timing:			
1. Early (%)	17.8		
2.On time (%)	68.4		
3. Late (%)	13.8		
Externalizing symptoms:			
1. Delinquent behaviors (alpha = 0.69, 15 items)	0.17	0.18	0; 1.27
2. Aggressive behaviors (alpha = 0.82, 17 items)	0.38	0.29	0; 1.65
Boys (N = 677)			
Age	13.19	1.31	11; 16
Family SES (parental education)	3.59	1.71	1; 7
BMI	20.74	4.56	9.23; 51.88
Pubertal indices:			
1. Growth spurt	2.57	0.81	1; 4
2. Body hair (underarm and pubic hair)	2.57	0.76	1; 4
3. Facial hair	1.76	0.72	1; 4
4. Skin change	2.03	0.88	1; 4
5. Deepening of the voice	2.39	0.87	1; 4
Pubertal Development Scale (PDS) (alpha = 0.74)	2.26	0.57	1; 3.80
Pubertal timing:			
1. Early (%)	16.1		
2. On time (%)	65.2		
3. Late (%)	18.6		
Externalizing symptoms:			
1. Delinquent behaviors (alpha = 0.69, 15 items)	0.26	0.21	0; 1.33
2. Aggressive behaviors (alpha = 0.78, 17 items)	0.36	0.27	0; 1.47

Note. Alpha refers to Cronbach's alpha.

Table 2

Correlations of Study Variables

A. Girls

Variables	1	2	3	4	5	6	7
1. Age							
2. Family SES	.04						
3. BMI	.23***	.04					
4. PDS	.60***	.11*	.28**				
5. Pubertal Timing: Early	-.04	.07	-.01	-.20***			
6. Delinquent behavior	.22***	.08	.08*	.20**	-.01		
7. Aggressive behavior	.32***	.08*	.11**	.33***	.08	.70***	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Timing = pubertal timing. PDS = Pubertal Development Scale; 1 = early, 0 = on time/late

B. Boys

Variables	1	2	3	4	5	6	7
1. Age							
2. Family SES	.06						
3. BMI	.08*	.08					
4. PDS	.46***	.09*	.17***				
5. Pubertal Timing: Early	.02	-.01	.02	-21***			
7. Delinquent behavior	.30***	.04	.05	.21***	.00		
8. Aggressive behavior	.23***	.08	.04	.15***	-.02	.67***	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Timing = pubertal timing. PDS = Pubertal Development Scale; 1 = early, 0 = on time/late

Table 3

Regressions predicting Externalizing Problems

A. Girls

Predictors	1. Delinquent behaviors			2. Aggressive behaviors		
	β	SE	p	β	SE	p
Step1:						
Family SES	0.04	0.01	.31	0.08	0.01	.054
Step 2:						
BMI	0.05	0.00	.24	0.04	0.00	.36
Step 3:						
PDS	0.16	0.01	<.001	0.12	0.01	.004
R^2	0.030			0.022		

B. Boys

Predictors	1. Delinquent behaviors			2. Aggressive behaviors		
	β	SE	p	β	SE	p
Step1:						
Family SES	0.04	0.01	.31	0.08	0.01	.054
Step 2:						
BMI	0.05	0.01	.24	0.04	0.01	.36
Step 3:						
PDS	0.20	0.00	<.001	0.14	0.00	<.001
R^2	0.043			0.027		

Note. PDS = Pubertal Development Scale

11 Discussion

The present dissertation consists in three empirical studies, carried out in a sample of early Kosovar adolescents.

The first brief report investigated the relationship between Body Mass Index and pubertal development indices (secondary sex characteristics) in girls and boys. **The second study** investigated the extent to which pubertal transition conceptualized as advanced pubertal status/stage and early pubertal timing would be related to internalizing symptoms, namely anxious/depressed, withdrawn/depressed, and somatic complaints in Kosovar girls and boys. It further investigated whether there are sex differences in the observed relationships (moderation effects). In addition, it also tested the extent to which internalizing symptoms rates differ between girls and boys independent of puberty development status and pubertal timing. **The third study** investigated the extent to which pubertal transition conceptualized as advanced pubertal status/stage and early pubertal timing would be related to externalizing symptoms, namely rule-breaking behaviours and aggressive symptoms in adolescent girls and boys. It further investigated whether the observed associations would differ between girls and boys (moderation effects). In addition, we also tested the extent to which externalizing symptoms rates differ between girls and boys independent of puberty development status and pubertal timing. Hereafter, I will summarize the overall key point in this discussion that was presented in each study throughout the previous sections.

In the first part of the empirical research, namely the brief report, the mean age of menarche was found to be 12.35 years, which is consistent or similar with other findings (Biro et al., 2018, 12.25 years). Our expectation that BMI would be significantly positively associated with puberty-related bodily changes in girls was supported, except for skin changes and pubic hair development. As expected, the BMI significantly positively predicted growth spurt, breast development, experiencing menarche, as well as the total PDS score (Pubertal Developmental Scale – indicating a more developed status or greater maturity), except for two specific puberty-related body changes that are body hair and skin change (acne or pimples) in girls. The overall model explained 6.4% in growth spurt, 23.6% in body hair, 17.1% in breast development, 7.9% in skin change, 53.3% in having menarche, and 39.2% in pubertal development. From these amounts of variance, BMI uniquely explained 1% in growth spurt, 1.5% in breast development, 4.9% in menarche,

and 2.2% in pubertal development; no significant additional variance was explained by BMI in the remaining outcomes. Others also found a significant positive association between BMI and puberty indices among girls, such as menarche and growth spurt (Durda-Masny et al., 2019) as well as breast development (Biro et al., 2013). Nevertheless, the BMI was not significantly related to skin changes and body hair among girls, despite the fact it was significantly correlated with total PDS indices score. Skin changes as well the body hair (pubic hair development), occur in more advanced stages of pubertal development. Thus, the longitudinal research would better address the pace of development of these specific puberty indices.

The expectation of whether BMI would be positively associated with puberty-related bodily changes in boys was supported, except for skin changes. As expected, the BMI was significantly positively associated with growth spurt, facial hair, and voice change, as well as the total PDS score (Pubertal Developmental Scale – indicating a more developed status or greater maturity), except for skin change in boys. The overall model explained 12.5% in growth spurt, 13.4% in body hair, 11.5% in facial hair, 13.3% in skin change, 17.3% in voice change, and 26.9% in pubertal development. From these amounts of variance, BMI uniquely explained 3.5% in growth spurt, 2.1% in body hair, 1.1% in facial hair, 1.2% in voice change, and 2.7% in pubertal development. Others also found a positive association between BMI and puberty indices among boys, such as pubic hair development (Tomova et al., 2015), and voice break (Juul et al., 2007). The largest portion of the girls were in advanced pubertal status (68.3%), while the largest portion of the boys were in 'mid pubertal' status (55%), which would indicate that girls enter puberty earlier than boys, just as expected, considering that girls enter puberty around two years earlier than boys (Pyra & Schwarz, 2019). A higher BMI in both boys and girls was found in the early puberty groups.

