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A Public Health Relevance for Anaemia Among Adolescent Girls and Associated Risk Factors

Husan Bano Channar[1], Ayaz Ali Samo[2]
[1]Assistant Professor,People's Nursing School,Liaquat University of Medical and Health Sciences, Jamshoro
[2]Assistant Professor, Department of Physiology, University of Sindh, Jamshoro-Pakistan.
husan.channar@gmail.com, ayazsamo@usindh.edu.pk

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ABSTRACT

Anaemia is characterised by a lower-than-normal amount of haemoglobin (Hb) in the body, which lowers oxygen-carrying ability. Anaemia can happen at any stage of life, although it is more common in young children, pregnant women, and adolescents. For a number of reasons, teenage girls are the most vulnerable group. Anaemia can be predicted by a number of variables, which can result in a variety of adverse outcomes. The goal of this review was to evaluate the factors that adolescents develop anaemia. Articles were retrieved from many databases, including PubMed, World Bank, Google Scholar, and WHO databases, to conduct a review. Relevant papers were discovered in several databases using the text keywords and phrases "anaemia," "prevalence and determinants of anaemia," "adolescent girls," "risk factors for anaemia," "iron deficiency anaemia," "nutritional deficiency," "meal pattern," "dairy products," and "menstrual flow." We identified a number of socio-cultural determinants, including female gender, age, early marriage, poor household income and family size. The existence of additional physiological parameters, such as menstrual cycle duration, and sanitary pad use was also demonstrated. Skip meals behaviour, eat less often, and drink tea are the main dietary variables that cause anaemia. Fatigue, poor mental health, low academic achievement, lower exercise capacity, developmental delays are just a few of the negative effects of anaemia. Adolescent anaemia is more prevalent in Sindh than in other Pakistani regions. One of the major public health issues in emerging nations is anaemia, which particularly impacts South Asian populations. Anaemia can result in a number of negative consequences that can be avoided. Starting a food fortification programme, educating teenagers in schools and the general public about the benefits of dietary diversity, fortification, usage of fruits and vegetables, animal-based food, and increasing physical activity are all part of the ideal strategy for reducing anaemia in teenagers.

Keywords: Anemia, adolescent girls, determinates of anemia, risk factors, nutritional deficiency, and food fortification.

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INTRODUCTION

Anaemia is characterised by a lower-than-normal amount of haemoglobin (Hb) in the body, which lowers oxygen-carrying ability. Anaemia is an indication of both poor nutrition and health (U. WHO, 2004), and it has been associated to decreased exercise capacity, impaired cognitive function, developmental delays, and aberrant behaviour (Pinhas-Hamiel et al., 2003).Despite its multifactorial

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aetiology, anaemia can be caused by dietary deficiencies (iron, folic acid, and vitamin B12), inherited conditions (thalassemia and sickle cell), environmental toxins (lead), infectious diseases (malaria), socioeconomic conditions (low maternal education and household income), demographic conditions (age and gender), autoimmune conditions (hemolytic anaemia), and chronic conditions (cancer); iron deficiency anemia is the most common cause of anemia(Al-Zabedi et al., 2014; Mawani, Ali, Bano, & Ali, 2016).In underdeveloped nations, iron deficiency anaemia is common and places a further load on the health care system (Mawani et al., 2016). Iron is necessary for erythroblasts to produce hemoglobin.

If there is not enough iron available, hemoglobin production stops and the number of red blood cells decreases (Milman, 2011).Anaemia is defined by the World Health Organisation (WHO) as haemoglobin concentration cut offs at 11.0 g/dl for pre-schoolers and pregnant women, and 12.0 g/dl for non-pregnant women (>15 years)(C. Who, 2008). Clinical signs of iron deficiency anaemia include palpitations, tachycardia, and tachypnea with exercise. A smooth tongue and brittle nails are symptoms of severe deficiency, along with other skin and mucosal abnormalities. Many people with iron deficiency anaemia experience Pica, a need for particular foods (such ice chips, lettuce, etc.) that are frequently low in iron (ML, 2006).

