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Provide a context or background for the study (i.e., the nature of the problem and its significance). State the specific purpose or research objective of, or hypothesis tested by, the study or observation; the research objective is often more sharply focused when stated as a question. Both the main and secondary objectives should be made clear, and any pre-specified subgroup analyses should be described. Give only strictly pertinent references and do not include data or conclusions from the work being reported.

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CONCLUSION(S)

Conclusion should elucidate how the results communicate to the theory presented as the basis of the study and provide a concise explanation of the allegation of the findings.

ACKNOWLEDGEMENT

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PAKISTAN BIOMEDICAL JOURNAL

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Technology in Advancing Medical Practice

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The role of technology in advancing medical practice and improving patient outcomes is increasingly vital in today's healthcare landscape. In the past few decades, we have seen rapid advancements in medical technology, which have transformed how we diagnose, treat, and prevent diseases. Medical technology has brought about remarkable improvements in patient outcomes and quality of life, as well as reducing healthcare costs. One of the most significant advances in medical technology is the development of electronic health records (EHRs). EHRs allow healthcare providers to store patient information electronically, making it more accessible and easier to share between healthcare providers. With EHRs, healthcare providers can access patient records in real-time, enabling them to make informed decisions about patient care. EHRs also enable healthcare providers to track patient outcomes and improve the quality of care provided to patients. Medical imaging technology has also revolutionized medical practice. Medical imaging technology includes X-rays, CT scans, MRI, and PET scans. These technologies allow healthcare providers to visualize the inside of a patient's body, enabling them to diagnose and treat diseases more accurately and effectively. In addition, the development of 3D printing technology has allowed healthcare providers to create custom prosthetics and implants for patients, improving their quality of life. Telemedicine is another area where technology has advanced medical practice. Telemedicine allows healthcare providers to diagnose and treat patients remotely, reducing the need for in-person visits. This technology has been particularly useful in rural areas where patients have limited access to healthcare. Telemedicine also reduces healthcare costs by reducing the need for expensive in-person visits. In conclusion, technology has played a significant role in advancing medical practice and improving patient outcomes. From electronic health records to medical imaging technology and telemedicine, medical technology has transformed how we diagnose, treat, and prevent diseases. While there are still challenges to overcome, such as ensuring the security and privacy of patient information, it is clear that medical technology will continue to play a critical role in improving healthcare outcomes and reducing healthcare costs. As healthcare providers and technology companies work together to develop and implement new medical technologies, we can expect to see continued progress in the years to come.

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Original Article

Association Between Tea and Coffee Consumption and Symptoms of Iron Deficiency Among University Students

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ABSTRACT

Excessive consumption of tea and coffee has been linked with dietary iron deficiency in many clinical trials. People who consume tea or coffee with meal are at higher risk of developing dietary iron deficiency. **Objective:** The aim of this study was to assess the prevalence of iron deficiency in relation with tea or coffee among female university students. **Methods:** 150 female students at University of Lahore selected randomly. All participants were willing to participate in this survey. Questionnaires (on the base of 25 iron deficiency related question) were used for the collection of data to assess the relation between consumption of tea and iron deficiency. **Results:** 88 participants reported experiencing headache when not taking tea or coffee for long time. 41 desire to consume it all the time. 49 participants experience fatigue when not consumed tea or coffee. 31 participants consume tea or coffee with meal. 27 participants experience symptoms of anemia. 68 participants consume tea or coffee for mind relaxation. 54 participants take tea or coffee for better sleep. 83 participants consume for weight management. About 91 participants take dietary supplement for iron less than 1-2 times a day. **Conclusions:** This study shows that all the participants consume tea or coffee on daily basis while majority of them take with meal. The participants revealed to have symptoms of iron deficiency. Consumption of tea or coffee with meal is one of the reasons of dietary iron deficiency as chelates present in tea and coffee hinders the absorption of iron from food.

INTRODUCTION

Iron deficiency and iron deficiency anemia (IDA) is a condition where hemoglobin (Hb) and red blood cell (RBC) numbers are lower than the normal range due to insufficient iron, lacking to meet a person's physiological demands. Iron deficiency anemia is the most widely recognized kind of anemia [1]. In red blood cells, hemoglobin is the iron-binding protein that contains oxygen from the lungs to the tissues [2]. This ability can't occur when the body loses iron; accordingly, unique outcomes like inadequacy, exhaustion, and windedness are seen. It is most normal in females and children [2]. It influences about 33% of the total population of the world. Anemia is connected with extended grimness and mortality in women and children, poor birth results, lessened work effectiveness in adults, and crippled mental and social improvement in youth. Preschool youths and women of conceptive age are particularly influenced [3]. Iron deficiency is present to a great extent in underdeveloped countries, with the inescapability of 43% more than in developed countries, with 9% of the total population [4]. World Health Organization (WHO) surveys that almost two billion people, or 25% of the all-out people, are anemic, and around half of them experience the severe impacts of IDA [5]. The World Health Organization (WHO)

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evaluated all around that 273 million young people under 5 years of age were suffering from anemia in 2011, and about 50% of them had Iron deficiency anemia [6]. Anemia inescapability continues to be the most raised in South Asia and Central and West Africa. The Pakistan National Nutrition Survey coordinated in 2011-2012 reported that the presence of IDA in youths under five is between 40-70% [7]. The assistant assessment was performed using the National Nutrition Survey in Pakistan 2011-2012. The predominance of IDA was 18.1% among non-pregnant women of childbearing age [8]. The cause of IDA in adolescence might be a result of extended iron deficiency or decreased iron intake, severe blood loss, iron malabsorption, pregnancy, or parasitic sickness, which significantly reduces mental activity, poor daily life performance, and other health conditions and may continue in adulthood [4]. Few foods and beverages can interfere with iron absorption in the body, which is one of the leading reasons for iron deficiency [9]. Tea and coffee are among such beverages which reduce the absorption of dietary iron. Tea and coffee are the most consumed beverages in the world [10]. Pakistan is one of the countries where tea and coffee are highly consumed; about 91% of Pakistanis prefer tea over any other beverage, while coffee is consumed about 0.8kg per person in Pakistan [11]. According to a survey, males showed a high ratio of tea consumption than females in Pakistan. The survey also reported that the professionals (both genders) drink more tea than the non-professionals. Tea and coffee have been known for their health benefits as they contain numerous anti-oxidants which prevent cancers and cardiovascular diseases [12]. But recent studies have shown that the overconsumption of tea and coffee can lead to many diseases like iron deficiency, iron deficiency anemia, diabetes, and osteoporosis [10]. Tea and coffee contain such nutritive elements that reduce the absorption of dietary iron from food. Reportedly, about 39% of iron absorption is reduced when tea or coffee is consumed with food [10]. Tea and coffee have the potential to inhibit the absorption of non-heme and heme iron from the gut [13]. There are two compounds, tannins, and oxalates, that are naturally present in tea and coffee, which are the reason for the inhibition of iron absorption from food. They bind with iron and excrete out of the body. Several studies have been done to find the health effects of tea and coffee. Many previous types of research have shown that drinking tea or coffee with meals can reduce iron absorption, which may lead to a deficiency over time. In Pakistan, having tea or coffee with meals is one of the common practices. The black tea consumption in 2022 in Pakistan has an estimated 1,72,911 tones, which is expected to increase up to 2,50,755 in 2027. About 40% of Pakistan's total population suffers from iron deficiency [8]. However, studies on the effects of coffee and tea intake on iron deficiency are limited in Pakistan. We aimed to find the association of iron deficiency and iron deficiency anemia (IDA) with excessive tea and coffee consumption in adult populations like university students. This research will help in understanding iron deficiency in association with coffee or tea consumption and its management among Pakistanis.

METHODS

A population-based cross-sectional study was conducted on the association of iron deficiency caused by tea and coffee consumption among 150 students at the University of Lahore. A purposive sampling technique was used. Questionnaires were used for the collection of data. Female University students aged 18-30 years who are consuming a minimum of 2-3 cups of tea or coffee were included according to the specific inclusion criteria. The targeted sample size was 150 females. Students aged below 18 and above 30 who do not consume tea or coffee and who were having any disease were not included according to the exclusion criteria. All participants were provided with written informed consent, which was attached. All information and data gathered were kept strictly confidential. The administered questionnaire consisted of 43 questions, divided into 3 main parts. The first part included questions concerning demographic characteristics such as age, gender, marital status, educational level, BMI, residential status, and residential level. The second and third parts tackled iron deficiency features or intake of tea or coffee such as feeling anemic, intake of Vit. c in diet, disturbed menstrual cycle, iron deficiency has a relation with tea or coffee, disturbance in the digestive system, and regular consumption of tea or coffee in the diet. The survey was filled out by the participants after reading questions to them. Data were analyzed by the application of statistical methods. SPSS version 25.0 was used to tabulate and data analysis. Descriptive and inferential statistics were used to report the data. The qualitative variables were reported in the form of frequency percentages. The association between the variables was found by using chi-square.

RESULTS

According to the Table 1, results showed that out of 150 participants, 141 were of age between 18-24 years whereas 9 were between 25-30 years, 89 belonged to the normal BMI (18.5-24.9), 3 belonged to the obese range of BMI (above 30), 31 belonged to the underweight range of BMI (less than 18) and 27 belonged to the overweight range of BMI (25-29.9), 145 participants were unmarried whereas 5 participants were married, 126 participants were doing graduate while

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15 participants were in pre-graduate and 9 participants were in post-graduate, 109 belonged to the middle socio-economic status where 9 belonged to lower and 32 belonged to upper socioeconomic status, 122 participants belonged to urban areas whereas 28 participants belonged to rural areas.

Sr No.	Categories	Ranges	Frequency (%)
1.	Age	18-24 years	141 (94%)
		25-30 years	9 (6%)
2.	BMI	Underweight below 18	31 (20.7%)
		Normal 18.5-24.9	89 (59.3%)
		Overweight 25-29.9	27 (18%)
		Obese above 30	3 (2%)
3.	Marital status	Unmarried	145 (96.7%)
		Married	5 (3.3%)
4.	Education Level	Pre-graduate	15 (10%)
		Graduate	126 (84%)
		Post-graduate	9 (6%)
5.	Socio-Economic status	Lower Class	9 (6%)
		Middle Class	109 (72.7%)
		Upper Class	32 (21.3%)
6.	Residential level	Urban	122 (81.3%)
		Rural	28 (18.7%)

Table 1: Demographic Profile of Participants

According to Table 2, results showed that all 150 participants consumed tea or coffee regularly in their diet whereas 106 knew that excessive consumption of tea or coffee may lead to iron deficiency while 44 didn't knew about it. 84 participants didn't knew that excessive use of tea or coffee may disturb menstrual cycle while 66 participants knew about it, 88 participants experienced headache while not consuming tea or coffee whereas 62 participants didn't experienced, 95 was aware of the side effects of excessive consumption of tea or coffee whereas 55 wasn't aware of it, 92 knew that tea or coffee has a relationship with iron deficiency whereas 58 didn't knew about it, 79 believed that high intake of tea or coffee increases the risk of miscarriages in pregnant women whereas 71 didn't believed in it, only 55 participants used iron supplements whereas 95 didn't used the iron supplement.

Sr No.	Diagnosis		Frequency (%)
1.	Consumption of tea or coffee regularly in the diet	No	0 (0%)
		Yes	150 (100%)
2.	Excessive consumption of tea or coffee may lead to iron deficiency.	No	44 (29.3%)
		Yes	106 (70.7%)
3.	Excessive use of tea or coffee may disturb the menstrual cycle	No	84 (56%)
		Yes	66 (44%)
4.	Headache while not consuming tea or coffee	No	62 (41.3%)
		Yes	88 (58.7%)
5.	Awareness about the side effects of excessive consumption of tea or coffee	No	55 (36.7%)
		Yes	95 (63.3%)
6.	Tea or coffee has a relationship with iron deficiency	No	58 (38.7%)
		Yes	92 (61.3%)
7.	High intake of tea or coffee in pregnant women has a higher risk of miscarriage	No	79 (52.7%)
		Yes	71 (47.3%)
8.	Use of Iron supplement	No	95 (63.3%)
		Yes	55 (36.7%).

