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Knowledge, consumption pattern of ultra-processed foods and beverages and anthropometric status of students of Abia State Polytechnic, Aba

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ABSTRACT: The cross-sectional study examined knowledge and consumption patterns of ultra-processed foods and beverages and the anthropometric status of students of Abia State Polytechnic, Aba. Structured and validated questionnaires were used to obtain data from the students. Standard procedures were followed in taking anthropometric measurements, which were compared to reference values. Data collected were coded and analysed with IBM SPSS version 25. Frequencies and percentages were used to analyse data on personal information, knowledge and consumption patterns of those foods, while Pearson correlation was used to relate consumption patterns and anthropometric status. Results indicated that 53.5%, 34.2% and 12.3% had good, average and poor knowledge of ultra-processed foods and beverages, respectively. Biscuits/cookies (20.5%), breakfast cereals (16.8%) and carbonated soft drinks (22.7%) were consumed once daily by the students. Anthropometric status showed that 45.9%, 18.6% and 18.2% were underweight, overweight and obese, respectively. A moderate negative significant relationship (r=-.477, P=.000) existed between biscuits/cookies consumption and normal weight. Breakfast cereals exhibited a weak negative significant relationship with normal weight (r=-.272, P=.000), a weak positive significant relationship with overweight (r=.189, P=.000) and obesity (r=.201, P=.000). Carbonated soft drinks intake showed a weak negative significant relationship with normal weight (r=-.182, P=.007) and a moderate positive significant relationship with overweight (r=.314, P=.007). This showed that frequent consumption of ultra-processed foods and beverages leads to weight gain, which may subsequently affect overall health.

Keywords: Nutrition transition, consumption pattern, knowledge and ultra-processed foods.

INTRODUCTION

Globally, there has been rapid change in diets of people in what is now known as the nutrition transition. This is driven largely by economic growth, the industrialisation of food systems and globalisation of food corporations. This has paved the way for diets that are too high in free sugars, refined starches, salt and unhealthy fats (Baker *et al*., 2020). As a result, traditional diets based on whole and minimally processed staples and freshly prepared meals are often being replaced by nutrient-poor unhealthy diets dominated by ultra-processed foods and beverages (UPFs and B) (United Nations International Children's Fund (UNICEF), 2025).

Ultra-processed foods and beverages are formulations of ingredients made by a series of industrial processes, which often require sophisticated equipment and technology. Some of these processes are fractioning of whole foods into substances, chemical modifications of these substances, assembly of unmodified and modified food substances using extrusion, molding and pre-frying (Monteiro *et al*., 2019a). Additives such as emulsifiers, emulsifying salts, thickeners, foaming, anti-foaming, bulking, carbonating, gelling and glazing agents are incorporated to make the final products palatable or hyper-palatable. The additives disguise unpleasant sensory properties created by the ingredients. They also override satiety signals, disturb the gut microbiome and/or

contribute to chronic inflammation (Rondinella *et al*., 2025; Asensi *et al*., 2023). The other additives, such as preservatives, artificial colours and flavours and sweeteners, may also have harmful effects on children and adolescents (Warner, 2024). Peculiar ingredients used in UPFs and B are varieties of sugars (fructose, high-fructose corn syrup, fruit juice concentrates, invert sugar, maltodextrin, dextrose, lactose), modified oils (hydrogenated or interesterified oils) and sources of protein (hydrolysed proteins, soya protein isolate, glutein, casein, whey protein and mechanically separated meat). Also, sophisticated packaging, usually with plastic and other synthetic materials, is used for the manufacture of UPFs and B (Monteiro *et al*., 2019a). Some examples of UPFs and B are packaged biscuits or cookies, jam, sauces, ice cream, chocolates, packaged candies (confectionery), margarine, infant formula, corned beef, hot dogs, burgers, noodles, pizza, French fries or chips, packaged plantain or potato chips, breakfast cereals, carbonated soft drinks, cocoa drinks/beverages, malt drinks, distilled spirits (Monteiro *et al*., 2019a).