It is believed that adolescents are a demographic group that is more prone to dietary issues. A rapid move in growth and insufficient dietary intake raise the risk of nutritional deficiencies in teenagers (Hettiarachchi, Liyanage, Wickremasinghe, Hilmers, & Abrams, 2006).The need for nutrients is highest throughout adolescence because of the rapid growth that takes place there up to 45% of skeletal growth and 15% to 25% of adult height (Organization, 2005). Anaemia can have a detrimental effect on an adolescent girl's immunity, general health, low birth weight babies, prenatal mortality, an increase in mother deaths, and afterwards high infertility rates and survival rates if it is not treated (T. Kaur & Kaur, 2015; Kulkarni, Durge, & Kasturwar, 2012).

According to a report by the World Bank on anaemia, in every region/country, anaemia prevalence decreases with income. Adolescent girls from low-income families between the ages of 13 and 19 were the subjects of a cross-sectional analytical study in Lahore. The findings revealed that IDA was present in 68.8% of the girls, of whom 40.2% had moderate anaemia (8 to 10 gm/dl) and 28.8% had mild anaemia (10.9 to 11.9 gm/dl)(Hassan, Salim, & Humayun, 2017).An observational cross-sectional research by King Edward Medical University, which included participants aged 10 to 19, revealed that 50.6% of teenage females had anaemia (Toheed, 2017).Statistics demonstrate that iron insufficiency is more prevalent in underdeveloped nations than in industrialised ones, despite the fact that it affects women in both groups(Zimmermann & Hurrell, 2007).

The literature has revealed several risk factors for anaemia, however these are not compiled in one place.The goal of this review was to evaluate the factors that adolescents develop anaemia.

Methods

Articles were retrieved from many databases, including PubMed, World Bank, Google Scholar (http://schol ar.google.com), and WHO databases, to conduct a review. Relevant papers were discovered in several databases using the text keywords and phrases "anaemia," "prevalence and determinants of anaemia," "adolescent girls," "risk factors for anaemia," "iron deficiency anaemia," "nutritional deficiency," "meal pattern," "dairy products," and "menstrual flow."

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Results

Epidemiology of Anaemia

The Epidemiology of anaemia varies by the area due to variations in social, economic, demographic, dietary, and other contributing variables.

Age

There is a significant frequency of anaemia among new-borns from six months on, with iron deficiency anaemia being the main reason. Iron deficiency anaemia can occur at any stage of life, although adolescents are more likely to encounter it (Chaudhary & Dhage, 2008). Due to a significant growth spurt and the monthly loss of 12.5–15 mg of iron, teenage females are particularly at risk for anaemia, and their iron needs rise by two to three times. Adolescent girls are the most susceptible demographic for a variety of reasons (Mengistu, Azage, & Gutema, 2019).

Gender

Compared to male adolescents, female adolescents had a greater rate of anaemia (Pandey & Singh, 2013). Accelerated growth, hormonal changes, malnutrition, and the beginning of a girl's menstrual cycle are the main factors during this time (Beard, 2000; Halterman, Kaczorowski, Aligne, Auinger, & Szilagyi, 2001).Numerous studies have found that the majority of adolescents have mild to moderate anaemia (Jayaprakash & Manjulatha, 2020; Kulkarni et al., 2012).

Low household monthly income

It's important to have enough money to purchase sufficient amounts of nutritious meals. Women with high economic position have access to good nutrition and healthcare compared to women living in poverty. Adolescents with low home monthly income are more likely to have iron deficiency anaemia (Al-Alimi, Bashanfer, & Morish, 2018; Chaudhary & Dhage, 2008; Jayaprakash & Manjulatha, 2020; Mengistu et al., 2019).

Family size

A family is a social unit whose members live together and are related by blood, means of support, and place of residence (Structure, 1949).Anaemia prevalence continues to be high in large families (Djazayery, Keshavarz, Ansari, & Mahmoudi, 2001; Joshi & Kushwaha, 2018; Mengistu et al., 2019).

Literacy level

Education is a significant component that affects the girl and her family both directly and indirectly. Higher education has been linked to higher HB Levels (Bailey & Davies, 1997). Many research have explored the relationship between teenage girls' education and anaemia (Jolly, Rajaratnam, Asokan, & Jonathan, 2000; S. Kaur, Deshmukh, & Garg, 2006; Kulkarni et al., 2012).