In the second part of empirical research, I presented study two. The expectations, whether pubertal status or stage would be positively associated with the rates of *anxious/depressed* and *withdrawn/depressed* and *somatic complaint symptoms,* and that the relationship would be stronger in girls in comparison to boys, were fully supported for the girls and was partially supported for the boys. In our regression analysis, advanced pubertal development status/stage was significantly positively associated with the three internalizing symptoms, namely anxiety/depressed, withdrawn/depressed, and somatic complaints in girls; however, it was only significantly positively associated with withdrawn/depressed symptoms among the boys. In addition, in the regression analysis, BMI

was significantly positively associated only with withdrawn/depressed symptoms in girls and none of the internalizing problem scales in boys. Thus, advancing in pubertal status or stage has adverse sequelae on girls' emotional development; however, among the boys, it was only related to withdrawn/depressive symptoms. A higher BMI posits a risk for girls with withdrawn/depressed symptoms and in none of the internalizing problem scales in boys.

Our findings on the positive associations between advanced pubertal status and depressive and anxiety symptoms among girls but not boys are consistent with previous work (Conley & Rudolph, 2009; Lewis et al., 2018; Reardon et al., 2009; cf. Richardson et al., 2006). In the United Nations Population Fund (2014) report, Kosovar adolescent girls reported more headaches (30.7%) compared to boys (19%), and older adolescent girls were more likely to experience headaches. This may be indicative that advancing in the pubertal stage and experiencing menarche may potentiate the experience of somatic complaint symptoms.

Richardson and colleagues (2006) reported that a positive association between depressive symptoms and obesity can be present for boys in early and middle puberty years; however, there was no increase in depressive symptoms as boys were advancing through later stages of pubertal development. Rudolph (2009) asserts that susceptibility to depression is related to negative beliefs, especially when youth are in stressful situations. More specifically, diathesis-stress models, in which negative thoughts interact with stressful events, play a role in predicting depression. The interaction between negative beliefs and stressful events creates a cognitive vulnerability (Rudolph, 2009). It has been suggested that during adolescence, cognitive predispositions are not stabilized in trait-like vulnerability factors until youth reach the capacity of abstract thinking, generalization, and formal operational thinking. In this way, the interaction between cognitive readiness and stress can predict depression in adolescence (Rudolph, 2009, p. 453). Considering that puberty may be a stressful event in early adolescence, it is likely to contribute to the rates of depressive symptoms in both girls and boys.

In addition, increases in cognitive skills and abstract thinking may also make adolescents more attentive to daily events compared to when they were younger; the formal operational thinker now has the cognitive skills that will allow them to anticipate or avoid stressful situations or cope with them when they do occur (Larson & Sheeber, 2009; p. 24). In this sense, not having the skills to cope with the stress that comes during puberty transition may make them to some extent vulnerable to adjustment.

Anxiety and depression co-occur more among girls compared to boys and anxiety often precedes the onset of depression (Hankin et al., 2009, p. 385); in addition, anxiety is more prevalent among girls, compared to boys (Lewinsohn et al., 1998; Reardon et al., 2009). Thus, it may be that the boys in our study sample are less likely to feel anxious/depressed as they advance through pubertal stages, but girls are however more likely to feel anxious/depressed as they advance through puberty stages. Thus, it may be a developmental pathway for girls from anxiety to depression, however, the nature of that role remains yet to be determined (Flannery-Schroeder, 2006; Hankin et al., 2008). With regard to co-morbidity, the 2001 manual of the ASEBA, each syndrome consists of the problem items that were found to co-occur in the ratings by parents, teachers, and youth, and the title of each syndrome summarizes the problems that comprise the syndrome (Achenbach & Rescorla, 2001; Achenbach, personal communication, June 22, 2022). Thus, the title 'anxious/depressed' reflects the fact that problems of anxiety and depression co-occur' (Achenbach, personal communication, June 22, 2022).

In the work of Ames and colleagues (2015), the trajectory of BMI predicting internalizing symptoms was different for girls and boys. In boys, a higher BMI at the age of 10 positively predicted internalizing symptoms from early to middle adolescence but not in late adolescence (ages 16 and 17). In contrast, in girls, a higher BMI at the age of 10, positively predicted internalizing symptoms across all stages of adolescence (age 10 to 17). Thus, this is suggestive that BMI is a more salient correlate in the development of internalizing symptoms (depressive symptoms) in girls, and to a lesser extent in boys.

The increased preponderance of depressive symptoms in adolescence may reflect the interaction between developmental processes and other factors, such as environmental as well as cultural vulnerabilities, that result in depressive symptoms (Allen & Sheeber, 2009, p. 5). Thus, examining the interaction between developmental processes in adolescence and the pre-existing vulnerabilities offers a unique insight into better understanding the etiology of depressive disorders (Allen & Sheeber, 2009, p. 5).

Next, our expectations of whether pubertal timing would be positively associated with anxious/depressed, withdrawn/depressed, and somatic complaints in girls and boys, in comparison with on-time and late-maturing youth, and that the relationship would be stronger in girls in comparison with boys was partially supported. Notably, early pubertal timing was positively associated with anxious/depressed and somatic complaints in girls, compared with late-maturing girls, but no significant links were found for the boys; on-time and late maturation were negatively associated with internalizing symptoms in girls.

Our findings are consistent with other reports on the positive associations between pubertal timing and anxiety (Blumenthal et al., 2011; Reardon et al., 2009) and depression or depressive symptoms (Conley & Rudolph, 2009; Graber et al., 1997) in early maturing girls, but not in boys. Our evidence is as well consistent with previous work, which found positive links between early pubertal timing and somatic complaint symptoms in girls (Rhee, 2005; see also Kløven et al., 2017). However, others have also found a significant positive relationship between early pubertal timing and internalizing behaviours in both boys and girls (Ge et al., 2006; Huddleston & Ge, 2003; Ullsperger & Nikolas, 2017).

Conley and Rudoph (2009) also found a higher incidence of depression among early-maturing girls and less depression among early-maturing boys; in fact, it was late maturational timing that positively predicted depression in boys, compared to early-maturing ones. Both associations between early pubertal timing and depression in girls and late pubertal timing and depression among boys were intensified when girls and boys reported stressful peer relationships and were tamed in low-stress peer relationships (Conley & Rudolph, 2009). In another study conducted by Ge et al. (1994), increased environmental stress was uniquely associated with depressive symptoms in girls at age 13, but not boys. This evidence stresses the importance that the social context at which puberty unfolds, for instance, may account for sex differences in the rates of emotional problems.

The second study findings advance our understanding that girls in early pubertal timing (e.g., early developing girls relative to their peers), compared to late pubertal timing categories (e.g., lagging behind their peer counterparts), do not have the developmental readiness to navigate the tasks that come with early adolescence, therefore putting them at risk for the onset of internalizing symptoms. As such, our evidence further supports the *developmental readiness hypothesis*, also known as the stage termination hypothesis, which asserts that early maturing girls are at particular risk for developing emotional problems, compared with other maturing groups (Negriff & Susman, 2011; Petersen & Crockett, 1985). Namely, it is the maturational disparity between physical and cognitive development that hinders emotional adjustment in girls due to not being well prepared to adjust to the profound cognitive and physical changes and heightening the risk of internalizing symptoms.