Manufacturers of these UPFs and B employ persuasive and aggressive marketing strategies such as visually appealing packaging, misleading health and nutrition claims, emotionally appealing advertising campaigns and promotional offers. These are designed to build brand loyalty, encourage repeat purchases and increase intake (Monteiro *et al*., 2018). Excessive consumption of these UPFs and B displaces whole, minimally processed nutritious and healthy diets. According to the United Nations Children's Fund (2025), a nutritious and healthy diet contains a variety of nutritious and healthy foods and is low in or free from unhealthy foods and beverages. It supplies adequate amounts of vitamins and minerals, protein, unrefined carbohydrates, healthy fats, fibre and other health-promoting substances. It balances energy intake with energy requirements, supports the growth and development of children and adolescents and provides protection from all forms of malnutrition and diet-related non-communicable diseases. In contrast, a nutrient-poor, unhealthy diet contains excessive quantities of unhealthy foods and beverages and is low in or lacks nutritious and healthy foods. Such diet often contain inadequate amounts of essential vitamins and minerals, protein, fibre, and other health-promoting substances and provide excessive energy. It increases the risk of all forms of malnutrition (stunting, wasting, underweight, micronutrient deficiencies and overweight and obesity) as well as diet-related non-communicable diseases (NCDs) (UNICEF, 2025).

A higher consumption of UPFs and B is associated with overweight and obesity prevalence among children, adolescents and adults. Globally, overweight and obesity prevalence has been on the increase as 8% of children and adolescents aged 5-19 years are obese in 2022 compared with 3% in 2000. In 2022, 42% of all overweight children and adolescents aged 5-19 years are obese (163 million out of 391 million), up from 30% in 2000 (58 million out of 194 million). Between 2000 and 2022, the global prevalence of overweight almost doubled among adolescents aged 15-19 years (9% to 16%) (UNICEF, 2025). The global prevalence of adult obesity rose from 12.1% in 2012 to 15.8% in 2022. In Western Africa and Nigeria, the prevalence of adult obesity in 2022 was 11.6% and 12.4%, respectively (Food and Agriculture Organisation, International Fund for Agricultural Development, United Nations Children's Fund, World Food Programme and World Health Organisation (FAO, IFAD, UNICEF, WFP & WHO), 2025). In 2025, the global prevalence of obesity among school-aged children and adolescents has overtaken that of underweight (9.4% versus 9.2%) (UNICEF, 2025). In Nigeria, among women of reproductive age (WRA), the prevalence of overweight and obesity was 15-19 years (4.1% versus 1.6%) and 20-29 years (13.2% versus 5.2%) (Federal Government of Nigeria & International Institute for Tropical Agriculture (FGoN and IITA), 2024).

Recent evidence also links consumption of UPFs and B with cardiometabolic risk factors such as abdominal obesity, elevated blood pressure and triglycerides, low-density lipoprotein cholesterol and fasting blood glucose (Petridi *et al*., 2024; De Amicis *et al*., 2022; Farhangi *et al*., 2020; Calcaterra *et al*., 2023; Nguyen *et al*., 2023). According to Cascaes *et al*. (2023), high intake of UPFs and B is associated with greater dental caries in children and adolescents. Studies have also reported links between diets high in UPFs and B and poor mental health such as anxiety, depression, aggressive behaviour and suicidal behaviour among children and adolescents (Reales-Moreno *et al*., 2022; Pengpid and Peltzer, 2019; Shi *et al*., 2020; Liu *et al*., 2022).

This growing problem of overweight and obesity is closely linked with shifting dietary patterns among children, adolescents and young adults. Unhealthy diets, which have been a concern in high-income countries for decades, are now serious public health issues in low- and middle-income countries. This is primarily because the food environment has become increasingly dominated by ultra-processed, energy-dense and nutrient-poor foods and beverages (UNICEF, 2025). Consequently, the diets of children and adolescents are shaped by what foods and beverages are available and affordable in retail settings and schools (Raza *et al*., 2020). Data from the Gallup World Poll suggests that older adolescents are more likely to exceed the World Health Organisation guidance on sugar intake if they consume a single soft drink or more than one sugary food or beverage and are more likely to exceed the WHO guidance on salt intake if they consume more than one salty processed food (Herforth *et al*., 2025). Globally, 60% of adolescents consumed more than one sugary food/beverage during the previous day, 32% consumed soft drinks, and 25% consumed more than one salty processed food during the previous day (UNICEF, 2025).