Table 2: Attributes of intake of Tea or Coffee

DISCUSSION

The current study was conducted to find out the association between tea and coffee consumption and symptoms of iron deficiency among university students. The participants were selected through a non-probability convenient sampling technique. In the current study, the results showed that 94% of participants were of between 18-24 years of age group, and 6% were of between 25-30 years of age group. In 2018, a similar study was conducted by Al-Alimi *et al.*, who showed that 59.2% of participants were between 20-22 years of age group and 25% of participants were 17 to 19 years of age and 15.8% of participants were 23-25 years of age group [4]. In the recent research, the results showed that 20.7% of participants were underweight having BMI below 18, 59.3% of participants were normal having a BMI of 18-24.9, 18% of participants were overweight having a BMI of 25-29.9 whereas 2% participants were obese having a BMI above 30. In 2018, a study was conducted by Mazhar *et al.*, having similar outcomes. He reported that the BMI of 61 % of participants is in the normal range, 23.1% of participants have a BMI of less than 18, and 16% were a BMI of above 25 [14]. The present study showed that 96.7% of participants were unmarried and 3.3% were married. In 2019, similar research was observed by Vibhute *et al.*, which showed that a higher number of women were non-married and non-pregnant at the time of their studies [15]. The current study showed that 10% of participants were pre-graduate, 84% were doing graduate and 6% were post-graduate. In 2019, Mahmood *et al.*, executed a similar study which showed that students with age less than 20 were 20.6% whereas students in the age group 20-30 were 44.4 % [16]. In the current study, 6% of participants belonged to lower socioeconomic status, 72.7% of participants belonged to middle socio-economic status and 21.3% belonged to high socio-economic status. In 2017, another study conducted by Cote *et al.*, showed that 53% of participants belonged to middle-class people [17]. In our study, 100% of participants consumed tea or coffee regularly in their diet. A similar study was conducted by Gaeini *et al.*, who reported that 90% of participants were tea addicted and 4% of participants were coffee addicted [18]. In the present study, 70.7% of participants know that excessive intake of tea and coffee leads to iron deficiency. Similarly, a study conducted by Fan *et al.*, in 2016 investigated that drinking

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tea or coffee leads to iron deficiency [9]. In the current research, 61.3% of participants believed that there is a relationship between tea or coffee and iron deficiency. In 2019, a similar study by Mani *et al.*, showed that ingesting too many tannins from coffee & tea sources can result in iron deficiency in the body. Hence, there is a relationship between tea or coffee and iron deficiency [19]. In a recent study, 47.3% of participants believe that a high intake of tea or coffee increases the risk of miscarriages in pregnant women. A similar study was conducted by El-Saidy *et al.*, *who* reported that consuming more caffeine (>200 mg/d) causes an increased rate of miscarriages in pregnant females[20].

CONCLUSIONS

Iron deficiency anemia is a condition where there is an imbalance between the body's demand and dietary iron absorption. Our study concludes that there is an association between tea or coffee consumption and symptoms of iron deficiency in the body. About 52% of participants are tea or coffee addicted. Most of the participants feel fatigued, have dizziness, shortness of breath, digestive issues, insomnia, and poor quality of life. It has been seen that there is a significant relationship between excessive consumption of tea or coffee causing anxiety & menstrual disturbance through Chi-Square as their p-value is less than 0.05. Nutrition awareness is necessary to cope with the symptoms and side effects of iron deficiency & the intake of supplements like iron & vit. C (which enhances iron absorption). To treat iron deficiency among adults, IDA iron sulfate supplements are recommended at 60mg, and for children, 30mg.

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Garcia-Casal MN, Pasricha SR, Sharma AJ, Peña-Rosas JP. Use and interpretation of hemoglobin concentrations for assessing anemia status in individuals and populations: results from a WHO technical meeting. Annals of the New York Academy of Sciences. 2019 Aug; 1450(1): 5-14. doi: 10.1111/nyas.14090.

[2] Yıldız TK, Yurtay N, Öneç B. Classifying anemia types using artificial learning methods. Engineering Science and Technology, an International Journal. 2021 Feb; 24(1): 50-70. doi: 10.1016/j.jestch.2020.12.003.

[3] Chaparro CM and Suchdev PS. Anemia epidemiology, pathophysiology, and etiology in low and middle-income countries. Annals of the New York Academy of Sciences. 2019 Aug; 1450(1): 15-31. doi: 10.1111/nyas.14092.

[4] Al-Alimi AA, Bashanfer S, Morish MA. Prevalence of iron deficiency anemia among university students in Hodeida Province, Yemen. Anemia. 2018 Apr; 2018: 4157876. doi: 10.1155/2018/4157876.

[5] Mantadakis E, Chatzimichael E, Zikidou P. Iron deficiency anemia in children residing in high and low-income countries: risk factors, prevention, diagnosis and therapy. Mediterranean Journal of Hematology and Infectious Diseases. 2020 Jul; 12(1): e2020041. doi: 10.4084/mjhid.2020.041.

[6] Sundararajan S and Rabe H. Prevention of iron deficiency anemia in infants and toddlers. Pediatric Research. 2021 Jan; 89(1): 63-73. doi: 10.1038/s41390-020-0907-5.

[7] Habib MA, Black K, Soofi SB, Hussain I, Bhatti Z, Bhutta ZA, *et al.* Prevalence and predictors of iron deficiency anemia in children under five years of age in Pakistan, a secondary analysis of national nutrition survey data 2011-2012. PloS One. 2016 May; 11(5): e0155051. doi: 10.1371/journal.pone.0155051.

[8] Habib MA, Raynes-Greenow C, Soofi SB, Ali N, Nausheen S, Ahmed I, *et al.* Prevalence and determinants of iron deficiency anemia among non-pregnant women of reproductive age in Pakistan. Asia Pacific Journal of Clinical Nutrition. 2018 Jan; 27(1): 195-203.

[9] Fan FS. Iron deficiency anemia due to excessive green tea drinking. Clinical Case Reports. 2016 Nov; 4(11): 1053. doi: 10.1002/ccr3.707.

[10] Sung ES, Choi CK, Kim NR, Kim SA, Shin MH. Association of coffee and tea with ferritin: data from the Korean National Health and Nutrition Examination Survey (IV and V). Chonnam Medical Journal. 2018 Sep; 54(3): 178-83. doi: 10.4068/cmj.2018.54.3.178.

[11] Islam T, Ahmed I, Ali G, Ahmer Z. Emerging trend of coffee cafe in Pakistan: factors affecting revisit intention. British Food Journal. 2019 Jul; 121(9): 2132-47. doi: 10.1108/BFJ-12-2018-0805.

[12] Naveed S and Hameed A. Consumption of Tea in Professionals and Non-professionals. SOJ Pharmacy & Pharmaceutical Sciences. 2014 Sep; 1(3): 1-4. doi: 10.15226/2374-6866/1/3/00116.

[13] Delimont NM, Haub MD, Lindshield BL. The impact of tannin consumption on iron bioavailability and status: A narrative review. Current Developments in Nutrition. 2017 Feb; 1(2): 1-2. doi: 10.3945/cdn. 116.000042.

[14] Mazhar S, Bano M, Azam S, Abbas R. Periodontal

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Disease and Obesity: A Hospital Based Cross-Sectional Study. Pakistan Oral & Dental Journal. 2018 Nov; 38(3): 353-7.

[15] Vibhute NA, Shah U, Belgaumi U, Kadashetti V, Bommanavar S, Kamate W. Prevalence and awareness of nutritional anemia among female medical students in Karad, Maharashtra, India: A cross-sectional study. Journal of Family Medicine and Primary Care. 2019 Jul; 8(7): 2369. doi: 10.4103/jfmpc.jfmpc_353_19.

[16] Mahmood T, Rehman AU, Tserenpil G, Siddiqui F, Ahmed M, Siraj F, *et al.* The association between iron-deficiency anemia and adverse pregnancy outcomes: a retrospective report from Pakistan. Cureus. 2019 Oct; 11(10): e5854. doi: 10.7759/cureus.5854.

[17] Côté S, Kraus M, Piff PK, Beermann U, Keltner D. Social class clash: A dyadic model of social affiliation in cross-class and same-class interactions. Rotman School of Management Working Paper. 2014 Oct: 1-69.

[18] Gaeini Z, Malmir H, Mirmiran P, Feizy Z, Azizi F. Snack consumption patterns and their associations with risk of incident metabolic syndrome: Tehran Lipid and Glucose Study. Research Square. 2022 Jun; 9: 1-16. doi: 10.21203/rs.3.rs-1760399/v1.

[19] Mani L, Fatimah-Muis S, Kartini A. The correlation of intake phytate and tannin on serum transferrin receptor and hemoglobin in stunted overweight adolescents. Potravinarstvo. 2019 Jan; 13(1): 870-874. doi: 10.5219/1191.

[20] El-Saidy TM and Amr TE. The modifiable and nonmodifiable risk factors for miscarriage. Egyptian Nursing Journal. 2016 Sep; 13(3): 169. doi: 10.4103/2090-6021.200178.

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Original Article

Physicochemical Characteristics, Total Phenolic Content and Free Radical Scavenging Activity of Apple (Malus Domestica) Peel Powder

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ABSTRACT

Apple peel is considered as a waste product in many fruit industries but it is a noteworthy source of nutrients and phytochemicals, particularly polyphenols which have the ability to scavenge free radicals. **Objectives:** To study the physicochemical properties of apple (*Malus domestica*) peel powder, as well as its TPC and free radical scavenging activities. **Methods:** Proximate analysis of the apple peels powder was carried out. Total polyphenol content of apple peel powder was determined. The total content of phenolic compounds was expressed as gallic acid equivalent, i.e. mg GAE/100g of extract dry weight of sample. **Results:** The results of physicochemical characteristics moisture (7.65±0.88%), ash (2.50±0.35%), fat (1.18±0.02%), fiber (15.25±1.03%), protein (2.79±0.05%), carbohydrates (71.0±2.30%) and energy were 312±4.70 Kcal/100g. The total phenolic contents in the methanolic extract of apple peel powder were 320±5.4 mg GAE/100g while in H_2O extract 201±4.20 mg/100g. The findings of the apple peel powder's methanolic extract's capacity to scavenge free radicals varied from 25.40±1.30—69.2±3.80%, while those of the water extract were 14.30±1.05—45.62±1.90% and BHT were 17.8±1.15—51.62±2.15% at concentration 20-100 µg/ml. **Conclusions:** The outcomes showed that both apple peel powder extracts had promising total polyphenols and have strong free radical scavenging activity. These findings suggest that the apple peel powder act as robust naturally occurring antioxidants and may be employed as a preventative therapy for several oxidative stress-related degenerative disorders.

INTRODUCTION

Plants are essentially the basis of life and offer an unrivalled, exceptional source of nutrition for both humans and animals. Due to the many chemical compounds that they contain, many plant species have medical benefit (Ani and Abel, 2018)[1]. The best sources of natural antioxidants are fruits and vegetables. It is reasonable to hypothesise that increasing the purposeful consumption of these fruits would improve the intake of natural antioxidants. Since various fruits have varying antioxidant capacities, they may offer diverse protection against oxidative stress. Antioxidants are chemicals that can stop or postpone oxidative damage to lipids, proteins, and nucleic acids when they are present at low concentrations[2]. The apple (*Malus domestica*) is a member of the rose family (*Rosaceae*) and it is the fourth most produced fruit in the world. In 2020, there were 84.6 million tonnes of apples produced globally [3]. Apple fruit and its products are a great source of natural antioxidants in our diet, contributing up to 22% of all dietary phenolics. Drinks and dietary supplements for the food sector are regularly made with apples which are significant part of the human food chain and a complex of physiologically active phenolic and triterpenic chemicals governs their nutritional qualities. After citrus, mango, and banana, apple is the fourth most popular fruit in Pakistan and is consumed frequently. It is cultivated commercially in Pakistan's Gilgit-Baltistan, Punjab, Khyber Pakhtunkhwa, and Quetta [4]. Apple peel has a variety of biological properties and in earlier research; apple peel extract was found to have an inhibitory impact on obesity related insulin resistance and type II

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diabetes in mice. In those mice, dietary treatment with apple peel extract lowered levels of cytokines during the early stages of pro-inflammation, enhanced insulin sensitivity and decreased levels of oxidation in adipose tissue [5]. According to Raudone *et al.*, 2017 study, hydroxycinnamates, flavanols, anthocyanins, and dihydrochalcones are polyphenolic chemicals in apple peel that contribute to antihypertensive and anti-inflammatory and antioxidant properties [6]. Numerous factors, including as environmental factors, soil composition, the timing of harvest, varied storage conditions, etc., affect the quantity of polyphenolic compounds as well as their antioxidant activity in many apple cultivars and their content fluctuates [7]. Consumers' growing health consciousness has increased demand for functional foods that contain minerals, polyphenols, and antioxidants. Thus, the primary goal of the investigation is to concentrate on the apple peel nutrients, identify its phenolic contents and antioxidant capabilities.