Access to health care

The risk factor for anaemia is the inability to access health care services (Goswmai & Das, 2015; Habib, Abbasi, & Aziz, 2020).A well-educated woman can access proper medical treatment and is knowledgeable about dietary nutrition and personal cleanliness(Batool, 2010).

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Adolescence marriage and pregnancy

High prevalence of anaemia is caused by adolescence and pregnancy (Anand, Rahi, Sharma, & Ingle, 2014). In accordance to the United Nations, an early marriage is one that takes place before the required legal age of 18 years old. Many women are married before they turn 18 and are therefore prone to early pregnancies(Goli, Rammohan, & Singh, 2015). Adolescent married females have been found to have the highest anaemia prevalence rates in several analysis (Chaturvedi, Chaudhuri, Priyanka, & Chaudhary, 2017). Early marriage is associated with anaemia in teenage boys and females(Organization, 2011a). The complications related to teenage pregnancies are the major causes of death among adolescent girls globally and situation is worse in developing countries(Batool, 2010).

Physiological State

A person's haemoglobin level is used to assess their overall health. Girls are more likely than boys to have anaemia. Additionally, blood loss during menstruation contributes to its onset. According to various studies, teenagers are more likely to develop anaemia because of increased iron requirements associated with puberty and female menstrual losses (Al-Sharbatti, Al-Ward, & Al-Timimi, 2003). According to multiple studies, adolescent girls who had menstrual flow for ≥ 5 days are more probable to be anemic as compared to those adolescent girls with menstrual flow < 5 days per each cycle (Leenstra et al., 2004; Miah, Rahman, Prodhan, Linkon, & Rahman, 2014; Siva, Sobha, & Manjula, 2016). Anaemia and the frequency of menstrual pads use (a measure of blood loss) are both substantially correlated(Siva et al., 2016).Moreover, multiple studies found no connection between menarche status and anaemia (Chaudhary & Dhage, 2008; Kulkarni et al., 2012; Siva et al., 2016).

Cultural and religious factor

Iron-rich diets are forbidden for a number of cultural and religious reasons. As a considerable section of the world's population consumes a predominantly vegetarian diet, a failure to maintain iron. Adolescent anaemia increases significantly as a result of traditional dietary practices (Balcı, Karabulut, Gürses, & Çövüt, 2012).Cultural groups restrict from eating foods high in iron, which accounts for a significant percentage of the world's population(Siddiqui & Siddiqui, 2008). For a number of reasons, teenage girls are more prone to suffering. There are several cultural practices that discriminate against women. Malnutrition is widespread in homes with few resources, and girl child are frequently ignored(Joshi & Kushwaha, 2018).

Dietary habits

Dietary patterns indicate personal dietary choices and are frequently influenced by factors such as culture, education, financial status, and health status. Skipping meals is a behavior that increases the risk of anaemia in adolescents since skippers are likely to consume less food overall (Ghaffar & Waqar, 2018; Joshi & Kushwaha, 2018). The number of primary meals that eat each day has a significant impact on overall anaemia. Many studies have shown a link between frequent meals and anaemia (Abriha, Yesuf, & Wassie, 2014; Joshi & Kushwaha, 2018; Yerpude & Jogdand, 2013).South Asians enjoy their meals excessively cooked and deep-fried because it enhances the flavor. However, it seriously reduces their nutritional value. Many reproductive age women in Pakistan frequently consumes tea(Baig-Ansari et al., 2008);especially female adolescents in the region of Baluchistan(Montazerifar, Karajibani, & Dashipour, 2012).A few research showed that adolescents' anaemia and tea drinking may be related (Chaturvedi et al., 2017).The greatest sources of dietary iron are meat, fish, and other animal products,

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however consumption of these foods continues to be low(Balcı et al., 2012; Kabir, Shahjalal, Saleh, & Obaid, 2010).