Girls may be more prone to emotional problems due to their social norms related to *gender role expectations* (Hill & Lynch, 1983), which puts them under pressure to conform to culturally endorsed gender roles, more than boys. For instance, Kosovar families still follow patriarchal values related to family roles (e.g., females are responsible for childbearing

and household while men are dominant and held responsible for family income, for instance) (Latifi, 2014). Traditional gender roles (feminine roles) which are linked to some extent with patriarchal values, are associated with poor mental health, particularly female anxiety, for instance (Aparicio-García et al., 2018). On the other side, Mora (2012) reported that puberty was a social achievement linked to masculine enactment that was influenced by the dominant gender expectations of peers at school and their communities. Namely, by showing their tolerance of pain and physical power, the boys signaled they were entering puberty according to their societal norms.

In the Wichstrom (1999) study, adolescent boys scored higher than girls on masculine items, and girls scored higher on feminine items across all adolescent ages. Girls also scored higher in depressive symptoms between the ages of 13 and 14 and femininity positively correlated with depressed mood, and no correlations were found for masculinity and depressive symptoms. Many societies would expect that an early maturing boy's appearance might be an advantage of male physical development, thus early timing would predict fewer emotional problems. In fact, accelerated pubertal development might be considered positive and elicit positive responses from peers and friends.

Puberty unfolds emotional difficulties, particularly among youth who grow up in a disadvantageous context, e.g., exposed to various stressors throughout their development (Ge et al., 2011; Natsuaki et al., 2014, see *contextual amplification hypothesis*). Kosovar society is a post-war country, and a country in transition in multiple domains such as familial (extended vs nuclear), cultural (a continuous shift from collectivism to individualism), and intergenerational trauma from the 1998 and 1999 war, which might have indirectly contributed to our study outcomes. Thus, the increase of negative affect in adolescence may be potentiated by intrapersonal or situational characteristics that contribute to patterns of depressive symptoms (Larson & Sheeber, 2009; p. 26).

Our expectations of whether girls would indicate higher levels of internalizing symptoms in comparison to boys, namely anxious/depressed, withdrawn/depressive, and somatic complaint symptoms, was supported. Specifically, girls in our sample reported higher rates of internalizing symptoms, namely anxious/depressed, withdrawn depressed, and somatic complaints symptoms, compared to boys. Nevertheless, family SES was unrelated to the rates of internalizing problems. A critical point in the emergence of depressive symptoms for girls is mid-adolescence, namely around the age of 13, which corresponds with puberty, thus marking puberty an important hallmark in the development of sex differences in depression (Hankin & Abramson, 1999).

Our findings are consistent with other's findings that reported higher rates of anxiety depressive symptoms among Kosovar adolescent girls compared to boys (Arenliu et al., 2016; Fanaj et al., 2015; Kamberi et al., 2019; Shahini et al., 2015) and consistent with the findings from other developmental contexts (Angold et al., 2002; Hankin et al., 1998; Hankin & Abramson, 1999; Ksinan & Vazsonyi, 2019; Nolen-Hoeksema, 2009; Richardson et al., 2006).

Additionally, in Lewinsohn et al. (1998) developmental study, girls reported a higher preponderance of anxiety symptoms than did adolescent boys. They further ague that differing social norms and experiences did not explain a girl's vulnerability to anxiety disorder; instead, a girl's vulnerability to anxiety may be related to some biological factors such the genetic one.

Specifically, developmental studies and epidemiological evidence highlight that the emergence of sex differences occurs during the pubertal transition, around mid-puberty, with girls having higher symptoms compared to boys (Angold et al., 2002; Hankin et al., 1998; Hankin & Abramson, 1999, Kessler et al., 2009). Hormonal and psychosocial mechanisms contribute to the sex disparities in emotional difficulties. Females are more likely to experience firsts, longer depressive episodes, and a greater reoccurrence than males (Nolen-Hoeksema, 2009, p. 387). Females also tend to engage more in ruminative reactions when depressed, thus amplifying their symptoms; whereas men are more likely to distract themselves from depressed moods thus lessening negative mood symptoms (Nolen-Hoeksema, 1991, see *Response Style Theory*). Thus, a greater prevalence of emotional problems in girls may be due to *rumination* (Mclaughlin & Nolen-Hoeksema, 2011; Nolen-Hoeksema, 1991).

In addition to this evidence, it is likely possible that ruminative or retrospective focus on future events, rather than on past events, may contribute to girls' prevalence of anxiety symptoms, compared to boys (Lewinsohn et al., 1998). Or it can be that girls will generalize their rumination to both current and future events that may be held accountable for the elevated prevalence of both anxiety and depression in females (Lewinsohn et al., 1998).

Females have also been reporting internalizing symptoms, particularly during periods of change in their gonadal hormones during their menstrual periods, postpartum, or menopause (Angold et al., 2002; Nolen-Hoeksema, 2009). Graber and colleagues (2006) reported that estradiol in girls was associated with depressive symptoms in girls.

In the third section of empirical research, I presented the study three. The expectations of whether early pubertal timing would be positively associated with

externalizing problems, namely delinquent behaviors (aggressive behaviours), in comparison to on-time or late maturing youth; and that the link would be stronger in boys in comparison to girls (moderation effect) was not supported. Pubertal timing was unrelated to either. Similar findings have been found in previous research with regard to delinquent and aggressive symptoms in girls and boys (Graber et al., 2006; Susman et al., 2007; cf. Najman, 2009). However, previous research has found that early pubertal timing is linked to externalizing problems in girls and boys (Ge et al., 2006; Kowalski et al., 2021; Ullsperger & Nikolas, 2017).

As discussed, pubertal events are linked inextricably with the socio-cultural environment. Despite the fact that early maturation may potentiate the onset of externalizing symptoms, several external supporting resources such as maternal support and communication may promote better behavioral adjustment (Branje et al., 2012). For boys, as discussed previously, an adult-like physical appearance may be an asset, that would increase their self-esteem, thus taming their risk for externalizing symptoms. Our study results, however, do not support the *developmental readiness hypothesis framework*, which posits that early maturation increases the risk for youth behavioral problems (Negriff & Susman, 2011; Petersen & Crocket, 1985). Early maturation in the present study did not present a risk for developing aggressive or delinquent problems in neither sex.

Our expectations whether pubertal status or stage, would be associated with the rates of delinquent and aggressive behaviours was supported for both girls and boys. Namely, regression analysis provided evidence that advanced pubertal status/stage was significantly positively associated with delinquent and aggressive symptoms in both boys and girls, which is consistent with other's work (Ge et al., 2002, 2006; Oldehinkel et al., 2011; Flannery et al., 1993; cf. Finkelstein et al., 1994; Nottlemann et al., 1987). Others also predicted a decline in aggressive behaviors as youth matured (Benson & Beuhler., 2012). In our study, neither socioeconomic status (SES) nor BMI explained the variance or was significantly associated with either measure of externalizing problems in girls or boys. Najman's (2009) developmental study also found an increase in aggressive and delinquent behaviors in both boys and girls as they progressed through puberty at about a similar magnitude. In addition, Najman also evidenced that adjusting for SES and age did not, however, affect these associations.

According to Moffit and colleagues (2001), males engage in more antisocial behaviours than females, with two exceptions: males and females were less likely to differ in their antisocial behaviours during adolescence (around the age of 15), and the males and

females are similar in their drug and alcohol-related offenses. Thus, the sex differences in the rates of externalizing problems are narrowest by middle adolescence. Males are more likely to be diagnosed with a conduct disorder; however, during the peri-pubertal period, the prevalence of the incidence rises the difference (Moffitt et al., 2001). Thus, puberty potentially contributes to the female's externalizing behaviors and mechanisms, and the circumstances under which this behavior occurs need to be explored (Moffitt et al., 2001). As such, it makes the pubertal stage a critical point for better understanding the etiology of girl's externalizing problems (Moffitt et al., 2001).