METHODS

All of the chemicals and solvents that used in this study were of the analytical grade and procured from Merk, Sigma Aldrich. Apples were purchased from a local Lahore market. The fruits were carefully rinsed under running water before being peeled with an apple peeler. Fresh peels were dried for 6 to 8 hours in a hot air oven at 50 °C. For further investigation, the dried peel was then ground into a powder using a grinding mill and packaged in a plastic bag. Proximate analysis of the apple peels powder was carried out as follows: Moisture content was determined using the hot air oven by drying at 60-70 °C till constant weight. Ash, protein, fat and crude fiber were determined. Carbohydrate content was determined by difference method. The sum of percentage moisture, ash, protein, fat, and crude fiber was subtracted from 100.

Percentage (%) carbohydrate = 100 – (% moisture + % ash + % protein + % fat + crude fiber).

The energy was calculated using the formula computed by multiplying the percentages of crude protein and carbohydrate by 4.0 and crude fat by 9.0 which was expressed as Kcal/100g [8]. To make the water and methanolic extract. 5 gram of apple peel powder was mixed with 200 ml of methanol and water by using of electronic blender. The mixture was then agitated for four hours in a thermostatic water bath set at 40°C. The residue was removed by filtration using filter paper and the filtrate was used for antioxidant study. Total polyphenol content of apple peel powder was determined according to the method described by Singleton and Rossi (1965) [9]. The total content of phenolic compounds was expressed as gallic acid equivalent, i.e. mg GAE/100g of extract dry weight of sample. The free radical activity was performed according to the DPPH assay described previously by Brand-Williams (1995) method [10] with slight modification. The percentage inhibition of DPPH radicals (%I) was calculated according to the equation:

$$\% \text{ Inhibition } (DPPH^{\cdot}) = A^{(517)}_{control} - A^{(517)}_{sample} / A^{(517)}_{control} \times 100$$

where: A^{517}_{conrol}: absorbance of the control sample, A^{517}_{sample}: absorbance of the tested sample. The concentration of the extracts was plotted against the % inhibition. Version 21 of the Statistical Product for Service Solution (SPSS) was used to statistically evaluate the data that was collected. As means and standard deviation, they were expressed (SD).

RESULTS

Table 1 shows the percentage of moisture, ash, fat, fiber and protein values of apple peel powder sample were 7.65±0.88%, 2.50 ±0.35%, 1.18±0.02%, 15.25±1.03%, 2.79±0.05%, respectively. While the carbohydrates was measured by difference which was 71.0±2.30% and energy 312±4.70 Kcal/100g.

Sr. No.	Parameters	Values (g/100g)
1	Moisture	7.65 ± 0.88
2	Ash	2.50 ± 0.35
3	Crude fat	1.18± 0.02
4	Crude fiber	15.25 ± 1.03
5	Crude protein	2.79 ± 0.05
6	Carbohydrate	71.00 ± 2.30
7	Energy (Kcal/100g)	312 ± 4.70

Table 1. Nutritional facts of fresh Apple peel
Data are represented ± standard deviation

In the current study, it was discovered that apple peel powder extract in methanolic form had greater levels of radical scavenging activity than its water extract, as measured by the DPPH assay. As the concentration increased from 20—100 µg/ml, the % inhibition of the samples increased. Figure 1 shows the range of DPPH radical scavenging activity for methanolic extract of apple peel powder, which was 25.40±1.30—69.2±3.80% while 14.30±1.05—45.62±1.90% with water extract and with BHT was 17.8±1.15—51.62±2.15%.

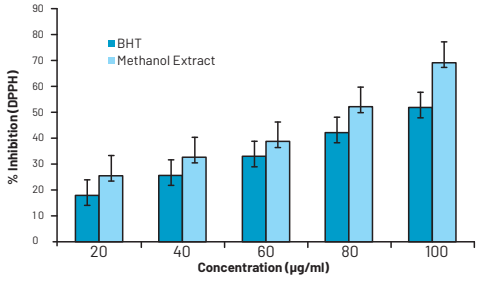

Figure 1: Free radical scavenging activity (% Inhibition DPPH) of

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methanol extract of apple peel powder

Methanol extract had higher free radical scavenging activity than the synthetic standard antioxidant BHT followed by water extract (Figure 2).

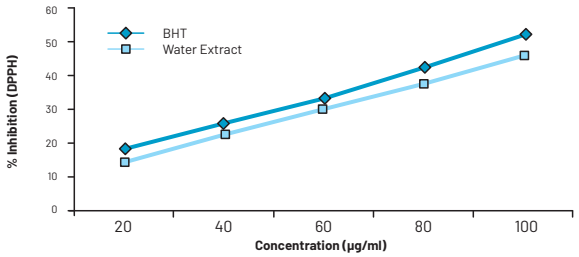

Figure 2: Free radical scavenging activity (% Inhibition DPPH) of water extract of apple peel powder

DISCUSSION

It is now widely acknowledged that apple fruits are a good source of phytochemicals, which are mostly concentrated in the peel. They influence the nutritional content, aesthetics, flavour, colour and texture of meals in addition to improving customers' health (Ou and Gu, 2014) [11]. According to Safdar *et al*. (2017) [12], estimation of proximate composition is important for determining the quality of raw materials. Apple peel powder contains moderate level of carbohydrate, moisture, low level fat and protein, moderate level of crude fiber and ash. According to Henrquez *et al*. (2010) [13], apple peels include ash (2.4%), crude fat (2.7%), crude fiber (19.6%), crude protein (2.7%), and NFE (72.7%) and our findings are in line with this findings. In food processing, moisture content is one of the most significant and often utilized parameters which affects both product's shelf life and the viability of microorganism development [14, 15]. The sample's ash content reveals how much inorganic materials and oxides are present. It is the factor that determines the composition of the sample's minerals [16]. Fat provide great source of energy and also improves the transit of fat-soluble vitamins, insulates, protects interior tissues, and supports essential cellular functions. However, it is firmly held that excessive consumption of saturated fatty acids is to blame for men's propensity for coronary thrombosis and aortic atheroma. High quantity of polyunsaturated fatty acids significantly decrease the blood cholesterol levels [17]. According to scientific data, increasing fibre consumption especially dietary fiber helps prevent, cure, and manage chronic illnesses as well as support physiological processes including blood lipid and glucose regulation [18, 19]. Energy generation is the main metabolic function of carbohydrates in diets. There are several forms of carbohydrates, but only total carbohydrates are taken into account in meals, which is what remains after protein, fat, moisture, and ash have been taken out [20]. The phenolic content of the apple peel was determined as the gallic acid equivalent. According to the findings, the total phenolic content of the powdered apple peel in methanolic extract was 320±5.4 mg GAE/100g and 201±4.20 mg/100g after the extraction in H_2O. El-Messery 2019 [21] said that the overall polyphenolic content in apple peel 1141.92 ppm and this is confirmed by Jakobek *et al*. (2013) [22] who mentioned PC in apple peel ranged from 672 to 3150 mg•kg–1. The TPC reported by Vasile *et al*. (2021) [23] varied from 2056 to 2723 mg GAE/kg among red skinned varieties, which was greater than the TPC found in yellow skinned apples. Moreover Khalid *et al*. (2021) [24] obtained grater TPC in apple peel than our results and he determined the amount of phenolic compounds in the apple peel as chlorogenic acid equivalents and demonstrated that it was 832.05±0.05 mg GAE/100g. The antioxidant action of apples is established by phenolic compounds, which operate as reducing agents by donating hydrogen, quenching singlet oxygen, serving as chelators and trapping free radicals. This inhibits free radicals from harming DNA, proteins, lipids, and other biomolecules structures [25, 26]. The DPPH radical scavenging experiment shows a positive correlation between TPC and % inhibition. According to Ahmad *et al*., (2020) the overall free radical scavenging capacity of apple peels was 2.5 times larger than that of the pulp [27].

CONCLUSIONS

This study provides evidence that apple peel powder is a superior source of nutrients, especially fiber. They have the high free radical activity (% DPPH scavenging activity) and a high quantity of phenols. The polyphenolic rudiments found in apple peel powder may be linked to the antioxidant action.

Conflicts of Interest

The authors declare no conflict of interest

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REFERENCES

[1] Ani PN and Abel HC. Nutrient, phytochemical, and antinutrient composition of Citrus maxima fruit juice and peel extract. Food Science & Nutrition. 2018 May; 6(3): 653-8. doi: 10.1002/fsn3.604

[2] Saeed MK, Zahra N, Ahmad I, Syed Q. Quality assessment, sensory evaluation, and radical scavenging activity (RSA) of orange (Citrus auranthium) pulp. Bangladesh Journal of Scientific and Industrial Research. 2022 Jun; 57(2): 123-30. doi: 10.3329/bjsir.v57i2.60409

DOI: https://doi.org/10.54393/pbmj.v6i02.847

[3] FAO F. Food and agriculture organization of the United Nations. Rome. 2018 Jul.

[4] Akhtar S, Khan FA, Ali J, Javid B. Nutritional composition, sensory evaluation and quality assessment of different brands of commercial tetra pack apple juices available in local market of Peshawar Pakistan. Global Journal of Biotechnology and Biochemistry. 2013; 8(11): 69-73.

[5] Qiang J, Khamis OA, Jiang HJ, Cao ZM, He J, Tao YF, *et al*. Effects of dietary supplementation with apple peel powder on the growth, blood and liver parameters, and transcriptome of genetically improved farmed tilapia (GIFT, Oreochromis niloticus). PLoS One. 2019 Nov; 14(11). doi: 10.1371/journal.pone.0224995

[6] Raudone L, Raudonis R, Liaudanskas M, Janulis V, Viskelis P. Phenolic antioxidant profiles in the whole fruit, flesh and peel of apple cultivars grown in Lithuania. Scientia horticulturae. 2017 Feb; 216: 186-92. doi: 10.1016/j.scienta.2017.01.005

[7] Kschonsek J, Wolfram T, Stöckl A, Böhm V. Polyphenolic compounds analysis of old and new apple cultivars and contribution of polyphenolic profile to the in vitro antioxidant capacity. Antioxidants. 2018 Jan; 7(1): 20. doi: 10.3390/antiox7010020

[8] Akinyeye RO, Oluwadunsin A, Omoyeni A. Proximate, mineral, anti-nutrients, phyto-chemical screening and amino acid compositions of the leaves of Pterocarpus mildbraedi harms. Electronic Journal of Environmental, Agricultural & Food Chemistry. 2010 Sep; 9(8).

[9] Singleton VL and Rossi JA. Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. American journal of Enology and Viticulture. 1965 Jan; 16(3): 144-58.