Academic achievement

Studies that examined the impact of iron deficiency anaemia on cognitive processes revealed a substantial difference in adolescents' intellectual ability between those who were anaemic and those who were not (Petranovic, Batinac, Petranovic, Ruzic, & Ruzic, 2008). Numerous studies have linked adolescents' anaemia to intellectual achievements (Abalkhail & Shawky, 2002; Al-Alimi et al., 2018; Jalambo, Hamad, & Abed, 2013; Kim, Kim, & Keen, 2005).
Iron requirement in female adolescents.

Infants need 1.0 mg of iron daily; adolescents girls need 0.8 mg; adolescents boys need 0.6 mg; non-pregnant women need 0.6 mg; preschoolers and schoolchildren need 0.4 mg; and adult males need 0.3 mg (Narsinga Rao, 1983).

Nutrition education

Nutrition education is a helpful technique in the prevention of anaemia since it is the most fundamental and sustainable method to modify eating behaviours and create a balanced diet. The iron deficiency prevalence significantly decreased as a result of the nutritional education intervention (García-Casal et al., 2011).Additionally, teenagers with nutritional education possessed higher knowledge, attitudes, and haemoglobin levels(Yusoff, Wan Daud, & Ahmad, 2012).

Communicable diseases

According to research on adolescent females in Pakistan, communicable illnesses are strongly linked to anaemia(Habib et al., 2020).

Sedentary life styles

The majority of adolescents engage in physical inactivity. Studies have shown the significant relationship between anemia and the sedentary life style (Al-Alimi et al., 2018; Habib et al., 2020; Jalambo et al., 2013).

Detection of anemia

Blood tests for CBC, haemoglobin, and hematocrit can be used to assess the severity of anemia(Manandhar & Bhattarai, 2018).

Global situation

Based on data from the WHO, Anaemia is estimated to affect two billion people globally, with the IDA reporting 50% of all cases (Unicef, .2001). The most afflicted age group is preschoolers, with an incidence of 47%, followed by pregnant women (41%), non-pregnant women (30%), school-aged children (25%) and those over the age of 60 (24%); males are the least affected group (12%).In accordance to the WHO, Southeast Asia and Africa have been the most severely affected (Organization, 2008).While, the least affected regions are Western pacific and Europe (Organization, 2015; Stevens et al., 2013).Pregnant women (56%), school-aged children (53%), non-pregnant women (44%), and young

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children (42%) are the population categories most severely impacted in developing nations. However, another group demands attention as well: older children, half of whom are anaemic (51%)("Iron deficiency anaemia,")[59] [59]. Anaemia is a problem with moderate (20.0-39.9%) or severe (>40%) relevance from the perspective of public health among preschool-aged children as well as in pregnant and no pregnant women in South Asian nations (Geneva & Organization, 2011).Anaemia is more common among adolescents in underdeveloped nations (27%), compared to industrialized countries (6%) (Dugdale, 2001).Further, According to estimates from the World Health Organization, there were 1.7 million teenage deaths in the South-East Asia region in 2015. Suicide, traffic accidents, and maternal mortality (among women) were the main causes of these deaths. A loss of 21783 Disability Adjusted Life Years (DALYs) per 100 000 teenagers due to self-harm, iron deficiency anaemia, mental disorders, auto accidents, and diarrheal infections is also cited as substantial morbidity among adolescents in the Region (Organization).The prevalence of anemia is more prevalent in low socioeconomic groups.

Local situation analysis

Anemia is most prevalent in Pakistan. According to Pakistan's National Nutrition Survey, iron deficiency anaemia is one of the major health problems impacting women of reproductive age (Pakistan, 2011). According to estimates from the EMRO WHO, anaemia affects more than one fifth of women in Pakistan. Numerous regional studies confirm that there is knowledge of this enduring health issue at the national level (Siddiqui & Siddiqui, 2008). The Pakistani Planning Commission reported that in the beginning of the 1980s, 39% of teenage females and 20% of adolescent boys had anaemia (Hb <10 mg%); of them, 80-85% had iron deficiency anaemia(Qureshi, Hashmi, & Akhtar, 1999). Pregnant adolescents, older adolescent girls, and individuals of lower socioeconomic groups are more likely to suffer from iron insufficiency (Qureshi et al., 1999).People who are most at risk for iron deficiency, are the poorest, and have the least education represent the population(Milman, 2011).