Significant increases in delinquent and aggressive symptoms as youth progress through puberty may be linked to hormonal changes that surge during adrenarche and also psychosocial mechanisms reinforcing the externalizing behaviors. Some evidence suggests a positive association between the total and free estradiol and both aggressive and non-aggressive risk-taking behaviors among adolescent girls (Vermeersch et al., 2008); and there was no evidence of testosterone being related to aggressive and non-aggressive risk raking behaviors in girls (Vermeersch et al., 2008). Others found that higher levels of androgen (testosterone and dihydrotestosterone) are linked to externalizing behavior in boys (Maras et al., 2003). On the other hand, others did not find a significant link between puberty maturational timing as measured by DHEA and testosterone levels and adolescent externalizing problems in either sex (Dehestani et al., 2023).

Several other developmental processes that emerge at the beginning of adolescence may explain the increase in rule-breaking or delinquent behaviors and aggressive behaviors in both girls and boys as they advance through puberty status or pubertal stage. The process of *individuation,* particularly in adolescence, encompasses gradual and progressive self-autonomy as competent and separate from parents (Steinberg & Silk, 2002). The developmental changes in a parent-adolescent relationship include *autonomy* (the extent to which parents control adolescent whereabouts), *harmony* (the extent parents are nurturing or close to their adolescent child), and *conflict* (the extent to which parent-adolescent relationship is negotiable or hostile) (Steinberg & Silk, 2002). Evidence suggests that parent-adolescent conflict increases during pubertal years (Branje et al., 2012), and an upsurge in parent-adolescent conflict has been shown to potentiate the risk for youth to engage in externalizing problems (Weymouth et al., 2016).

As adolescents gain autonomy they will have less parental monitoring, and a decrease in parental monitoring may contribute to adolescent engagement in externalizing problems (Martins et al., 2008). A positive, nurturing family environment, such family

warmth, also negatively predicts aggression and family hostility positively predicts aggression (Benson and Beuhler., 2012). Thus, the more adult supervision, the fewer externalizing behaviors; and deficits in parental closeness and supervision may potentiate youth's deviant behavior as adolescents progress through puberty.

As adolescents gain autonomy granted by their parents, they become more involved in social activities that are related to peers and are also subject to increased peer pressure. Benson and Beuhler (2012) studied the extent to which family processes and peer influence predict adolescent deviant behavior. The study found that a hostile family environment and affiliation with deviant peers were linked with higher aggressive behavior. Thus, both family and peer influences are linked to adolescent behavior adjustment (Benson and Beuhler., 2012), which can either lead to externalizing problems or resiliency.

In our third study, we found no evidence that SES was related to externalizing problems; however, Tahiraj and Colleagues (2016) also found no association between SES and rule-breaking behaviors, from the youth from the same developmental context, namely Kosovo. Overall, in our findings, boys scored significantly higher on delinquent behaviors (namely rule-breaking) in comparison to girls, which is consistent with previous work (Bartel et al., 2015). In addition, Shahini and colleagues (2015) also found sex differences in rates of rule-breaking behaviors in Kosovar boys in comparison to girls, where boys reported higher rates as compared to girls (for similar evidence on alcohol or substance use, see Carkaxhiu et al., 2011; Tahiraj et al., 2016).

Girls' and boys' involvement in certain rule-breaking behaviors that involve risk-taking during puberty might provide an explanation for these findings. A greater tendency for alcohol consumption has been found in Kosovar girls and boys (harmful drinking 41% was reported among boys, and 37% among girls) (Tahiraj et al., 2016). Furthermore, 16% of the boys reported daily smoking while 9% of the girls reported they smoked daily. 17% of the boys and 9% of the girls reported having used illicit drugs (Tahiraj et al., 2016). On the other side, other research provides evidence that girls smoke more cigarettes, while boys are more likely to use drugs (Carkaxhiu et al., 2011). Thus, it is important to consider the female preponderance in specific rule-breaking behaviors, and the male preponderance in other rule-breaking behaviors, which would explain sex differences in our study results.

Adolescents show a broader emotional range compared to adults; as such, they experience a greater frequency of extremely positive or negative emotions (Larson & Sheeber, 2009; p. 20). Research has demonstrated that progression through adolescence,

particularly early and middle adolescence, is associated with a normative increase in negative emotion levels that slows down in mid- to late adolescence, however, this is not always the case (Larson & Sheeber, 2009, p. 20); only a fraction of youth, however, face adjustment difficulties while navigating through adolescence and puberty.

11.1 Research limitations

The three studies provide a better understanding of the associations between BMI and puberty development (secondary sex characteristics), as well as the extent to which early pubertal maturation and advanced pubertal development status/stage are related to internalizing and externalizing symptoms in Kosovar adolescents, a novel observation in this developmental context. The large sample and the developmental context are certainly unique and have research strengths; however, several limitations need to be considered when interpreting research findings.

The research design is cross-sectional, and based on a convenient sample; thus, no causality can be interfered. The data have been assessed only at a one-time point; thus, it is limited in providing information regarding the developmental changes of Body Mass Index and pubertal development indices, peak height velocity, the sequence of pubertal indices events (which are longitudinal concepts), nor the changes in internalizing and externalizing problems over time. Future longitudinal research will better address the extent to which puberty, emotional, and behavioral processes change over time, in a specific developmental context, and for the specific sex. As such, the findings are limited to the ability to provide information regarding the sequence of the pubertal events (whether beast development would precede pubic hair development, for instance). Alternatively, whether the pubertal tempo (the pace of puberty indices development) and the extent to which these processes relate to emotional and behavioral adjustment.

Another limitation is the sole use of self-report measurements; thus, it may introduce the monomethod bias. Prospective research should employ multiple informants such as the parent, teacher, or physician reports (the use of Tanner Stages for instance) to better capture the puberty development and experience and adolescent adjustment. In fact, the review of the literature in this research work highlights that there is a lack of pediatric research that documents puberty-related bodily changes (secondary sex characteristics) in Kosovar adolescents. Therefore, this work emphasizes the need to advance our empirical knowledge on puberty development indices status (through Marshall and Tanner measurements, 1969,1970), as an initiation foundation for additional evaluation of the biological implication

on adolescent mental health in this developmental context. Also, the use of BMI for the overweight/obesity categories needs to be interpreted with caution. Previous work has shown that BMI does not always capture excess body fat, also related to different body types and sizes (Nuttall, 2015; Romero-Corral et al., 2008). Future work may also consider including youth from other minority ethnic groups (such as Roma youth) that live in Kosovo to better understand the extent to which ethnicity impacts pubertal development and youth psychosocial adjustment in general and the relationship between these correlates in particular.

To better understand the relationships between the pubertal stage and pubertal timing and emotional and behavioral problems, would be examining them through the mediation variables (Hankin & Abramson, 1999). In the present studies, we only used moderation to explain gender differences in the observed relationship. A mediation analysis in future research would evidence the extent to which a factor for instance social support, peer affiliation, or parenting processes, might account for the associations between puberty status and pubertal timing, and adolescent internalizing and externalizing problems.