As has already been discussed, shifts in dietary

patterns, largely driven by the food environment, shape what children, adolescents and adults consume. Food environments are the spaces in which people make decisions about the food they procure, prepare and consume (UNICEF and GAIN, 2019). In addition to that, knowledge about foods plays a crucial role in the choice of what to consume. Such knowledge constitutes the personal food environment, which represents the individual and household-level factors that influence the accessibility, affordability, convenience and desirability of different food and beverage options (UNICEF, 2025). According to Monteiro *et al*. (2019b), most of the time, it may be unclear if some food products are ultra-processed or not. In such situations, it becomes pertinent to examine the ingredient labels that by law must be included in pre-packaged food and drink products.

Anthropometry is the scientific study of human body measurements and proportions. Measurement techniques in anthropometry use various methods to capture the dimensions and proportions of the human body (Jones, 2023). Direct measurements involve the use of callipers, tapes, scales, etc., to take precise linear and circumferential dimensions of different body parts. Medical and health care anthropometry is essential in clinical settings where baseline data for growth monitoring, nutritional assessment and disease management are carried out (Jones, 2023). Additionally, in field studies, some measurements such as weight, height, circumferences, etc. can also be carried out.

The persistent rise in the prevalence of overweight and obesity, coupled with the food environment being increasingly dominated by ultra-processed, energy-dense and nutrient-poor foods and beverages, necessitates evidence-based data. Few studies have been carried out on the link between knowledge, consumption of UPFs, and anthropometric status of undergraduates in Abia State. To the authors' knowledge, none have been specifically done in Abia State Polytechnic, Aba. Additionally, undergraduates often live away from home and may lack access to home-prepared meals. As a result, they may opt for available foods and drinks on campus and in its environs. Moreover, some of these students are still adolescents who are largely influenced by peers, particularly in their dietary habits. Therefore, the level of independence available to them may largely influence their lifestyle choices. Consequently, an insight into how knowledgeable these students are about these food and drink products and the frequency of their intake is very crucial. Thus, the study was designed to ascertain knowledge and consumption patterns of ultra-processed foods and beverages and the anthropometric status of undergraduates of Abia State Polytechnic, Aba.

MATERIALS AND METHODS

Study design and area

The study was a cross-sectional descriptiv e study carried out among undergraduate students of Abia State Polytechnic, Aba. Aba is a city in Southeastern Nigeria and the commercial centre of Abia State. Upon the creation of Abia State in 1991, the old Aba Township was divided into two local government areas, being Aba South and Aba North, while the suburban neighbourhood of what was then known as Obioma Ngwa L.G.A. was divided into three L.G.A.s (namely Osisioma Ngwa, Obingwa and Ugwunagbo) for administrative convenience (Okechukwu, 2022; Nwachukwu, 2021). Aba lies along the west bank of the Aba River and is at the intersection of roads leading to Port Harcourt, Owerri, Umuahia, Ikot Ekpene and Ikot-Abasi (Hoiberg, 2010). The city became a collection point for agricultural products following the construction of a British-made railway running through it to Port Harcourt. Aba is a major urban settlement and commercial centre in its region, which is surrounded by small villages and towns. The indigenous people of Aba are the Ngwa. Aba is well known for its craftsmen and is the most populous city in Southeastern Nigeria. The Abia State Polytechnic, Aba was established by Edit No. 8 of 1994, which has a retrospective effect from 2nd October, 1992 and since then has worked towards being an institution of excellence in training her students in technology, industry, commerce and entrepreneurship (Nwosu, 2023).

Sample size and sampling procedure

According to Okoro (2024), the population size of Abia Polytechnic is approximately 15,000 from all the Departments in the school. The sample size (n) was determined using Yamane (1967) sample size calculation, which is $n = \frac{N}{1+N(e)^2}$. Where n = sample size; N = total population size of undergraduate students in Abia State Polytechnic, Aba, which is 15,000 (Okoro, 2024); and e = level of precision (5%) in proportion, also known as level of error (= 0.05). Substituting the values in the formula gave a total of 389.6, and a 10% dropout added gave the sum of 429. However, only 220 students were interviewed because the institution was on break at the time of data collection.