In recent studies, anaemia is the most prevalent nutritional deficit among teenage females in Pakistan(Jamali, Mahesar, & Bhutto, 2016; Khan & Saleem, 2018).

According to Agha, Sadaruddin, Khan, and Ghafoor (1992) in Pakistan, it was estimated that 39% of adolescents, 30% boys, and 54% females have been affected by Iron deficiency anemia. In Doulatpur Town, Sindh Province, a descriptive cross-sectional research was conducted on 150 adolescent's girls. It showed that 67.3% of people had iron deficient anaemia(Jamali et al., 2019). One study on teenage girls at the University of Peshawar, 237 female adolescents took part. It was shown that 82% of girls had low serum iron and 61% of girls had haemoglobin levels that were below normal, which may be associated to menarche, rapid changes in growth hormone, and malnutrition brought on by insufficient nutritional intakes(Ghaffar & Waqar, 2018).

A cross-sectional survey of teenage girls in Azad Jammu and Kashmir, Pakistan, included 626 female adolescents. The prevalence of anaemia was found to be 47.9%, with mild anaemia comprising up 47.7%, moderate anaemia comprising up 51.7%, and severe anaemia making up 5.7%. Economic well-being, the prevalence of communicable illnesses, menstrual problems, exercise routines, and meal regularity were all substantially connected with anaemia prevalence(Habib et al., 2020).

Consequences of anemia

Adolescent girls' immunity, health, and well-being can be negatively impacted by anaemia, which if untreated, can also lead to low birth weight babies, prenatal mortality, an increase in maternal death rates, high rates of future infertility, and survival, growth, and development of their offspring in later

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life (T. Kaur & Kaur, 2015; Kulkarni et al., 2012).Anaemia has been linked to behavioral disturbances, developmental delays, and reduced cognitive performance (Pinhas-Hamiel et al., 2003);and can affect perception and cause learning challenges, which might result in decreased academic achievement (Shill et al., 2014; Soemantri, Pollitt, & Kim, 1985). Additionally, numerous investigations have shown that anaemia decreases productivity at work and increases susceptibility to illnesses, which would significantly increase the economic burden(Balarajan, Ramakrishnan, Özaltin, Shankar, & Subramanian, 2011).

Strategies to combat anaemia

Prevention of Iron Deficiency Anaemia throughout critical life cycle phases with a proper diet and/or therapeutic interventions is essential. The World Health Organization has proposed four fundamental strategies for the prevention and control of ID, including changing one's diet to consume more iron, supplementation, food fortification, and infection control(Allen, 2001).

Dietary modification

Dietary changes might be a useful strategy for combating anemia. However, People in South Asia eat accordance to their preferences. Changing eating habits, however, seems difficult in environments where education and awareness are inadequate and where communities primarily depend on the limited knowledge and food supplies. Animal foods are costly and in limited availability in underdeveloped nations, which limits access. Government programmes to alter eating habits are challenging to execute and maintain because of cultural traditions(Nestel & Nalubola, 2000). Collectively, young children and adolescents girls and young women should be the target of interventions (Milman, 2011). Fresh fruits and vegetables provide a significant source of vitamin C and folate, both of which are necessary for the body to absorb iron (Stevens et al., 2013);and increasing consumption of animal-based foods will also help to prevent an iron shortage.

Food fortification

WHO suggests that the fortification is the deliberate addition of one or more micronutrients (such vitamins and minerals) to a meal or condiments in order to improve the nutritional content of the food supply and benefit the general public.