However, the large sample size and the focus on this understudied Kosovar adolescent population, the experience of puberty as a novel finding in the Kosovar developmental context, and the consistent findings with evidence from youth of other developmental contexts, present a unique future that may in part outweigh the research limitation.

11.12 Contribution and implication for practice

The research results of the present studies imply several significant points for practical implications. Progressing through the puberty stage and earlier pubertal timing was found to be a significant correlate of internalizing symptoms in girls; however, advanced pubertal status/stage was found to be the only significant correlate of withdrawn/depressive symptoms in boys. In addition, the advanced pubertal stage was found to be a significant correlate of externalizing symptoms in both boys and girls, and no significant association was found between early pubertal timing and externalizing symptoms in either girls or boys.

As emotional problems generally peak in middle adolescence (Lewis et al., 2018; Hankin et al., 1998; Abramson et al., 1999; Nolen Hoeksema et al., 2008), these observations advance our understanding of the potential risks of early pubertal development in youth adjustment of this developmental context. The development of the psychological therapeutic intervention, which focuses notably on girls in the middle adolescence years, the psychoeducation programs that focus on raising the knowledge about reproductive health and correlates to

better inform the expected bodily changes, are considered that are vital and to be involved in school curricula. Particularly when knowing that adolescents with prior knowledge about the expected bodily changes are less likely to develop negative expectations toward them (Belgrave, 2009), thus potentially lessening the negative emotional experiences during transitional puberty years.

As behavioral problems are also likely to occur in middle adolescence (Moffit et al., 2001, Najman et al., 2009), these observations also advance our understanding of the potential risks of advancing through puberty in Kosovar boys and girls' behavioral adjustment. Particularly, this is important, considering that elevated rates of externalizing problems such as rule-breaking or delinquency and aggressive behaviors in adolescence may be a precursor and persist to later violent or criminal behaviors in adulthood. Research has provided evidence that parental monitor or supervision serves as a protective factor for adolescent development of externalizing behaviors (Fosco et al., 2012) and potentially decreasing the likelihood of youth engaging in externalizing behaviors, and encouraging the healthy growth. Building intervention programs that foster parent-adolescent relationships, and parenting processes such as harmony, monitoring, closeness, and support, would improve children's behavioral outcomes.

**Note: References of discussion are in the end*

12 Summary

Scholarly evidence associated with the significance of biological development and its psychological correlates in adolescents, particularly the developments since the 1980s, has built the foundations and has advanced fundamentally the knowledge that we possess now regarding the interplay between endogenous and exogenous factors in youth adjustment as they progress through the stages of puberty.

Nowadays, we understand that puberty, as a developmental process, is not pathogenic in and of itself (Allen and Sheeber, 2009, p. 6, as elaborated in Derose and Brooks-Gunn, 2009). However, it can potentiate some adverse effects on young people, especially in periods of stress, and can interact with other biological and environmental factors, primarily among youth coming from vulnerable developmental contexts and backgrounds, which may compromise youth healthy behaviors. Both biological and psychological changes occur with the onset and progression into puberty (Susman and Dorn., 2013) at individual level, in brain development, social relationships, and familial hierarchical levels, which have psychosocial implications; however, despite these advances, much remains to be uncovered.

Thus far, empirical evidence has been consistent in the assumption that there is an increase in affective problems in early and middle adolescence, with girls being at a greater risk for emotional symptoms compared to the boys. The increase in emotional problems oftentimes persists in late adolescence and young adulthood, particularly for adolescent girls. The evidence thus far has also been supportive that externalizing symptoms may surge during adolescence, with boys being at a greater risk for externalizing problems compared to girls.

One dimension that allows us to understand better the variations in affective/emotional and behavioral problems and sex differences is examining the effects of puberty on youth psychosocial adjustment. Mounting evidence has been supporting the expectations on the risk of early puberty and internalizing symptom links in girls (Ge et al., 2002; Graber et al., 1997; Kowalski et al., 2021) but also in boys (Ullsperger & Nicholas., 2017; Kowalski et al., 2021) although to a lesser extent in boys. Other evidence has also supported the positive associations between early pubertal timing and externalizing problems among girls and boys (Graber et al., 1997; Kowalski et al., 2021; Lynne et al., 2007; Ullsperger,

2020; cf. Graber et al., 2006; White et al., 2013) and slower pubertal timing was associated with a decrease (Kowalski et al., 2021; cf. Graber et al., 1997).

Furthermore, prior empirical evidence has been consistent in the premise that advancing through puberty status/stage also significantly positively predicts externalizing problems in both sexes (Ge et al., 2006; Najman, 2009; cf. Nottlemann et al., 1987) and internalizing problems mainly for girls (Angold et al., 1998; Reardon et al., 2009), and to a lesser extent for the boys (Richardson et al., 2006).

Several potential explanations support the assumption of the adverse influences of early puberty maturation on adolescents' psychosocial adjustment, such the disparity between physical, cognitive, and social development (e.g., *developmental readiness hypothesis* by Negriff & Susman., 2011; Petersen & Crocket et al., 1985), hormonal surge or imbalance during the adrenarche and gonadarche processes, social mechanisms such affiliation with deviant peers or indifferent parenting, living in a disadvantageous context (see *contextual amplification hypothesis* by Ge et al., 2011; Natsuaki et al., 2014). Several developmental tasks need to be accomplished for a healthful shift from childhood to adolescence, and if these are not in line with normative development, it may increase youth vulnerability to psychosocial adjustment. In addition to the developmental readiness hypothesis, Lewis et al. (2018) propose *a pubertal status hypothesis* (stage of development, irrespective of timing) that early puberty posits a risk for depression, and their findings were significant for girls but not boy.

Based on the large previous evidence that puberty may potentially have some adverse effects on adolescents' mood and behaviors, and the observed relationships often vary between the sex or SES, the present dissertation sought to further advance our understanding by testing several hypotheses and expectations as specifically addressed in the study one, two and three, which are a novel observation in the Kosovar developmental context. The empirical evidence of this dissertation addresses a significant gap identified in Kosovar scholarship by investigating the extent to which BMI is significantly associated with pubertal development indices (secondary sex characteristics), and the onset of menarche. It also fills the gap by testing the extent to which puberty transition, conceptualized as advanced pubertal status and early pubertal timing, would be associated with externalizing and internalizing symptoms or problems in a large convenient sample of Kosovar adolescent

girls and boys aged 11 to 15 (N=1,342; 665 girls; M age = 13.12 years, SD = 1.27; 677 boys; M age = 13.19 years, SD =1.31).

Based on the findings in **the first brief report** that tested the relationship between BMI and puberty development indices (secondary sex characteristics, and menarche) in girls and boys, the following can be concluded:

- Kosovar girls reported a lower BMI than boys (M = 20.74; t = 4.36, p < .001).
- The average age of menarche for girls was 12.35 years.
- The largest portion of the girls in the study sample reported they were in the 'advanced pubertal' status (namely 68.3%), then in the 'mid pubertal' (10.2%), in 'prepubertal' (3.3%), and 'post-pubertal' category (3.3%) and in 'early pubertal' (4.4%).
- The largest portion of the boys in the study sample reported they were in 'mid-pubertal' (55%), then in 'early pubertal' (25.4%), 'prepubertal' (2.7%), and 'advanced pubertal' status (16.7%).
- In girls, Body Mass Index was significantly positively associated with breast development, growth spurt, the onset of menarche, as well as the total PDS score (Pubertal Development Scale) controlling for the age and SES, except for skin changes and body hair development.
- In boys, Body Mass Index was significantly positively associated with growth spurt, voice change, body hair, and facial hair (chin), as well as with the total PDS score (Pubertal Development Scale), except for the skin changes.
- Overall findings suggest the significance of BMI in puberty development in both sexes, with a few exceptions.