Multi-stage sampling was employed. In the first stage, the list of the five (5) colleges in the school was obtained. Also, the twenty-one (21) departments under each of the five (5) colleges were listed as well. In the second stage, 11 departments out of the 21 departments were randomly chosen by selecting every department with odd numbers after making a list comprising 1 to 21. In the third stage, twenty (20) undergraduates were selected with the use of simple random sampling technique by balloting from the each of the departments selected. Almost half of the students were chosen from each department to correspond to the adjusted sample size when the data was collected.

Informed consent and ethics approval

Oral consent was obtained from the students before the

study commenced. Prior to data collection, participants were assured of confidentiality regarding the information they provided. They were assured that the data they provided will be used solely for research purposes and would not be exposed to any third party. Ethics approval was obtained from Federal Medical Centre, Umuahia, and the assigned ethics number is FMC/OEH/G.596/Vol.10/839. The centre where the ethics approval was obtained was located close to the University where the researchers operate from and not the Polytechnic where the data was collected. However, the three institutions were located in the same state. Also, the REC of the medical centre is more functional than the others.

Data collection

Data were collected with the use of well-structured questionnaires. The questionnaires were validated by lecturers in the Department of Human Nutrition and Dietetics of Michael Okpara University of Agriculture, Umudike, Abia State. The questionnaire was pretested using some students who were not part of the research. The questionnaires were self- and interviewer-administered to the students. The weights of the undergraduates were taken using a weighing scale. The scale was balanced with both sliding weights at zero and the balance bar aligned. For accuracy, subjects were measured wearing light clothing, barefoot, and standing on the scale with their heads pointing straight. Each participant stood in the centre of the platform, distributing their weight evenly on both feet. The weights were moved until the beam00 balanced. Their weights were measured to the nearest 0.1 kilogram (kg) (WHO, 2005).

Heights were measured to the nearest 0.1 centimetre (cm) using a height meter. Participants were asked to remove their shoes, heavy outer garments and hair ornaments. The participants stood with their backs to the height ruler. The back of the head, back, buttocks, calves and heels were required to be upright, with feet together. The top of the external auditory meatus (ear canal) was aligned with the inferior margin of the bony orbit (cheekbone). Participants were instructed to look straight. Heights were recorded to the nearest 0.1 cm (WHO, 2005).

Data and statistical analysis

Data on knowledge of ultra-processed foods among undergraduates were collected by scoring yes responses as 1, while no response = 0, making up a total of 31 variables, that is 31 points. Scores 0 - 10 indicate poor knowledge, while scores 11 - 20 indicate average knowledge and scores 21- 31 indicate good knowledge. Weight and height were used to obtain the body mass index (BMI) of the undergraduates. The WHO reference standard was used to compare the anthropometric indices of the students. Personal information of the undergraduates and socio-economic status of their parents, information on knowledge of ultra-processed foods and consumption of ultra-processed foods and beverages were analysed using frequencies and percentages. Pearson correlation was used to relate consumption patterns of ultra-processed foods and beverages and anthropometric status of the students. A P-value of less than or equal to 0.05 was accepted as statistically significant.

RESULTS

The personal characteristics of the students and socio-economic status of their parents are shown in Table 1. The age range of the students indicated that 6.4% were 16-19 years, 26.8% (20-22 years) and 37.7% and 29.1% were aged 23-25 years and 26 years and above, respectively. Their sex indicated that 52.3% were males while 47.7% were females. The majority (96.4%) were single, and 3.6% were married. Their year of study revealed that 13.2% (100L), 9.5% (200L), 9.5% (300L), 20.5% (400L), 36.8% (500L) and 10.5% (600L). Their place of residence showed that a greater proportion (77.7%) lived off campus and 22.3% lived in hostels. Highest educational attainment of their parents revealed that 13.2% of their mothers and fathers had no formal education, while 40.0% and 32.7% attained tertiary education and 20.5% and 24.5% reported that their mothers and fathers had secondary education, respectively. Their parents average household income showed that 13.2% earned below N30,000 while 7.3%, 12.7% and 19.5% earned N30000-60000, N61000-90000 and N91000 and above, respectively. The rest (47.3%) did not know.