[10] Brand-Williams W, Cuvelier ME, Berset CL. Use of a free radical method to evaluate antioxidant activity. LWT-Food science and Technology. 1995 Jan; 28(1): 25-30. doi: 10.1016/S0023-6438(95)80008-5

[11] Ou K and Gu L. Absorption and metabolism of proanthocyanidins. Journal of Functional Foods. 2014 Mar; 7: 43-53. doi: 10.1016/j.jff.2013.08.004

[12] Safdar MN, Kausar T, Nadeem M. Comparison of ultrasound and maceration techniques for the extraction of polyphenols from the mango peel. Journal of Food Processing and Preservation. 2017 Aug; 41(4): e13028. doi: 10.1111/jfpp.13028

[13] Henríquez C, Speisky H, Chiffelle I, Valenzuela T, Araya M, Simpson R, *et al*. Development of an ingredient containing apple peel, as a source of polyphenols and dietary fiber. Journal of Food Science. 2010 Aug; 75(6): H172-81. doi: 10.1111/j.1750-3841.2010.01700.x

[14] Nasir M, Akhtar S, Sharif MK. Effect of moisture and packaging on the shelf life of wheat flour. Internet Journal of Food Safety V. 2004; 4: 1-6.

[15] Nwofia GE, Victoria NN, Blessing KN. Nutritional variation in fruits and seeds of pumpkins (Cucurbita Spp) accessions from Nigeria. Pakistan Journal of Nutrition. 2012 Oct; 11(10): 848-858. doi: 10.3923/pjn.2012.946.956

[16] Preti R and Tarola AM. Study of polyphenols, antioxidant capacity and minerals for the valorisation of ancient apple cultivars from Northeast Italy. European Food Research and Technology. 2021 Jan; 247: 273-83. doi: 10.1007/s00217-020-03624-7

[17] Akpabio UD, Akpakpan AE, Enin GN. Evaluation of proximate compositions and mineral elements in the star apple peel, pulp and seed. Magnesium (Mg). 2012; 6(3.52): 29-49.

[18] Figuerola F, Hurtado ML, Estévez AM, Chiffelle I, Asenjo F. Fibre concentrates from apple pomace and citrus peel as potential fibre sources for food enrichment. Food chemistry. 2005 Jul; 91(3): 395-401. doi: 10.1016/j.foodchem.2004.04.036

[19] Romelle FD, Rani A, Manohar RS. Chemical composition of some selected fruit peels. European Journal of Food Science and Technology. 2016 Sep; 4(4): 12-21.

[20] Hussain M, Maqbool M, Ishtiaq M. Nutritional Evaluation of Some Selected Fruits (Pyrus Malus, Psidium Guajava, Musa Paradisiaca, Citrus Maxima) Available in Local Market of Sargodha City of Pakistan. Transactions in Physical and Biochemical Sciences. 2021; 1(1): 47-56.

[21] El-Messery TM, El-Said MM, Demircan E, Ozçelik B. Microencapsulation of natural polyphenolic compounds extracted from apple peel and its application in yoghurt. Acta Scientiarum Polonorum Technologia Alimentaria. 2019 Mar; 18(1): 25-34. doi: 10.17306/J.AFS.2019.0597

[22] Jakobek L, García-Villalba R, Tomás-Barberán FA. Polyphenolic characterisation of old local apple varieties from Southeastern European region. Journal of food composition and analysis. 2013 Sep; 31(2): 199-211. doi: 10.1016/j.jfca.2013.05.012

[23] Vasile M, Bunea A, Ioan CR, Ioan BC, Socaci S, Viorel M. Phytochemical content and antioxidant activity of Malus domestica Borkh peel extracts. Molecules. 2021 Dec; 26(24). doi: 10.3390/molecules26247636

[24] Khalid MU, Shabbir MA, Mustafa S, Hina S, Quddoos MY, Mahmood S, *et al*. Effect of Apple peel as an antioxidant on the quality characteristics and

DOI: https://doi.org/10.54393/pbmj.v6i02.847

oxidative stability of mayonnaise. Applied Food Research. 2021 Dec; 1(2). doi: 10.1016/j.afres.2021.100023

[25] Li H, Subbiah V, Barrow CJ, Dunshea FR, Suleria HA. Phenolic profiling of five different Australian grown apples. Applied Sciences. 2021 Mar; 11(5): 2421. doi: 10.3390/app11052421

[26] Butkeviciute A, Abukauskas V, Janulis V, Kviklys D. Phenolic content and antioxidant activity in apples of the 'Galaval'cultivar grown on 17 different rootstocks. Antioxidants. 2022 Jan; 11(2): 266. doi: 10.3390/antiox11020266

[27] Ahmad I, Khalique A, Shahid MQ, Ahid Rashid A, Faiz F, Ikram MA, *et al*. Studying the influence of apple peel polyphenol extract fortification on the characteristics of probiotic yoghurt. Plants. 2020 Jan; 9(1). doi: 10.3390/plants9010077

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Original Article

Impact of Poverty on Secondary School Academic Achievement among Girls in District Faisalabad, Pakistan; A cross sectional study

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ABSTRACT

One of the most fundamental and obvious human rights in all countries is the right to an education. However, poverty has continued to be a stumbling block for the majority of people in achieving this fundamental right. Objective: To investigate how poverty affects academic performance of girls in secondary school. **Methods:** A cross-sectional study was conducted among 100 students of schools in District Faisalabad, Pakistan. The questionnaire designed for this study is self-designed, multi-section survey i-e. Demographic information including age, sex, educational level, family financial status. The (SPSS) version 22.0 was used to examine the data that had been gathered. **Results:** According to the current study, there were 100 total respondents, and all of them were women. About 39% of respondents' fathers were illiterate or had just a middle level of education, 28% had graduated, 21% had a middle to metric level of education, and only 12% had a high level of education. About 54% of respondents' moms were illiterate or had just a middle level of education, 21% had graduated, 17% had a middle to metric level of education, and only 8% had a high level of education. **Conclusion:** The study comes to the conclusion that poverty is a growing problem today and that the number of individuals living in poverty is always rising. The research also showed a strong correlation between children's academic success and their parents' socioeconomic level.

INTRODUCTION

In order for civilization to advance, education is essential. If the populace of the community is well educated, the society may be more enlightened and well-disciplined. Families are primarily responsible for integrating kids so they can contribute positively to society [1]. Certainly, research on academic achievement is a topic that teachers, psychologists, policymakers, parents and guardians, social workers, and others are interested in. In their endeavor to understand what controls students' academic performance, researchers come up with more questions than solutions. Prior research has recently revealed the importance of family, schools, society, and motivation on learning outcomes [2]. A person is considered to be in poverty if they have more money or other quantitative resources than is normal or socially acceptable. When people lack the resources to satisfy their basic needs, poverty results [3]. Numerous studies have demonstrated that poverty in childhood, particularly persistent poverty, is associated with a number of significant inadequacies in adulthood. Wagmiller claims that these obstacles for poor children include low academic achievement and degree of schooling attained, health issues, and lower wellbeing (which includes self-worth and health) [4]. When compared to their peers who

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are in a secure economic position, those who have lived in poverty since childhood or for an extended length of time are more likely to be unemployed, earn less money, and be impoverished. Family income is a key component of socioeconomic status and is usually used to gauge poverty. Income has a significant impact on children's success, wellbeing, and conduct, and is closely related to results that are ability-related [5]. The growth of children is disturbed by socioeconomic shortcomings. Compared to temporary poverty, persistent poverty has more detrimental effects on socio-emotional growth, adequate cognitive functioning, and academic accomplishment [6]. Recent studies on the effects of poverty argue that the severity and duration of poverty have significant effects on academic achievement. Socioeconomic deprivation throughout the first five years of a child's life adversely affects scholastic success more than poverty during the transitional years between childhood and adolescence [7]. In comparison to children who never experienced resource deprivation, youngsters who persevered in deprived families scored 6 to 9 points worse on the various evaluations [8]. The severity of poverty has significant repercussions. Children from disadvantaged homes with incomes below 50% of the poverty level scored 7 to 12 points lower than those from near-poor families, while those from disadvantaged families with incomes between 50% and 100% of the poverty line scored 4 to 7 points lower [8, 9]. The purpose of this study is to assess the effects of family poverty on secondary school students' academic performance in District Faisalabad (Pakistan). Additionally, to assess the impact of parental resources, education, and occupation on children's academic achievement. Additionally, to pinpoint the essential elements or elements that may help explain why students who live in poverty struggle academically and to offer a feasible solution to improve these students' academic performance.

METHODS

A descriptive-quantitative study design was employed in this study. A self-administered questionnaire survey with close ended questions was designed to examine family's poverty, parent's educational level, parent's occupation level, availability of resources and secondary school academic achievement in District Faisalabad (Pakistan). The participants were selected by random sampling method from three different Government Secondary Schools in District Faisalabad (Pakistan). The study included Grade 6th, 7th, and 8th students were included in the questionnaire survey. The total number of questionnaires was 100 that school students filled out. In order to signify suitable sample, 50 students from rural government school and remaining 50 students from urban government schools were selected randomly. The questionnaire designed for this study is self-designed, multi-section survey i-e. Demographic information including age, sex, educational level, family financial status. For accessing the participant's poverty, family information such as parent education and occupation, house structure, sanitation, nutrition, academic materials, academia, household amenities, activities, and parental involvement are required. The questionnaire was carefully constructed based on various real surveys from other studies, modified for this research study, and evaluated by a supervisor. All of the recruits voluntarily completed the questionnaires. A letter of consent from the Head/Principal of school was allowed prior to the distribution of questionnaires. Verbal announcements in various classes were done to detail the subject, the goals of the study, and the questionnaire administration process. The gathered questionnaires Data was analyzed through the (SPSS) **version 22.0.** The results were tabulated in proportions and percentages (descriptive statistics, i-e. mean, SD and frequency) and chi square test was applied to measure the association of academic achievement of children with Socio-economic status(SES).

RESULTS

According to the current study, there were 100 responders in all, and 100 percent of them were women. A little more than half of respondents' parents had monthly incomes of 10,000 to 20,000, 22% had monthly incomes of 50,000 or more, 14% had monthly incomes of 20,000 to 30,000, and 13% had monthly incomes of 5,000 or less in PKR. Parents of respondents made up of about 22% of those with high SES, 12% of those with intermediate SES, and 66% of those with low SES. About 39% of respondents' fathers were illiterate or had just a middle level of education, 28% had graduated, 21% had a middle to metric level of education, and only 12% had a high level of education. Mothers of respondents made up almost 54% of those who were illiterate or had just a middle level of education, 21% of those who graduated from high school, 17% of those who had a middle to metric level of education, and only 8% of those who had a high level of education. A little over 16% of respondents reported great achievement, 38% reported moderate achievement, and 46% reported low achievement (Table 1).

Variables	Categories	Frequency (%)
Monthly income	50,000 or above	22 (22%)
	30,000 or above	11 (11%)
	20,000 and less than 30,000	14 (14%)
	10,000 and less than 20,000	40 (40%)
	5000 or less	13 (13%)

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Socioeconomic status	High SES	22 (22%)
	Middle SES	12 (12%)
	Lower SES	66 (66%)
Fathers' education	Middle	39 (39%)
	Middle to Matric	21 (21%)
	Intermediate to Graduation	28 (28%)
	Above graduation	12 (12%)
Mothers' education	Middle	54 (54%)
	Middle to Matric	17 (17%)
	Intermediate to Graduation	21 (21%)
	Above Graduation	8 (8%)
Marks Secured	High achievement (above 80%)	16
	Middle Achievement (60%-80%)	38
	Low Achievement (Below 60%)	46

Table 1: Demographic Characteristics of participants

Table 2 shows association between parents' socioeconomic status and academic achievement. Data show a strong connection between students' academic success and their parents' socioeconomic status (Table 2).