Based on the findings of **the second study** that tested the extent to which puberty transition is related to internalizing symptoms in girls and boys, the followings can be concluded:

- T-tests results provided evidence of higher levels of internalizing symptoms in girls compared to the boys ($t = -12.46$, $p < 0.001$, for Anxious/depressed; $t = -10.40$, $p < 0.001$, for Withdrawn/depressed; and $t = -7.17$, $p < 0.001$, for Somatic complaints); independent of puberty transition measures.
- In regression analysis for girls, being late maturing compared to early was significantly negatively related to internalizing symptoms, namely anxious/depressed and somatic

compliant symptoms (β = -0.17, for both). In other words, early maturation was positively associated with internalizing symptoms, and late-timing was negatively associated with internalizing symptoms. In the regression analysis for girls, controlling for pubertal timing, BMI was significantly positively associated only with withdrawn/depressed symptoms (β = 0.15). As such the findings support the *developmental readiness hypothesis* for girls only (Negriff and Susman., 2011).

- In regression analysis for girls, pubertal development stage or status was significantly and positively associated with measures of internalizing symptoms among girls (anxious/depressed, withdrawn/depressed, and somatic complaint symptoms), controlling for BMI and family SES (βs = 0.31, 0.24, and 0.22, respectively). Thus, our evidence supports the *pubertal status hypothesis* (Lewis et al., 2018), which posits that advanced pubertal status is related to depressive symptoms in girls, however not in boys.
- With regard to the boys, no significant association was found between pubertal timing or BMI and internalizing symptom links (anxious/depressed, withdrawn/depressed, and somatic complaint symptoms).
- Regression analysis for boys revealed a significant positive relationship between pubertal development status and withdrawn/depressive symptoms (β = 0.13) only.
- Overall findings suggest that pubertal transition, as conceptualized as advanced pubertal status and early pubertal timing, has a more adverse influence on girls' emotional development compared to boys.
- The overall findings highlight the significance of assessing both puberty transition measures to understand better the extent to which each puberty domain is related to internalizing symptoms, in different developmental context.

Finally, based on the findings in the third study, which tested the extent to which puberty transition is related to externalizing symptoms in girls and boys, the following can be concluded:

- T-tests found significant sex differences in delinquent ($t = -7.77, p < .001$), but however not for aggressive behaviours ($t = -1.53, p = .127$), independent of puberty transition measures.
- The regression analysis in girls provided evidence that pubertal development status was significantly positively associated with delinquent (β = 0.16) and aggressive

behaviors (β = .12). In boys, the regression analysis provided significant positive associations for delinquent ((β = 0.20) and aggressive behaviours (β = .14).

- BMI and SES, however, were not related to externalizing problems in either sex.
- The regression analysis also provides no significant relationships between pubertal timing categories and externalizing behaviors (delinquent and aggressive) in either sex.
- The overall findings support the evidence that advancing through the puberty stage heightens the risk for the onset of externalizing symptoms in our middle adolescent age sample, both girls and boys. Nonetheless, the maturational timing (relative to peer counterparts) does not posit a risk with regard to the onset of externalizing behaviors in either sex. As such, they do not support the *developmental readiness hypothesis* (Susman and Negriff., 2011), which posits that early pubertal timing heightens the risk for externalizing symptoms in adolescents.
- The overall findings highlight the importance to assess both puberty status and pubertal timing, to better understand the extent to which each puberty domain or constructs is associated with externalizing problems.

*References of summary, are in the end**

13 Přílohy

Vědecké poznatky spojené s významem biologického vývoje a jeho psychologických korelátů u dospívajících, zejména poznatky od 80. let 20. století, položily základy tohoto výzkumu a zásadně posunuly znalosti, které máme nyní k dispozici v oblasti vzájemného působení endogenních a exogenních faktorů při přizpůsobování mládeže v průběhu puberty.

V dnešní době chápeme, že puberta jako vývojový proces není sama o sobě patogenní (Allen a Sheeber, 2009, s. 6, jak je rozvedeno v Derose a Brooks-Gunn, 2009). Může však potencovat některé negativní vlivy na dospívající, zejména v obdobích stresu, a může interagovat s dalšími biologickými a environmentálními faktory, především u mládeže pocházející ze zranitelných vývojových kontextů a prostředí, což může ohrozit zdravé chování mládeže. S nástupem a přechodem do puberty dochází k biologickým i psychologickým změnám (Susman a Dorn., 2013) na individuální úrovni, ve vývoji mozku, sociálních vztazích a rodinné hierarchii, které mají psychosociální důsledky; navzdory těmto pokrokům v poznatcích však stále zůstává mnoho neodhaleného.

Dosavadní empirické poznatky se shodují v předpokladu, že v raném a středním dospívání dochází k nárůstu afektivních problémů, přičemž dívky jsou ve srovnání s chlapci více ohroženy emočními symptomy. Nárůst emočních problémů často přetrvává i v pozdní adolescenci a mladé dospělosti, zejména u dospívajících dívek. Dosavadní data rovněž potvrzují, že v období dospívání může dojít k prudkému nárůstu externalizujících symptomů, přičemž chlapci jsou ve srovnání s dívkami více ohroženi externalizujícími problémy.

Jednou z dimenzí, která nám umožňuje lépe pochopit rozdíly v afektivních/emocionálních a behaviorálních problémech a rozdíly mezi pohlavími, je zkoumání vlivu puberty na psychosociální přizpůsobení mládeže. Stále více důkazů potvrzuje riziko časné puberty v souvislosti s internalizujícími symptomy u dívek (Ge et al., 2002; Graber et al., 1997; Kowalski et al., 2021), ale také u chlapců (Ullsperger & Nicholas., 2017; Kowalski et al., 2021), i když v menší míře u chlapců. Pozitivní souvislosti mezi časným načasováním puberty a externalizujícími problémy u dívek a chlapců potvrdily i další důkazy (Graber et al., 1997; Kowalski et al., 2021; Lynne et al., 2007; Ullsperger, 2020; srov. Graber et al., 2006; White et al., 2013) a pomalejší

načasování puberty bylo spojeno s poklesem (Kowalski et al., 2021; srov. Graber et al., 1997).

Předchozí empirické poznatky se navíc shodují v předpokladu, že postupující stav/stupeň puberty také významně pozitivně předpovídá externalizující problémy u obou pohlaví (Ge et al., 2006; Najman, 2009; srov. Nottlemann et al., 1987) a internalizující problémy především u dívek (Angold et al., 1998; Reardon et al., 2009) a v menší míře u chlapců (Richardson et al., 2006).