Tables 2 present knowledge of ultra-processed foods and beverages by the students. In Table 2, 90.5% of the students were aware that many foods we consume are produced from whole foods and that ingredients are added to these foods by food industries (90.5%). Further, 95.9% knew that foods are broken down into sugars, oils, fat, starches and fibre. The majority (93.2%) were aware that additives such as flavours and colours disguise unpleasant sensory properties created by the ingredients, while 96.8% knew that the processes used to manufacture UPFs and B make the final product attractive to see, taste, smell and touch. In Table 2, 90.5% were aware that UPFs and B displace other food groups and also replace freshly prepared meals (90.5%). The majority (83.6%) knew that high intakes of UPFs and B are associated with overweight and obesity and other health problems. The knowledge grade of UPFs and B revealed that 53.5%, 34.2% and 12.3% had good, average and poor knowledge, respectively (Figure 1).

Consumption of UPFs and B by the students is shown in Table 3. Biscuits/cookies were consumed once daily by 20.5%, while 22.3% and 6.4% took them twice and three times per day, respectively. Breakfast cereals were eaten once, twice and three times daily by 16.8%, 3.2% and

Table 1. Personal characteristics of the students and socio-economic status of their parents.

Variable	Frequency	Percentage
Age range (years)		
16-19	14	6.4
20-22	59	26.8
23-25	83	37.7
26 years	64	29.1
Total	220	100
Sex		
Male	115	52.3
Female	105	47.7
Total	220	100
Marital status		
Single	212	96.4
Married	8	3.6
Divorced	0	0
Widow	0	0
Widower	0	0
Total	220	100
Level of education		
100L	29	13.2
200L	21	9.5
300L	21	9.5
400L	45	20.5
500L	81	36.8
600L	23	10.5
Total	220	100
Residence		
Hostels	49	22.3
Off campus	171	77.7
Total	220	100

Table 1. Contd.

Variable	Frequency	Percentage
Highest educational attainment of your mother		
No-formal	29	13.2
Primary	9	4.1
Secondary	45	20.5
Tertiary	88	40.0
I don't know	49	22.3
Total	220	100
Highest educational attainment of your father		
No-formal	29	13.2
Primary	15	6.8
Secondary	54	24.5
Tertiary	72	32.7
I don't know	50	22.7
Total	220	100
Household income of your parents (₦)		
Less than 30,000	29	13.2
30,000-60000	16	7.3
61000-90000	28	12.7
91,000 and above	43	19.5
Do not know	104	47.3
Total	220	100

3,2%, respectively. Cakes were taken once (3.6%), twice (6.4%) and three times (3.2%) daily, while carbonated soft drinks were taken once (22.7%), twice (3.2%), and three times (3.2%) daily. Cocoa drinks and beverages (10.0%, 6.4%, 34.5%), bread, buns chin chin (9.5%, 13.2%, 6.4%), distilled alcoholic beverages (10.0%, 3.6%, 6.4%), malt drinks (6.8%, 3.2%, 6.4%), noodles (9.5%, 3.2%, 6.4%), sausages (12.7%, 10.0%, 10.5%) and yoghurt (6.8%, 3.6%, 32.7%) were consumed once, twice and three times daily, respectively. The UPFs and B which were consumed 2-4 times or 5-7 times weekly were biscuits (13.6%, 3.7%), breakfast cereals (23.6%), carbonated soft drinks (24.1%, 3.2%), commercially produced and packaged bread, buns and chin chin (35.9%, 7.3%), noodles (32.7%, 6.8%), pasta (26.4%, 13.2%) and shawarma (29.5%, 6.8%), respectively. Doughnuts (78.2%), energy bar (78.2%), fruit yoghurt (72.3%), hot dogs and burgers (76.4%), ice cream (79.5%), pizza (79.5%), processed peas (76.4%), tinned fish (70.0%) and tinned meat (72.7%) were occasionally consumed.