Socioeconomic background	Marks secured in class			Total
	High achievement	Middle achievement	Low achievement	
High SES	13	9	0	22
	59.1%	40.9%	0.0%	100.0%
Middle SES	3	5	4	12
	25.0%	41.7%	33.3%	100.0%
Low SES	0	24	42	66
	0.0%	36.4%	63.6%	100.0%
Total	16	38	46	100
	16.0%	38.0%	46.0%	100.0%

Table 2: Association between parents' socioeconomic status and academic achievement

Chi-square=51.83, D.F.=4, p-value=.000***, Gamma=.872

Table 3 shows association between father's education and academic achievement of teenagers. Data shows that there is a significant correlation between girls' academic success and their fathers' level of education

Father's education	Achievement			Total
	High achievement	Middle achievement	Low achievement	
Middle	0	10	29	39
	0.0%	25.6%	74.4%	100.0%
Middle to Matric	0	9	12	21
	0.0%	42.9%	57.1%	100.0%
Intermediate to graduation	10	14	4	28
	35.7%	50.0%	14.3%	100.0%
Above graduation	6	5	1	12
	50.0%	41.7%	8.3%	100.0%
Total	16	38	46	100
	16.0%	38.0%	46.0%	100.0%

Table 3: Association between father's education and academic achievement

Chi-square=45.08, D.F.=6, p-value=.000, Gamma=.761

Table 4 shows that mothers' education had a significant impact on children's academic success. Teenagers' academic performance was 20% more impacted by the mother's education level than by the father.

Mother's education	Achievement			Total
	High achievement	Middle achievement	Low achievement	
Middle	0	17	37	54
	0.0%	31.5%	68.5%	100.0%
Middle to Matric	2	8	7	17
	11.8%	47.1%	41.2%	100.0%
Intermediate to graduation	9	10	2	21
	42.9%	47.6%	9.5%	100.0%
Above graduation	5	3	0	8
	62.5%	37.5%	0.0%	100.0%
Total	16	38	46	100
	16.0%	38.0%	46.0%	100.0%

Table 4: Association between mother's education and academic achievement

Chi-square=46.38, D.F.=6, P-value=.000, Gamma=.798

DISCUSSION

According to the current study, there were 100 total respondents, and all of them were women. About 40% of respondents' parents had monthly incomes of 10,000 or less and less than 20,000, 22% had monthly incomes of 50,000 or more, 14% had monthly incomes of 20,000 or less and less than 30,000, and 13% had monthly incomes of 5000 or less. Approximately 22% of respondents' parents had a high SES, 12% had a middle SES, and 66% had a low SES. About 39% of respondents' fathers were illiterate or had just a middle level of education, 28% had graduated, 21% had a middle to metric level of education, and only 12% had a high level of education. About 54% of respondents' moms were illiterate or had just a middle level of education, 21% had graduated, 17% had a middle to metric level of education, and only 8% had a high level of education. As a result, there is a high correlation between children's socioeconomic position and academic accomplishment, with children with strong socioeconomic status performing better academically than those with poor socioeconomic level [10]. Students with both parents possessing college degrees are more likely to accomplish at the highest levels, according to studies linking parental education and socioeconomic status to student achievement. The results of a different study reached a similar conclusion: students with educated parents performed better on homogenous examinations than students with uneducated parents [11]. Kamal *et al.*, study revealed that Children with no functional disabilities had better reading skills. Mothers with a higher level of education made a significant positive contribution to their children's learning abilities. Children who were deprived of books in appropriate language had a negative impact on their reading abilities. Rich children were more likely to have good learning skills than poor children. Parents who

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did not attend their children's school to discuss their progress had a significant negative impact on their children's numeracy skills. In Punjab, Pakistan, parental involvement in various forms significantly improved children's reading and numeracy skills [12]. According to a 2012 study by Suleman *et al.*, children with a high socioeconomic status exhibit greater academic performance, whereas those with a low socioeconomic position exhibit subpar and subpar academic performance [13]. The findings are connected to earlier studies by Duke, (2000) [14] and Eamon, (2005), [15] who discovered a negative correlation between poor parental socioeconomic position and students' academic achievement since it prevents access to learning resources for the person. The findings are consistent with studies by Jeyne's (2002) and Eamon (2005), which revealed that poor socioeconomic position has significant detrimental effects on learners' ability to succeed in school because it prevents them from accessing essential resources and increases stress and anxiety at home [15, 16]. It is evident from Hawkes' (1975) study that educated parents frequently contribute to their children's academic achievement and educational advancement [17]. Davis-Kean, 2005 contends that parents with higher levels of education deliberately push their kids to have high standards for themselves. According to Peters & Mullis and Blau, Teenagers' academic performance was 20% more impacted by the mother's education level than by the father [19, 20].

CONCLUSIONS

The study's findings indicate that poverty is a growing problem today and that the number of individuals living in poverty is always rising. The degree of poverty indicates how dependent a person is on their things. Economic, emotional, intellectual, mystical, and physical resources might be included in the possessions or resources. It can also involve affiliations, mentors, social networks, and awareness of unspoken rules. The research also showed a strong correlation between children's academic success and their parents' socioeconomic level. In light of the findings of this study, there are some recommendations for the government and parents on how to support kids in their academic endeavors and how to lower secondary school failure rates. Given that poverty is predominantly a rural concern, government should try to develop rural societies. Since low socioeconomic status was discovered to have a significant negative impact on students' academic performance, it is strongly advised that unemployment be reduced. For the impoverished, scholarships, free books, and other supplies should be made available. Additionally, it is advocated that government action be taken to improve people's socioeconomic standing.

Conflicts of Interest

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REFERENCES

[1] Chemagosi MJ, Odongo BC, Aloka PJ. Influence of parenting style on involvement in the education of public preschool learners in Nandi Central Sub County, Nandi County, Kenya. International Journal of Education and Research. 2016 Jan; 4(1): 137-54.

[2] Ballane GP. Understanding of Self-Confidence in High School Students (Doctoral dissertation, Walden University). 2019. Availableat: https://www.proquest.com/openview/101f34b1adc146d907b23c5f52934d26/1?pq-origsite=gscholar&cbl=18750&diss=y.

[3] Ellis F and Freeman HA. Rural livelihoods and poverty reduction strategies in four African countries. Journal of development studies. 2004 Apr; 40(4): 1-30. doi: 10.1080/0022038041000167317 5.

[4] Wagmiller RL and Adelman RM. Childhood and intergenerational poverty: The long-term consequences of growing up poor. 2009. doi: 10.7916/D8MP5C0Z.

[5] Borghesi S and Vercelli A. Happiness and health: two paradoxes. Journal of Economic Surveys. 2012 Apr; 26(2): 203-33. doi: 10.1111/J.1467-6419.2010.00635.X.

[6] Goldfeld S, O'Connor E, O'Connor M, Sayers M, Moore T, Kvalsvig A, *et al.* The role of preschool in promoting children's healthy development: Evidence from an Australian population cohort. Early Childhood Research Quarterly. 2016 Apr; 35: 40-8. doi: 10.1016/j.ecresq.2015.11.001.

[7] Kent G, Pitsia V, Colton G. Cognitive development during early childhood: Insights from families living in areas of socio-economic disadvantage. Early Child Development and Care. 2018 Nov: 1863-1877. doi: 10.1080/03004430.2018.1543665.

[8] Turley RN. Is relative deprivation beneficial? The effects of richer and poorer neighbors on children's outcomes. Journal of Community Psychology. 2002 Nov; 30(6): 671-86. doi: 10.1002/JCOP.10033.

[9] Seccombe K. Families in poverty in the 1990s: Trends, causes, consequences, and lessons learned. Journal of Marriage and Family. 2000 Nov; 62(4): 1094-113. 10.1111/j.1741-3737.2000.01094.x.

[10] Lam G. A theoretical framework of the relation between socioeconomic status and academic achievement of students. Education. 2014 Mar; 134(3): 326-31. doi: 10.1002/MCO2.29.

[11] Azhar M, Nadeem S, Naz F, Perveen F, Sameen A.

DOI: https://doi.org/10.54393/pbmj.v6i02.846

Impact of parental education and socio-economic status on academic achievements of university students. European Journal of Psychological Research. 2014; 1(1): 1-9.

[12] Kamal A, Amjad N, Yaqoob U, Saud N, Ijaz M, Khan I, *et al.* Role of socioeconomic and parental involvement factors on children foundational learning skills based on MICS (2017–2018) data Punjab, Pakistan. Scientific Reports. 2022 Jun; 12(1): 1-3. doi: 10.1038/s41598-022-13540-3.

[13] Suleman Q, Aslam HD, Hussain I, Shakir M, Khan FU, Nisa Z. Effects of parental socioeconomic status on the academic achievement of secondary school students in karak district, pakistan. International Journal of Human Resource Studies. 2012 Oct; 2(4): 14-32. doi: 10.5296/ijhrs.v2i4.2511.

[14] Duke NK. For the rich it's richer: Print experiences and environments offered to children in very low-and very high-socioeconomic status first-grade classrooms. American Educational Research Journal. 2000 Jun; 37(2): 441-78. doi: 10.3102/00028312037002441.

[15] Eamon MK. Social-demographic, school, neighborhood, and parenting influences on the academic achievement of Latino young adolescents. Journal of Youth and Adolescence. 2005 Apr; 34: 163-74. doi: 10.1007/s10964-005-3214-x.

[16] Jeynes WH. Examining the effects of parental absence on the academic achievement of adolescents: The challenge of controlling for family income. Journal of Family and Economic Issues. 2002 Jun; 23: 189-210. doi: 10.1023/A:1015790701554.

[17] Hawkes GR and Taylor M. Power structure in Mexican and Mexican-American farm labor families. Journal of Marriage and the Family. 1975 Nov; 37(4): 807-11. doi: 10.2307/350833.

[18] Davis-Kean PE. The influence of parent education and family income on child achievement: the indirect role of parental expectations and the home environment. Journal of Family Psychology. 2005 Jun; 19(2): 294. doi: 10.1037/0893-3200.19.2.294.

[19] Peters HE, Mullis NC. The role of family income and sources of income in adolescent achievement. Consequences of growing up poor. 1997: 340-81.

[20] Blau DM. The effect of income on child development. Review of Economics and Statistics. 1999 May; 81(2): 261-76. doi: 10.1162/003465399558067.

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Original Article

Effect of pH and different Fermentation Time Intervals on the Production of Single Cell Proteins (SCPs) from Potato Peels

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ABSTRACT

Dried cells of microorganisms such as fungi, algae, and bacteria, known as Single-Cell Proteins (SCPs), are utilized as a source of protein supplements in animal feed or human food. These SCPs can be produced through the use of low-cost feedstocks and waste materials as sources of carbon and energy, which can be converted into biomass and concentrated proteins. **Objective:** To optimize the yield and growth of dry cell biomass through the manipulation of fermentation conditions. **Methods:** A batch fermentation process was used to produce dry cell biomass from a microorganism. Different pH values, fermentation times, and reactor configurations were tested, and the resulting biomass was analyzed for its protein content. **Results:** The maximum yield of dry cell biomass was achieved at pH 4.5, with a yield of 1.951 g/100 ml. The maximum dry biomass was achieved after 72 hours of fermentation, with a yield of 2.824 g/100 ml. The maximum yield of dry biomass was achieved with an Airlift fermenter at an aeration rate of 1.0 vvm and a temperature of 35°C for 72 hours, resulting in a yield of 5.452 g/L. The protein content of the dried cell biomass was found to be in the range of 45-55%. **Conclusions:** This study demonstrates that the yield and growth of dry cell biomass can be optimized by controlling the fermentation conditions, specifically pH, fermentation time, and reactor configuration. These findings may have implications for the industrial-scale production of dry cell biomass, as they offer insight into how to maximize yield and protein content.

INTRODUCTION

Developing countries can expand their economies by converting low-cost industrial and agricultural waste into valuable products using emerging scientific approaches [1]. Potato peel waste, which is generated due to increased consumption of manufactured edible potato products, can be converted into value-added compounds such as enzymes, biosorbents, biohydrogen, and biogas [2]. The global population is expected to reach 9.3 billion by 2050, and an increase in the standard of living will cause a 50% hike in protein demand and a 102% rise in demand for meat products [3]. Researchers all over the world are making efforts to control these issues by making technological progress [4]. One of the most beneficial approaches for protein production is the production of single-cell proteins (SCPs) from agricultural waste sources through fermentation [5]. SCPs are dried cells of microorganisms such as fungi, algae, and bacteria that are used as protein supplements in human foods or animal feeds [6]. By using cheap feedstock and waste products as a source of carbon and energy, microorganisms can produce biomass and protein concentrates [7]. Potatoes are one of the most important components of human nutrition and are produced in large quantities worldwide. Substantial amounts of potato waste are created due to its broad use in different food industries [8]. Potato peel waste, which accounts for 15-40% of the total weight of potatoes depending on the peeling process used, has zero worth as a by-product of potato-processing industries [9]. Potato peel waste can be utilized as an antioxidant in the food chain due to its large phenol content, partial flour

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substitute, and as a solid substrate in fermentation [10]. "Green chemistry" techniques can be used to extract polyphenols from potato peels, which can have both environmental and economic benefits [8]. However, further research is necessary to improve processing lines, including the investment of capital, use of energy, yield, nature of solvent, and integration, to produce cost-effective products at the industrial level [11].