Předpoklad nepříznivého vlivu časného pubertálního zrání na psychosociální přizpůsobení dospívajících podporuje několik možných vysvětlení, jako je nesoulad mezi fyzickým, kognitivním a sociálním vývojem (např. hypotéza vývojové připravenosti podle Negriffa a Susmana), 2011; Petersen & Crocket et al., 1985), hormonální nárůst nebo nerovnováha během procesů adrenarche a gonadarche, sociální mechanismy, jako je afiliace s deviantními vrstevníky nebo lhostejná výchova, život v nepříznivém kontextu (viz hypotéza kontextového zesílení podle Ge et al., 2011; Natsuaki et al., 2015). Pro zdravý přechod z dětství do dospívání je třeba splnit několik vývojových úkolů, a pokud nejsou v souladu s normativním vývojem, může to zvýšit zranitelnost mládeže vůči psychosociálnímu přizpůsobení. Kromě hypotézy vývojové připravenosti Lewis et al. (2018) navrhují hypotézu pubertálního stavu (vývojového stadia bez ohledu na načasování), podle níž časná puberta představuje riziko pro depresi, a jejich zjištění byla významná pro dívky, ale ne pro chlapce.

Na základě velkého množství předchozích dat o tom, že puberta může mít potenciálně určité nepříznivé účinky na náladu a chování dospívajících a že pozorované vztahy se často liší podle pohlaví nebo SES, se tato disertační práce snaží dále posunout naše chápání testováním několika hypotéz, jak je konkrétně řešeno ve studii jedna, dvě a tři, které jsou novým pozorováním v kosovském vývojovém kontextu. Empirické důkazy této disertační práce řeší významnou mezeru identifikovanou v kosovské vědě tím, že zkoumají, do jaké míry je BMI významně spojen s ukazateli pubertálního vývoje (sekundárními pohlavními znaky) a nástupem menarché. Tuto mezeru vyplňuje také testováním míry, do jaké by přechod do puberty, koncipovaný jako pokročilý pubertální status a časné načasování puberty, souvisel s externalizujícími a internalizujícími symptomy či problémy na velkém vhodném vzorku kosovských dospívajících dívek a

chlapců ve věku 11 až 15 let (N=1 342; 665 dívek; M věk = 13,12 let, SD = 1,27; 677 chlapců; M věk = 13,19 let, SD =1,31).

Na základě výsledků první stručné zprávy, která testovala vztah mezi BMI a ukazateli vývoje puberty (sekundární pohlavní znaky a menarché) u dívek a chlapců, lze vyvodit následující závěry:

- Kosovské dívky uváděly nižší BMI než chlapci (M = 20,74; t = 4,36, p < .001).

- Průměrný věk menarché u dívek byl 12,35 roku.

- Největší část dívek ze zkoumaného vzorku uvedla, že je ve stavu "Pokročilý pubertální stav" (konkrétně 68,3 %), dále v kategorii "střední puberty" (10,2 %), v kategorii "prepubertální" (3,3 %) a "postpubertální" (3,3 %) a v kategorii "rané puberty" (4,4 %).

- Největší část chlapců ze zkoumaného vzorku uvedla, že jsou ve stavu "středního puberty" (55 %), dále ve stavu "raného puberty" (25,4 %), "prepubertálního věku" (2,7 %) a "pokročilého pubertálního věku" (16,7 %).

- U dívek byl index tělesné hmotnosti významně pozitivně spojen s vývojem prsou, růstovým spurtem, nástupem menarché i celkovým skóre PDS (Pubertal Development Scale) při kontrole věku a SES, s výjimkou kožních změn a vývoje ochlupení.

- U chlapců byl index tělesné hmotnosti významně pozitivně spojen s růstovým spurtem, změnou hlasu, ochlupením těla a obličeje, jakož i s celkovým skóre PDS (Pubertal Development Scale), s výjimkou kožních změn.

- Celkové výsledky naznačují význam BMI pro vývoj puberty u obou pohlaví, až na několik výjimek.

Na základě výsledků druhé studie, která testovala, do jaké míry souvisí přechod do puberty s internalizačními symptomy u dívek a chlapců, lze vyvodit následující závěry:

- Výsledky T-testů prokázaly vyšší úroveň internalizačních symptomů u dívek ve srovnání s chlapci (t = -12,46, p < 0,001, pro úzkostné/depresivní; t = -10,40, p < 0,001, pro stažené/depresivní; a t = -7,17, p < 0,001, pro somatické stížnosti); nezávisle na opatřeních v období puberty.
- V regresní analýze pro dívky bylo pozdní dozrávání ve srovnání s raným významně negativně spojeno s internalizačními příznaky, konkrétně s úzkostnými/depresivními a somatickými vyhovujícími příznaky (β = -0,17, pro oba). Jinými slovy, časné zrání bylo pozitivně spojeno s internalizačními

symptomy a pozdní zrání bylo negativně spojeno s internalizačními symptomy. V regresní analýze pro dívky, kontrolující pubertální načasování, byl BMI významně pozitivně spojen pouze s uzavřenými/depresivními symptomy (β = 0,15). Zjištění jako taková podporují hypotézu vývojové připravenosti pouze u dívek (Negriff a Susman., 2011).

- V regresní analýze pro dívky byla fáze nebo stav pubertálního vývoje významně a pozitivně spojena s internalizačními symptomy u dívek (úzkostné/depresivní, stažené/depresivní a symptomy somatických stížností) při kontrole BMI a SES rodiny (βs = 0,31, 0,24 a 0,22). Podporují tak "hypotézu pubertálního stavu" (Lewis et al., 2018), která předpokládá, že pokročilý pubertální stav souvisí s depresivními symptomy u dívek, nikoli však u chlapců.
- Pokud jde o chlapce, nebyla zjištěna žádná významná souvislost mezi pubertálním načasováním nebo BMI a souvislostmi s internalizujícími symptomy (úzkostné/depresivní, uzavřené/depresivní a symptomy somatických stížností).
- - Regresní analýza u chlapců odhalila pouze významný pozitivní vztah mezi stavem pubertálního vývoje a odtažitými/depresivními symptomy (β = 0,13).
- Celkové výsledky naznačují, že pubertální přechod, který je koncipován jako pokročilý pubertální status a časné načasování puberty, má nepříznivější vliv na emoční vývoj dívek ve srovnání s chlapci.
- Celková zjištění zdůrazňují význam hodnocení obou měřítek pubertálního přechodu pro lepší pochopení míry, do jaké jednotlivé domény puberty souvisejí s internalizujícími symptomy, a to v různých vývojových souvislostech.

Na základě výsledků třetí studie, která testovala, do jaké míry souvisí přechod do puberty s externalizujícími symptomy u dívek a chlapců, lze vyvodit následující závěry:

- T-testy zjistily významné rozdíly mezi pohlavími v delikventním chování (t = -7,77, p < .001), nikoli však v agresivním chování (t = -1,53, p = .127), a to nezávisle na opatřeních v období puberty.
- Regresní analýza u dívek poskytla důkaz o otm, že stav pubertálního vývoje významně pozitivně souvisí s delikventním (β = 0,16) a agresivním chováním (β = .12). U chlapců regresní analýza poskytla významné pozitivní asociace pro delikventní ((β = 0,20) a agresivní chování (β = .14).