Increasing the amount of key micronutrients, such as vitamins, minerals, and trace elements, in food is a practice known as fortification. The goal is to increase the nutritional quality of the food supply while providing a minimal risk of harm to human health (Service). Food items, flour, infant formula, quick noodles, fish sauce, curry powder, cookies, sugar, and salt are some of the often utilized food vehicles(Rao & Vijayasarathy, 1975). Ferrous sulphate is used as an iron fortificant, primarily to fortify bread and other short-term bakery products(Cook & Reusser, 1983).Pakistan is marketing iron-fortified flour as part of a planned strategy(Ranum & Wesley, 2008). The lack of literacy and traditional eating patterns in the rural areas prevents them from benefiting from this intervention programme. Adolescent females shouldn't be eating enough iron-rich meals(Hafeez, Rafique, Shaikh, & Laghari, 2016; Kabir et al., 2010).Consequently, a reduced amount of vitamin B12 is the result of consuming less animal-based meals(Balcı et al., 2012). Thus, encouraging the consumption of foods high in iron and other essential micronutrients increases in the absorption of iron.

Iron supplementation

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The medicine iron is used to control and treat iron deficient anaemia. Based on several analyses among adolescents, preventative measures like iron-folic acid prophylaxis and nutritional supplements are urgently needed for preventing off anaemia(Hafeez et al., 2016; Kulkarni et al., 2012; Yerpude & Jogdand, 2013).Women of reproductive age are more sensitive to supplements because they need enough reserves for both themselves and the baby during pregnancy(Stoltzfus & Dreyfuss, 1998).Treatment for iron deficiency depends on the specific cause, age, and state of health. If the issue is due to nutrition, increasing iron-rich foods in the diet may be beneficial. In addition, there are other situations where iron supplements are advised. In areas where the prevalence of anaemia in menstruation adult women and teenage girls is 40% or higher, menstruating adult women and adolescent girls (non-pregnant females in the reproductive age group) should take 30-60 mg elemental iron in tablet form daily for three consecutive months in a year(Organization, 2011b). Examining the hemoglobin levels is crucial 2-4 weeks after the initial dosage. Daily iron supplementation or an iron and folate combination reduces anaemia by 73% when compared to controls(Yakoob & Bhutta, 2011).

CONCLUSION

Anaemia develops when the amount and size of RBCs or the concentration of hemoglobin decreases below a certain cutoff level, lowering the blood's capacity to deliver oxygen throughout the body. Anemia is more common in Sindh, province. Anaemia has been linked to reduced ability to exercise, poor cognitive ability, developmental delays, and abnormal behavior, low academic achievements and poor access to health care services. Moreover, anemia is common in large families. In addition to our understanding of the factors, we have extraordinary solutions at community level, the greatest approaches to stop the onset of anaemia in adolescents include food fortification, increased public awareness of the advantages of varied diets, consumption of fresh fruits and vegetables, animal-sourced food, having a healthy lifestyle, and using infection prevention techniques. The frequency of anaemia is still very high in large families. We advise educating communities about the risks associated with avoiding meals high in iron.

Table 1. Shows the distribution of public health significance from normal to severe anemia (Geneva & Organization, 2011)

Category of public health significance	Prevalence of anemia percent
Severe public health problem	>40
Moderate public health problem	20.0-39.9
Mild public health problem	5.0-19.9
Normal / No public health problem	<4.9

Table 2. Shows the comparison of studies evaluating anemia from different cities of Pakistan

Study	Prevalence	Age group	City
Jamali et al. (2019)	67.3% female	10-16 years	Doulatpur Town, Sindh Province
Latif, Ayaz, Manzoor, and Ishaq (2018)	64.6%	under 15 years of age	Gwadar, Baluchistan.
Ghaffar and Waqar (2018)	82% of girls had low serum iron and 61% of girls had haemoglobin levels	16-19 years	At University of Peshawar
Agha et al. (1992)	39% in adolescents; 30% boys and 54% girls	13 to 20 years	Islamabad
Toheed (2017)	50.6%	10-19	Lahore

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Habib et al. (2020)	47.9%	10-19	Azad Jammu and Kashmir, Pakistan

In Sindh Province, adolescents have a greater prevalence of anaemia, whereas AJK Province has the lowest prevalence. Anaemia prevalence varies by city, with an anaemic population of 67.3% in Sindh, 64.6% in Baluchistan, 61% in Peshawar, 54% in Islamabad, 50.6% in Lahore, and 47% in AJK. The Ministry of National Health (2018), Sindh is the province with the highest rate of anaemia among all women of reproductive age, followed by Baluchistan and Punjab.

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