METHODS

The process of fermentation was carried out in mix broth with different pH and fermentation time intervals to determine the effect of these factors on the production of SCP. The effect of different pH levels on the growth of single cell biomass was investigated by adjusting the pH of growth media at 4.5, 5, 5.5, 6, and 6.5. All the flasks were then plugged and autoclaved at 121 °C for 15 minutes. Afterward these flasks were inoculated by adding inoculum at 2% v/v and incubated at 35 °C for 3 days. After three days the biomass was harvested and dried for further study. All the experiments were carried out in triplicates. To study the influence of fermentation time period on the cell biomass growth, seven flasks of growth media were prepared and adjusted their pH at 5.5 with 1M HCl/ 1M NaOH. These media were then autoclaved for 15 minutes at 121 °C and inoculated with 2 ml of inoculum prepared from Rhizopus *oligosporous* subcultures. These media were incubated at 35 °C for further study. The biomass from each flask was collected after the gap of 24 hours for subsequent seven days through the process of filtration and both wet as well as dry weight of biomass was measured each time. All the experiments were carried out in triplicates. For determination of reducing sugars Benedict's quantitative test was used [12]. The crude protein of single cell protein was determined by the Kjeldhal procedure [13]. The total protein in the growth media was estimated by following the Lowrey method [14].

RESULTS

Different pH values (4.5, 5, 5.5, 6, 6.5) of fermented media were investigated to obtain best yield of Rhizopus oligosporous biomass. The results mentioned in Table 1, showed that best qauntity of dry biomass (1.048 g/100 ml) was yielded at pH of 5.5. The total crude protein produced was 45-55 %. The statistical analysis confirmed that the results of yield of dry biomass were significantly different at 4.5 pH ($p < 0.001$). The clustered bar graph respresnting the total dry biomass, biomass yield and consumed sugar of mix media at different pH was shown in Figure 1.

Sr. No.	Nitrogen Sources	Dry biomass (%) Mean ± SD	Consumed sugar (%) Mean ± SD	Biomass yield (g/g) Mean ± SD
1.	4.5	$1.95^{a} \pm 0.004$	$2.77^{d} \pm 0.004$	$0.71^{a} \pm 0.004$
2.	5	$1.01^{c} \pm 0.015$	$2.81^{c} \pm 0.003$	$0.36^{b} \pm 0.006$
3.	5.5	$1.05^{b} \pm 0.007$	$2.88^{a} \pm 0.005$	$0.36^{b} \pm 0.004$
4.	6	$0.71^{e} \pm 0.006$	$2.72^{e} \pm 0.009$	$0.26^{d} \pm 0.005$
5.	6.5	$0.90^{d} \pm 0.012$	$2.86^{b} \pm 0.005$	$0.31^{c} \pm 0.005.$
	Significance level (95%)	$p < 0.001$		

Means that do not share a letter are significantly different

Table 1: Effect of different pH value on the biomass growth

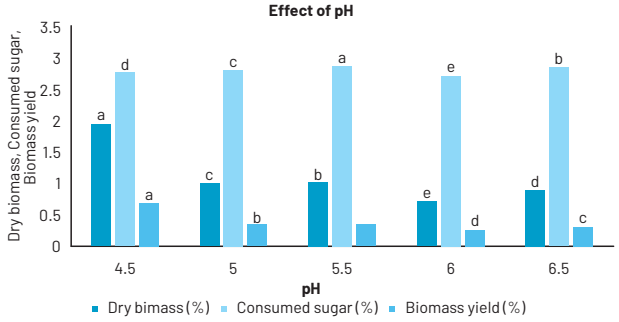

Figure 1: Effect of different pH levels on the total production of dry cell biomass and total sugar consumed in media

Seven flasks of mix media were inoculated to study the effect of different time periods on the process of fermentation. The biomass was harvested from each flask after 24 hours time intervals. The results of bioprotein yield obtained from different time period was shown in Table 2. The maximum dry biomass (2.824 g/100 ml) was obtained after three days of fermentation. The statistical study showed that dry cell biomass yield was significantly differenet at different time period ($p < 0.001$). The crude protein production after third day was not significantly different. The clustered bar graph respresnting the total dry biomass, biomass yield and consumed sugar of each medium was shown in Figure 2, while the variation in total crude protein content with respect to fermentation time period was depicted in Figure 3.

Sr. No.	Nitrogen Sources	Dry biomass (%) Mean ± SD	Consumed sugar (%) Mean ± SD	Biomass yield (g/g) Mean ± SD
1	0.26g ± 0.013	0.79d ± 0.019	0.33d ± 0.004	23.67c ± 0.501
2	0.48f ± 0.004	1.48c ± 0.004	0.33d ± 0.008	36.37b ± 0.39
3	2.82a ± 0.004	2.34b ± 0.007	1.21a ± 0.005	50.21a ± 0.615
4	1.28b ± 0.006	3.00a ± 0.006	0.43b ± 0.009	50.32a ± 0.142
5	1.16c ± 0.008	3.00a ± 0.009	0.39c ± 0.007	50.37a ± 0.072
6	1.02d ± 0.013	3.00a ± 0.006	0.34d ± 0.005	50.40a ± 0.043
7	0.98e ± 0.026	3.00a ± 0.005	0.33d ± 0.007	50.45a ± 0.046
	Significance level (95%)	P < 0.001		

Means that do not share a letter are significantly different in a column

Table 2: Effect of different fermentation periods on SCP production

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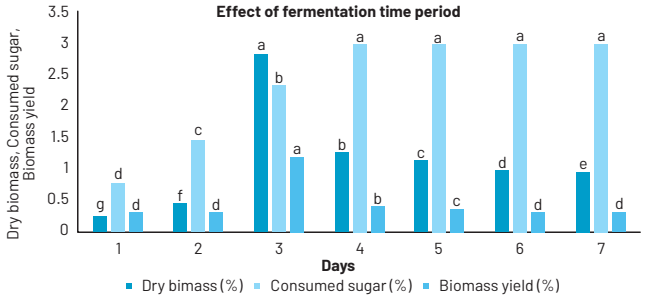

Figure 2: Effect of fermentation time period on the total dry cell biomass and consumed sugar as well as biomass yield

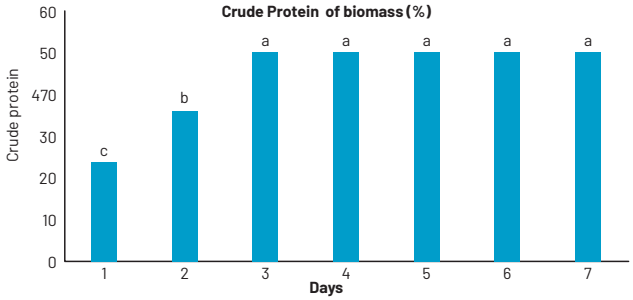

Figure 3: Crude protein variation with respect to the fermentation time period

DISCUSSION

The aim of this study was to investigate the effect of different pH values and fermentation time periods on the production of biomass. The study found that the best yield of dry biomass was obtained at pH 5.5, with a total crude protein produced ranging from 45-55%. The highest yield of dry biomass was achieved after three days of fermentation, with no significant difference in crude protein production after this point. The results of this study are consistent with previous research on the effect of pH on microbial growth. For example, a study by Qin *et al.*, found that the optimal pH for mycelial growth of *Rhizopus nigricans* was 5.5 [15]. Similarly, a study by Dinarvand *et al.*, reported that the maximum biomass production of *Aspergillus niger* was obtained at pH 5.5 [16]. The findings regarding the effect of fermentation time on biomass production are also consistent with prior research. For example, a study by Carboue *et al.*, (2012) found that the maximum biomass production of *Rhizopus oryzae* was achieved after three days of fermentation [17]. Similarly, a study by Zhu *et al.*, reported that the highest biomass yield of *Panus conchatus* was obtained after three days of fermentation [18]. However, the study did not investigate the effect of factors such as temperature or substrate concentration on biomass production, which could be important to consider in future research. Overall, the findings of this study suggest that pH and fermentation time are important factors to consider in the production of biomass. By optimizing these parameters, it may be possible to increase the yield of biomass and reduce the cost of protein-rich meals used as feed for animals, while minimizing environmental pollution [19, 20].

CONCLUSIONS

This research investigated various factors that impact the production of biomass from potato peels. Potato peels are a valuable substrate for producing single cell protein because they contain essential nutrients like sugar that microorganisms need to survive. To increase the yield of dry cell biomass, nitrogen can be added to the basic media. Moreover, using single cell protein from less expensive agro-industrial sources to feed animals can lower the cost of protein-rich animal feed, reduce waste, and decrease environmental pollution. Compared to traditional agricultural protein sources, single cell proteins offer a superior alternative.

Conflicts of Interest

The author declare no conflict of interest.

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REFERENCES

[1] Department of Economic and Social Affairs. World population projected to reach 9.7 billion by 2050. 2015. [Last cited: 20th Feb 2023]. Available from: https://www.un.org/en/desa/world-population-projected-reach-98-billion-2050-and-112-billion-2100.

[2] Javed A, Ahmad A, Tahir A, Shabbir U, Nouman M, Hameed A. Potato peel waste—its nutraceutical, industrial and biotechnological applications. AIMS Agriculture and Food. 2019 Sep; 4(3): 807-823. doi: 10.3934/agrfood.2019.3.807.

[3] Khan MK, Asif M, Razzaq ZU, Nazir A, Maan AA. Sustainable food industrial waste management through single cell protein production and characterization of protein enriched bread. Food Bioscience. 2022 Apr; 46: 101406. doi: 10.1016/j.fbio.2021.101406

[4] Sheikh RA, Al-Bar OA, Soliman YM. Biochemical studies on the production of biofuel(bioethanol)from potato peels wastes by Saccharomyces cerevisiae: effects of fermentation periods and nitrogen source concentration. Biotechnology & Biotechnological Equipment. 2016 May; 30(3): 497-505. doi: 10.1080/13102818.2016.1159527

[5] Reihani SF and Khosravi-Darani K. Influencing factors on single-cell protein production by submerged fermentation: A review. Electronic Journal of Biotechnology. 2019 Jan; 37: 34-40. doi: 10.1016/j.ejbt.2018.11.005