- BMI a SES však nesouvisely s externalizujícími problémy ani u jednoho pohlaví.
- Regresní analýza rovněž neposkytla žádné významné vztahy mezi kategoriemi pubertálního načasování a externalizujícím chováním (delikventním a agresivním) u obou pohlaví.
- Celková zjištění podporují tvrzení, že postupující puberta zvyšuje riziko výskytu externalizujících příznaků v našem vzorku střední adolescence, a to jak u dívek, tak u chlapců. Nicméně načasování zrání (vzhledem k vrstevníkům) nepředstavuje riziko s ohledem na výskyt externalizujícího chování u obou pohlaví. Jako takové nepodporují hypotézu vývojové připravenosti (Susman a Negriff., 2011), která předpokládá, že časné pubertální načasování zvyšuje riziko externalizujících příznaků u dospívajících.
- Celková zjištění zdůrazňují důležitost posouzení jak stavu puberty, tak i pubertálního načasování, aby bylo možné lépe pochopit, do jaké míry jsou jednotlivé oblasti puberty spojeny s externalizujícími problémy.

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Appendices

Appendix 1: Abstract of the thesis

Tittle: The associations between puberty and internalizing and externalizing symptoms among Kosovar adolescents

Author: Ms Elona Krasniqi

Supervisor: Prof. PhDr. Panajotis Cakirpaloglu, DrSc

Department: Department of Psychology, Faculty of Arts, Palacký University Olomouc

Number of pages and characters: 179 pages, 286,402 characters

Number of appendices: 4

Number of references 298

Abstract: The present dissertation consists of four parts: the introduction chapter, the empirical part of three studies, a general discussion, and a summary. The introduction chapter presents the history of scholarship on pubertal correlates and internalizing and externalizing symptoms or problems, focusing on early adolescence, theoretical models, and the scholarly relevance in the Kosovar developmental context. The first brief report studied the extent to which BMI would be associated with puberty-related bodily changes (secondary sex characteristics) in girls and boys. It was found that BMI was significantly positively related to puberty-related bodily changes in girls, except for body hair and skin changes; and in boys, BMI was significantly positively associated with puberty-related bodily changes, except for skin changes. Study 2 observed the associations between pubertal status/stage and pubertal timing and internalizing symptoms. The result confirmed that advanced pubertal status was significantly positively associated with anxious/depressed, withdrawn/depressed, and somatic complaints in girls, and only with withdrawn/depressed symptoms in boys. Likewise, pubertal timing was significantly positively associated with anxious/depressed, and somatic complaint symptoms in girls; no significant links were found for boys. Study 3 observed the associations between pubertal status/stage and pubertal timing and externalizing symptoms. No significant associations were found between pubertal timing and externalizing problems links in boys and girls. Findings provided support for a significant positive association between pubertal developmental status/stage and both delinquent and aggressive behaviors in both girls and boys. The research implications were discussed.

Keywords: BMI, pubertal status/stage, pubertal timing, internalizing symptoms, externalizing symptoms, Kosovar youth.

Appendix 2: Abstrakt disertační práce (CZ)

Název práce: Souvislosti mezi pubertou a internalizujícími a externalizujícími symptomy u Kosovských adolescentů.

Autor práce: Mgr Elona Krasniqi

Školitel: Prof. PhDr. Panajotis Cakirpaloglu, DrSc.

Název katedry: Katedra psychologie, Filozofická fakulta, Univerzita Palackého v Olomouci

Počet stran a znaků: 179, 286,402 characters

Počet příloh: 4

Počet titulů použité literatury: 298

Abstrakt: Tato disertační práce se skládá ze čtyř částí: úvodní kapitoly, tří studií v empirické části, obecné diskuse a shrnutí. V úvodní kapitole je představena teorie o pubertálních korelátech a internalizačních a externalizačních symptomech či problémech zaměřujících se na ranou adolescenci, dále jsou představeny teoretické modely a literatura relevantní pro kosovský vývojový kontext. První publikace se zaměřovala na to, do jaké míry BMI souviselo s tělesnými změnami souvisejícími s pubertou (sekundární pohlavní znaky) u dívek a chlapců. Bylo zjištěno, že BMI pozitivně souvisí s tělesnými změnami souvisejícími s pubertou u dívek, s výjimkou ochlupení a kožních změn, a u chlapců BMI pozitivně souvisí s tělesnými změnami spojenými s pubertou, s výjimkou kožních změn. Studie 2 sledovala souvislosti mezi pubertálním stavem/stádiem a načasováním puberty a internalizujícími symptomy. Studie potvrdila, že pokročilý pubertální status je pozitivně spojen s úzkostnými/depresivními, stažené/depresivními a somatickými stížnostmi u dívek a pouze se stažené/depresivními symptomy u chlapců. Stejně tak pubertální načasování pozitivně souviselo s úzkostnými/depresivními a somatickými symptomy u dívek; u chlapců nebyly zjištěny žádné významné souvislosti. Studie 3 sledovala souvislosti mezi pubertálním stavem/stádiem a načasováním puberty a externalizujícími symptomy. Nebyly zjištěny žádné asociace mezi pubertálním načasováním a externalizujícími problémy u chlapců a dívek. Zjištění poskytla podporu pro pozitivní souvislost mezi pubertálním vývojovým stavem/stádiem a delikventním i agresivním chováním u dívek i chlapců. Dále byly diskutovány výledky studie.

Klíčová slova: BMI, pubertální status, pubertální načasování, internalizující symptomy, externalizující symptomy, Kosovská mládež.

Appendix 3: Statement of the co-authorship

I consent to use the following manuscripts as a part of Ms. Elona Krasniqi's doctoral dissertation, entitled "*The associations between puberty and internalizing and externalizing symptoms in Kosovar adolescents*".

Krasniqi, E., Vazsonyi, A. T., & Cakirpaloglu, P. (2023). Externalizing problems among Kosovar adolescents: pubertal correlates in girls ang boys. *International Journal of Adolescence and Youth, 29* (1), 2286249. https://doi.org/10.1080/02673843.2023.2286249

Krasniqi, E., Vazsonyi, A. T., & Cakirpaloglu, P. (2024). Internalizing symptoms among Kosovar adolescents: pubertal correlates in girls and boys. *Journal of Child and Adolescent Trauma,* 1-16. https://doi.org/10.1007/s40653-024-00610-z

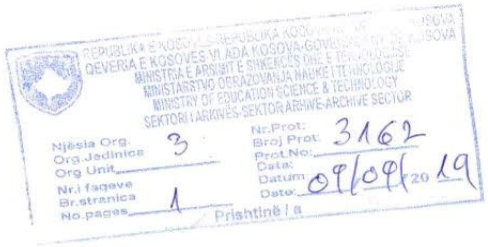
Ms. Elona Krasniqi is the first principal author of these peer-reviewed papers; therefore, I grant her permission to use them in her doctoral thesis work and to modify the text in her dissertation thesis as needed.

Prof. Dr. Panajotis Cakirpaloglu, DrSc

Prof. Dr. Alexander T. Vazsonyi, PhD

** The manuscripts have been prepared in consultation with the dissertation advisor, Prof. Dr. Panajotis Cakirpaloglu, DrSc, as well as in consultation with Prof. Dr. Alexander Vazsonyi, PhD, during Ms Krasniqi study exchange at the Adolescent Research Lab, Department of Family Sciences, at the University of Kentucky, United States.*

Appendix 4: Permission of Kosovo Ministry of Higher Education, Science and Technology for conducting the three studies



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Prandaj MASHT, rekomandon DKA-të për mbështetje dhe bashkëpunim.

Me respekt!