DOI: https://doi.org/10.54393/pbmj.v6i02.848

[6] Ritala A, Häkkinen ST, Toivari M, Wiebe MG. Single cell protein—state-of-the-art, industrial landscape and patents 2001–2016. Frontiers in Microbiology. 2017 Oct; 8: 2009. doi: 10.3389/fmicb.2017.02009
[7] Sindhu R, Binod P, Pandey A. Biological pretreatment of lignocellulosic biomass–An overview. Bioresource Technology. 2016 Jan; 199: 76-82. doi: 10.1016/j.biortech.2015.08.030
[8] Gaudino EC, Colletti A, Grillo G, Tabasso S, Cravotto G. Emerging processing technologies for the recovery of valuable bioactive compounds from potato peels. Foods. 2020 Nov; 9(11): 1598. doi: 10.3390/foods9111598
[9] Sepelev I and Galoburda R. Industrial potato peel waste application in food production: a review. Research for Rural Development. 2015 May; 1: 130-6.
[10] Food and Agriculture Organization of the United Nations. World Agriculture: towards 2015/2030. 2002. [Last Cited: 20th Feb 2023]. Available at: https://www.fao.org/3/y3557e/y3557e00.pdf.
[11] Delgado CL. Rising consumption of meat and milk in developing countries has created a new food revolution. The Journal of Nutrition. 2003 Nov; 133(11): 3907S-10S. doi: 10.1093/jn/133.11.3907S
[12] Hernández-López A, Sanchez Felix DA, Zuñiga Sierra Z, Garcia Bravo I, Dinkova TD, Avila-Alejandre AX. Quantification of reducing sugars based on the qualitative technique of Benedict. ACS Omega. 2020 Dec; 5(50): 32403-10. doi: 10.1021/acsomega.0c04467
[13] Sáez-Plaza P, Michałowski T, Navas MJ, Asuero AG, Wybraniec S. An overview of the Kjeldahl method of nitrogen determination. Part I. Early history, chemistry of the procedure, and titrimetric finish. Critical Reviews in Analytical Chemistry. 2013 Oct; 43(4): 178-223. doi: 10.1080/10408347.2012.751786
[14] Lowry OH, Rosebrough NJ, Farr AL, Randall RJ. Protein measurement with the Folin phenol reagent. Journal of Biological Chemistry. 1951; 193: 265-75. doi: 10.1016/S0021-9258(19)52451-6
[15] Qin G, Li G, Li P, Wang M, Hong X, Wang G. Optimization of fermentation process of exopolysaccharides from Rhizopus nigricans by response surface methodology. Mycosystema. 2019; 38(9): 1570-7.
[16] Dinarvand M, Rezaee M, Foroughi M. Optimizing culture conditions for production of intra and extracellular inulinase and invertase from Aspergillus niger ATCC 20611 by response surface methodology (RSM). Brazilian Journal of Microbiology. 2017 Jul; 48: 427-41. doi: 10.1016/j.bjm.2016.10.026
[17] Carboué Q, Tranier MS, Perraud-Gaime I, Roussos S. Production of microbial enzymes by solid-state fermentation for food applications. InMicrobial enzyme technology in food applications 2017 Mar: 437-451. doi: 10.1201/9781315368405-28
[18] Zhu M, Han Y, Hu X, Gong C, Ren L. Ergothioneine Production by Submerged Fermentation of a Medicinal Mushroom Panus conchatus. Fermentation. 2022 Aug; 8(9): 431. doi: 10.3390/fermentation8090431
[19] Mondal AK, Sengupta S, Bhowal J, Bhattacharya DK. Utilization of fruit wastes in producing single cell protein. International Journal of Science, Environment and Technology. 2012; 1(5): 430-8.
[20] Ismail S. Production of Single Cell Proteins (SCP) by Cupriavidus necator: Impact of environmental parameters, carbon and nitrogen sources (Doctoral dissertation, INSA de Toulouse). 2022. Available at: https://theses.hal.science/tel-03718434/.

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Original Article

Variations in Biochemical Parameters in Diabetic and Non-Diabetic Patients of Septicemia

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ABSTRACT

Septicemia is an infection caused by poisoning of blood by bacteria and is a prevalent disease in Pakistan. However, there is limited understanding of the pathogenesis of abnormal blood, liver and renal chemistry tests in septicemia. **Objective:** To determine variations in respective LFTs and RFTs and CBCs of diabetic and non-diabetic patients of septicemia. **Methods:** A descriptive, observational, cross-sectional research was directed, involving 101 participants diagnosed with septicemia. Study setting was Mayo Hospital Lahore. A specially designed Performa was used to record data, including liver function tests, renal function tests, and complete blood count for each patient. The data were analyzed using the latest version of SPSS. **Results:** In this study 45/101 patients of septicemia had diabetes. LFTs were also same for both non-diabetic and diabetic patients except Albumin which was low in diabetic patients but normal in non-diabetic patients. CBC were equally deranged in all diabetic and non-diabetic patients. **Conclusions:** This research provides important understandings into the variations of LFTs and RFTs and CBCs in diabetic and non-diabetic patients with septicemia. The findings suggest that while LFTs are similar between the two groups, there is a difference in albumin levels, highlighting the need for further investigation into the role of diabetes in septicemia.

INTRODUCTION

Septicemia, also known as sepsis, is a condition instigated by the regulation of toxicogenic microorganisms and their toxins in tissues or blood, leading to a systemic inflammatory response. It is commonly produced by infections caused by bacteria, such as Staphylococcus aureus, and sometimes occurs in combination with viral or fungal infections [1]. Septicemia has become increasingly common among hospitalized patients in recent decades and is a major cause of morbidity and mortality, particularly in infants with very low birth weight [2-4]. Symptoms of septicemia vary but commonly include fever, diarrhea, and vomiting. Low birth weight, prematurity, and complicated deliveries are among the risk factors associated with non-nosocomial infection sepsis [5, 6]. *Klebsiella* species and *Escherichia coli* are the most common organisms causing non-nosocomial infection sepsis, while *Klebsiella* is the most common cause of nosocomial sepsis [6, 7]. Contaminated intravenous lines are a common cause of septicemia and are normally located at the lungs and urinary tract [8]. Diabetes is listed as a comorbidity in many hospitalizations, and adult respiratory distress syndrome is associated with septicemia and worsens prognosis [7, 9].

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Septicemia can be diagnosed using blood culture to isolate the microbial causative agents [10-12]. Septicemia is a common clinical condition in hospitals worldwide, with reported rates varying by age, gender, and race. In the United States, septicemia causes over 34,000 deaths per year and is more common among elderly patients and the Black population [13]. In India, septicemia is encountered in most hospitals, and in Pakistan, it is a leading cause of hospital mortality [5, 14]. Hence, septicemia is a serious condition that can have severe consequences, particularly in vulnerable populations such as infants and the elderly. There is a less human health awareness related to septicemia and its relation to diabetes. This study is aimed to enhance health awareness and avoid common pitfalls in the evaluation of septicemia. It is important to identify and treat it promptly to improve patient outcomes.

METHODS

The research design of this study was observational, descriptive, cross-sectional study. Sample size was 101 participants diagnosed with septicemia. Study setting was accidental and medical wards of Mayo Hospital Lahore. The study included patients over the age of 30 years and excluded children, pregnant, and lactating women. The aim of the study was to observe the variations in RFTs, LFTs, and CBC of patients at the time of presentation by conducting careful examinations of the patients. Prior consent was obtained from the patients or their guardians, and all ethical considerations were taken into account during data collection. Ethical approval was taken by the Ethical Consideration board of KEMU. A specially designed Performa was used to record data, involving renal function tests, complete blood count and liver function tests for each patient. The data were analyzed using the latest version of SPSS.

RESULTS

Table 1 shows variations in RFTs in diabetic and non-diabetic patients of septicemia. Diabetes is a major risk factor of septicemia. In this study 45/101 patients of septicemia had diabetes (Table 1).

Diabetes status	Bilirubin			B. Glucose			B. Urea			Creatinine			Na+			K+			TOTAL
	L	N	h	L	N	h	L	N	h	L	N	h	L	N	h	L	N	h	
Diabetic	0	36	9	0	5	40	0	9	36	4	14	27	17	25	3	5	40	0	45
Non-Diabetic	0	47	9	7	33		0	20	36	15	16	25	25	29	2	7	47	2	56
TOTAL	0	83	18	7	38	56	0	29	72	19	30	52	42	54	5	12	87	2	101

Table 1: Variations in RFTs in patients of septicemia with and without diabetes

Table 2 shows variations in LFTs in patients of septicemia with and without diabetes. LFTs were also same for both type of patients except Albumin which was low in diabetic patients but normal in non-diabetic patients (Table 2).

Diabetes status	ALT			AST			ALP			Albumin			T. Protein			TOTAL
	L	N	h	L	N	h	L	N	h	L	N	h	L	N	h	
Diabetic	0	31	14	0	27	18	0	0	45	27	18	0	2	43	0	45
Non-Diabetic	0	32	24	0	23	33	0	1	55	18	38	0	1	55	0	56
TOTAL	0	63	38	0	50	51	0	1	100	45	56	0	3	98	0	101

Table 2: Variations in LFTs in patients of septicemia with and without diabetes

Table 3 shows variations in CBC in patients of septicemia with and without diabetes. RFTs and CBC were equally deranged in all diabetic and non-diabetic patients (Table 1, 3).

Diabetes status	WBC			Platelets			TOTAL	Hemoglobin Male			TOTAL	Hemoglobin Male			TOTAL
	L	N	h	L	N	h		L	N	h		L	N	h	
Diabetic	0	5	40	18	27	0	45	21	3	0	24	15	3	3	21
Non-Diabetic	0	11	45	19	32	5	56	22	5	0	27	21	8	0	29
TOTAL	0	16	85	37	59	5	101	43	8	0	51	36	11	3	50

Table 3: Variations in CBC in Diabetic and Non-Diabetic patients of septicemia

DISCUSSION

Septicemia is a serious and life-threatening condition that requires prompt diagnosis and treatment. In this study, the researchers aimed to determine the cause and etiology of septicemia in patients presenting to the medical wards and Accident & Emergency Department of Mayo Hospital Lahore. The study found that diabetes is a major risk factor for septicemia, as 45 out of 101 patients in the study had diabetes. The study also found that renal and liver function tests were similarly deranged in both diabetic and non-diabetic patients, while albumin was low in diabetic patients but normal in non-diabetic patients. These findings are consistent with previous studies that have shown a high prevalence of diabetes in

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patients with sepsis. A systematic review and meta-analysis of 26 studies by Liu *et al.*, (2020) found that diabetes was associated with an increased risk of sepsis and septic shock [15]. Another study by Umpierrez *et al.*, (2002) found that patients with diabetes had a higher risk of developing severe sepsis and septic shock and were more likely to require ICU admission and mechanical ventilation [16]. The finding that liver and renal function tests were similarly deranged in both diabetic and non-diabetic patients is also consistent with previous studies. A study by Martin *et al.*, (2003) found that patients with diabetes had higher rates of acute kidney injury and liver dysfunction compared to non-diabetic patients, but there was no significant difference in the severity of these complications between the two groups [17]. The finding of low albumin levels in diabetic patients with septicemia is also supported by previous studies. A study by Jaar *et al.*, found that low serum albumin levels were associated with increased mortality in patients with sepsis, and that this association was stronger in patients with diabetes [18]. The study has some limitations, including its small sample size and the fact that it was conducted at a single center. Future studies with larger sample sizes and conducted at multiple centers are needed to confirm these findings and provide a more comprehensive understanding of the relationship between diabetes and septicemia. In conclusion, this study found that diabetes is a major risk factor for septicemia, and that renal and liver function tests are similarly deranged in both diabetic and non-diabetic patients. However, albumin levels were lower in diabetic patients compared to non-diabetic patients. These findings are consistent with previous studies and highlight the need for early recognition and aggressive management of septicemia in patients with diabetes [19, 20].

CONCLUSIONS

Septicemia is a serious condition that can have severe consequences, particularly in vulnerable populations such as infants and the elderly. Diabetes is a significant risk factor for septicemia. This research offers important information about variations of LFTs and RFTs and CBCs in diabetic and non-diabetic patients with septicemia. The findings suggest that while LFTs are similar between the two groups, there is a difference in albumin levels, highlighting the need for further investigation into the role of diabetes in septicemia.

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Grant WB. Solar ultraviolet-B irradiance and vitamin D may reduce the risk of septicemia. Dermato-Endocrinology. 2009 Jan; 1(1): 37-42. doi: 10.4161/derm.1.1.7250.

[2] Elixhauser A, Friedman B, Stranges E. Septicemia in US hospitals, 2009: statistical brief# 122. Healthcare Cost and Utilization Project (HCUP) statistical briefs. Rockville: Agency for Health Care Policy and Research. 2006 Feb.

[3] Fanaroff AA, Korones SB, Wright LL, Verter J, Poland RL, Bauer CR, *et al.* Incidence, presenting features, risk factors and significance of late onset septicemia in very low birth weight infants. The Pediatric Infectious Disease Journal. 1998 Jul; 17(7): 593-8. doi: 10.1097/00006454-199807000-00004.

[4] Vinod Kumar CS and Neelagund YF. Incidence and antifungal susceptibility of Candida species in neonatal septicemia. The Journal of Communicable Diseases. 2004 Sep; 36(3): 182-6.

[5] Alam MS, Pillai PK, Kapur P, Pillai KK. Antimicrobial therapy and outcome of septicemia patients admitted to a University Hospital in Delhi. Arzneimittelforschung. 2012 Mar; 62(03): 117-22. doi: 10.1055/s-0031-1298005.

[6] Bhutta ZA, Naqvi SH, Muzaffar T, Farooqui BJ. Neonatal sepsis in Pakistan: Presentation and pathogens. Acta Pædiatrica. 1991 Jun; 80(6-7): 596-601. doi: 10.1111/j.1651-2227.1991.tb11916.x.

[7] McBean M and Rajamani S. Increasing rates of hospitalization due to septicemia in the US elderly population, 1986–1997. The Journal of Infectious Diseases. 2001 Feb; 183(4): 596-603. doi: 10.1086/318526.

[8] Matsumoto S, Suenaga H, Naito K, Sawazaki M, Hiramatsu T, Agata N. Management of suspected nosocomial infection: an audit of 19 hospitalized patients with septicemia caused by Bacillus species. Japanese Journal of Infectious Diseases. 2000 Oct; 53(5): 196-202.

[9] Azoulay G, Henry JF, Forette F, Berthaux P, Acar JF. Septicemia in the elderly (author's transl). La Nouvelle Presse Medicale. 1977 Oct; 6(34): 3075-6.

[10] Aksnes J, Abdelnoor M, Berge V, Fjeld NB. Risk factors of septicemia and perioperative myocardial infarction in a cohort of patients supported with intra-aortic balloon pump (IABP) in the course of open heart surgery. European Journal of Cardio-Thoracic Surgery. 1993 Mar; 7(3): 153-7. doi: 10.1016/1010-7940(93)90039-E.

[11] Malinovskiĭ NN, Reshetnikov EA, Shipilov GF, Tsibin VI. Diagnostika i lechenie sepsisa [Diagnosis and

DOI: https://doi.org/10.54393/pbmj.v6i02.850

treatment of septicemia]. Khirurgiia (Mosk). 1992 Jul; 7: 3-8.

[12] Ng PC, Ang IL, Chiu RW, Li K, Lam HS, Wong RP, *et al.* Host-response biomarkers for diagnosis of late-onset septicemia and necrotizing enterocolitis in preterm infants. The Journal of Clinical Investigation. 2010 Aug; 120(8): 2989-3000. doi: 10.1172/JCI40196.

[13] Melvan JN, Siggins RW, Bagby GJ, Stanford WL, Welsh DA, Nelson S, *et al.* Suppression of the stem cell antigen-1 response and granulocyte lineage expansion by alcohol during septicemia. Critical Care Medicine. 2011 Sep; 39(9): 2121-30. doi: 10.1097/CCM.0b013e31821e89dc.

[14] Tariq M, Jafri W, Ansari T, Awan S, Ali F, Shah M, *et al.* Medical mortality in Pakistan: experience at a tertiary care hospital. Postgraduate Medical Journal. 2009 Sep; 85(1007): 470-4. doi: 10.1136/pgmj.2008.074898.

[15] Liu J, Xie H, Ye Z, Li F, Wang L. Rates, predictors, and mortality of sepsis-associated acute kidney injury: a systematic review and meta-analysis. BMC Nephrology. 2020 Dec; 21: 1-6. doi: 10.1186/s12882-020-01974-8.

[16] Umpierrez GE, Isaacs SD, Bazargan N, You X, Thaler LM, Kitabchi AE. Hyperglycemia: an independent marker of in-hospital mortality in patients with undiagnosed diabetes. The Journal of Clinical Endocrinology & Metabolism. 2002 Mar; 87(3): 978-82. doi: 10.1210/jcem.87.3.8341.

[17] Martin GS, Mannino DM, Eaton S, Moss M. The epidemiology of sepsis in the United States from 1979 through 2000. New England Journal of Medicine. 2003 Apr; 348(16): 1546-54. doi: 10.1056/NEJMoa022139.

[18] Jaar BG, Hermann JA, Furth SL, Briggs W, Powe NR. Septicemia in diabetic hemodialysis patients: comparison of incidence, risk factors, and mortality with nondiabetic hemodialysis patients. American Journal of Kidney Diseases. 2000 Feb; 35(2): 282-92. doi: 10.1016/S0272-6386(00)70338-6.

[19] Powe NR, Jaar B, Furth SL, Hermann J, Briggs W. Septicemia in dialysis patients: incidence, risk factors, and prognosis. Kidney International. 1999 Mar; 55(3): 1081-90. doi: 10.1046/j.1523-1755.1999.0550031081.x.

[20] Saxena AK, Panhotra BR, Naguib M, Sundaram DS, Venkateshappa CK, Uzzaman W, *et al.* Outcome of dialysis access-related septicemia among diabetics following optimized AV-fistula placement. Kidney and Blood Pressure Research. 2002 Jul; 25(2): 109-14. doi: 10.1159/000063517.

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Dietary Modifications in Patients with Polycystic Ovary Syndrome: A Public Health Concern

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Occasional periods or no menstrual periods at all are typical symptoms of polycystic ovarian syndrome (PCOS). It is due to an excessive synthesis of the hormone androgens, people with PCOS frequently have numerous ovarian cysts [1]. According to literature between 33 and 83 percent of women with PCOS who are overweight or obese shows signs of acne, hirsutism, and male pattern baldness and if not managed high blood pressure, cardiovascular diseases and endometrial cancer. Insulin levels in PCOS patients are frequently reported to be higher than usual. The pancreas is where hormone insulin is made [2]. It works with the body's cells in converting sugar (glucose) into energy. The sugar levels in blood may increase if your body doesn't create enough insulin [3]. This can also occur when you develop insulin resistance, which prevents you from adequately using the insulin that you do make [4]. The body may try to produce excessive amounts of insulin if you develop insulin resistance in an effort to maintain normal blood sugar levels. Your ovaries may start to create more androgens like testosterone if your insulin levels are too high [5]. The obese and overweight according to BMI can cause the insulin resistance [6]. Due to their insulin resistance, people with PCOS typically deal with this issue, which can keep reduced weight more challenging [7]. It could be more challenging to regulate insulin resistance and, as a result, weight reduction if you eat a diet high in refined carbs, which including starchy and sugary meals [8].

Dietary modifications in PCOs

The use Carbohydrates: It is a primary source of energy that can be added to their which can reduce symptoms PCOS and balance their hormonal level. Give a low carbohydrate, high saturated fatty acid diet for at least 2 months to infertile and overweight women, their BMI drop, and ovulation process maintain and increase fertility [9-11].

The use of Protein: The protein is very like carbohydrates and fats so added in their diet as healthy protein sources and improve their insulin sensitivity and reduce their weight good source of protein whey protein that can be added to their diet and that can give 35 g of that supplements and after 7 days check their GLUT 4 response, that is an insulin-stimulated transporter and that was regulate glucose level and insulin level so whey protein helpful in alleviate PCOS symptoms [12].

The use of Fats and Oils: The diet related to saturated fats can cause dyslipidemia and then HDL level decreases and increase cholesterol and LDL level. Apo lipoprotein B increases because of insulin resistance and causes imbalance in androgens and corticosteroids hormones level and increase estrogen secretion. Healthy options of diet like monounsaturated fatty acids and poly unsaturated fatty acids like almonds and walnuts improve ovulation [13].

The use of Micronutrients: The utilization of vitamin D can be helpful in reproductive function and in insulin sensitivity. Inositol, folate, folic acid omega 6 fatty acid and omega 3 fatty acid added in their diet that can improve menstrual problems balance their hormonal level. Glycyrrhizin, vitamin Selenium and catechin effective in lowering testosterone level influence

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proinflammatory state in PCOS[14].

Conflicts of Interest

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REFERENCES

[1] Witchel SF, Oberfield SE, Peña AS. Polycystic ovary syndrome: pathophysiology, presentation, and treatment with emphasis on adolescent girls. Journal of the Endocrine Society. 2019 Aug; 3(8): 1545-73. doi: 10.1210/js.2019-00078.

[2] Williams T, Mortada R, Porter S. Diagnosis and treatment of polycystic ovary syndrome. American Family Physician. 2016 Jul; 94(2): 106-13.

[3] John A, Ali A, Shaheen M, Akram M. Thyroid Volume Measurements in Normal Adult Females of Gujrat, Pakistan. Pakistan BioMedical Journal. 2022 Apr; 5(4): 158-61. doi: 10.54393/pbmj.v5i4.374.

[4] Shahzad H, John A, Ali A, Ashraf A, Naeem MA. Incidence of infertility in females and Evaluation of its Causes Using Ultrasonography. Pakistan BioMedical Journal. 2022 Apr; 5(4): 55-58. doi: 10.54393/pbmj.v5i4.342.

[5] Pervaiz S, Naeem MA, Ali A, John A, Batool N. Frequency of Uterine Anomalies Associated with Persistent Miscarriages in Pregnancy on Ultrasound. Pakistan Journal of Health Sciences. 2022 Jun; 3(1): 55-58. doi: 10.54393/pjhs.v3i01.54.

[6] Gill A, John A, Iqbal N, Faridi TA, Noor S. Assessment of biochemical profile among patients of Microbiological Quality Assessment of Bakery Products Available in Lahore, Pakistan. Diet Factor (Journal of Nutritional & Food Sciences). 2020 Jun; 1(1): 24-9. doi: 10.54393/df.v1i01.1.

[7] Qaiser H, John A, Ali A, Bano S, Ashfaq N. Evaluation of Pregnancies with Pre-existing Hypertension and Diabetes. Diet Factor (Journal of Nutritional & Food Sciences). 2022 Jun; 3(1): 10-13. doi: 10.54393/df.v3i1.44.

[8] Liepa GU, Sengupta A, Karsies D. Polycystic ovary syndrome (PCOS) and other androgen excess-related conditions: can changes in dietary intake make a difference? Nutrition in Clinical Practice. 2008 Feb; 23(1): 63-71. doi: 10.1177/011542650802300163.

[9] Love JG, McKenzie JS, Nikokavoura EA, Broom J, Rolland C, Johnston KL. The experiences of women with polycystic ovary syndrome on a very low-calorie diet. International Journal of Women's Health. 2016 Jul; 8: 299-310. doi: 10.2147/IJWH.S100385.

[10] Sedighi S, Akbari SA, Afrakhteh M, Esteki T, Majd HA, Mahmoodi Z. Comparison of lifestyle in women with polycystic ovary syndrome and healthy women. Global journal of Health Science. 2015 Jan; 7(1): 228. doi: 10.5539/gjhs.v7n1p228.

[11] Zhang X, Zheng Y, Guo Y, Lai Z. The effect of low carbohydrate diet on polycystic ovary syndrome: a meta-analysis of randomized controlled trials. International Journal of Endocrinology. 2019 Nov; 2019: 4386401. doi: 10.1155/2019/4386401.

[12] Mehrabani HH, Salehpour S, Amiri Z, Farahani SJ, Meyer BJ, Tahbaz F. Beneficial effects of a high-protein, low-glycemic-load hypocaloric diet in overweight and obese women with polycystic ovary syndrome: a randomized controlled intervention study. Journal of the American College of Nutrition. 2012 Apr; 31(2): 117-25. doi: 10.1080/07315724.2012.10720017.

[13] Foroozanfard F, Rafiei H, Samimi M, Gilasi HR, Gorjizadeh R, Heidar Z, et al. The effects of dietary approaches to stop hypertension diet on weight loss, anti-Müllerian hormone and metabolic profiles in women with polycystic ovary syndrome: a randomized clinical trial. Clinical Endocrinology. 2017 Jul; 87(1): 51-8. doi: 10.1111/cen.13333.

[14] Hager M, Nouri K, Imhof M, Egarter C, Ott J. The impact of a standardized micronutrient supplementation on PCOS-typical parameters: a randomized controlled trial. Archives of Gynecology and Obstetrics. 2019 Aug; 300: 455-60. doi: 10.1007/s00404-019-05194-w.