Table 4 presents the anthropometric status of the students. From the Table, underweight prevalence was 45.9%, while 17.3%, 18.6% and 18.2% were normal, overweight and obese, respectively. The Pearson correlation between consumption of UPFs and B and the anthropometric status of the students is shown in Table 5. The results revealed that biscuits/cookies exhibited moderate negative significant relationship with normal weight (r=-.477, P=.000). Breakfast cereals showed weak negative significant relationship with normal weight (r=-.272, P=.000), weak positive significant relationship with overweight (r=.189, P=.000) and obesity (r=.201, P=.000). Carbonated soft drinks intake showed weak negative significant relationship with normal weight (r=-.182, P=.007) and moderate positive significant relationship with overweight (r=.314, P=.007). Cocoa drinks consumption showed moderate negative significant relationship with normal weight (r=-.347, P=.000) and weak positive significant relationship with overweight (r=.241, P-.000). Doughnut intake exhibited weak negative significant relationship with normal weight (r=-.134, P=.048), weak positive significant relationships with overweight (r=.151, P=.048) and obesity (r=.207, P=.048).

Similarly, energy drink intake showed a moderate

Table 2. Knowledge of ultra-processed foods and beverages by the students

Variables	Yes	%	No	%
Many foods we consume are produced from whole foods.	199	90.5	21	9.5
Food industries add Ingredients to these whole foods.	199	90.5	21	9.5
Big equipment and technology change the original foods into different forms, sizes and colours.	176	80.0	44	20.0
The additives added to those foods at different stages make the final products sellable, palatable and hyper palatable.	185	84.1	35	15.9
Big packaging like plastics and other man-made material are used	198	90.0	22	10.0
Some of the ingredients are sugar, oil or fats and salt.	185	84.1	35	15.9
Those ingredients are sources of energy and nutrients that are of little or no health benefits.	149	67.7	71	32.3
Other ingredients are high fructose corn syrup, hydrogenated or inter-estrified oils and protein isolates.	155	70.5	65	29.5
The additives includes flavours, flavour enhancers, colours, emulsifiers, artificial sweeteners, thickners, carbonating, bulking, foaming, gelling, glazing agents, fruit juice concentrates and invert sugar.	175	79.5	45	20.5
The other additives prolong duration or shelf life, protect original properties and prevents the proliferation of microorganisms.	171	77.7	49	22.3
The whole foods are broken down into substances like sugars, oils, fats, proteins, starches and fiber.	211	95.9	9	4.1
The substances are obtained from corn, wheat, soybean.	179	81.4	41	18.6
Animal foods are grinded or pureed to get some of those substances.	140	63.6	80	36.4
Chemical modifications such as hydrolysis or hydrogenation are used to change the substances.	184	83.6	36	16.4
Modified and unmodified substances are assembled with little or no whole food using industrial techniques.	178	80.9	42	19.1
The industrial processes or techniques are extrusion, moulding and pre-frying.	192	87.3	28	12.7
The additives especially flavors and colors either disguise unpleasant sensory properties created by the ingredients.	205	93.2	15	6.8
The processes used to manufacture ultra-processed foods make the final product attractive to see, taste, smell and touch.	213	96.8	7	3.2
The processes and ingredients used to manufacture ultra-processed foods are designed to create highly profitable products.	184	83.6	36	16.4
The ingredients used are low cost, have long shelf life and powerfully branded.	191	86.8	29	13.2
Ultra-processed foods are convenience because they are ready to eat and not perishable.	155	70.5	65	29.5
The transnational corporations who produce them use penetrating advertisement to promote them.	191	86.8	29	13.2
Ultra processed foods can displace other food groups.	199	90.5	21	9.5
Ultra processed foods replace easily freshly made regular meals and dishes with snacking anytime and anywhere.	199	90.5	21	9.5
Ultra-processed foods may look similar to home cooked foods but the ingredients and formulations are different.	171	77.7	49	22.3
Most times, it may be unclear to identify ultra-processed foods.	155	70.5	65	29.5
Food substances not used in kitchens appear in the beginning or in the middle of the lists of ingredients of ultra-processed foods.	191	86.8	29	13.2
Additives used in ultra-processed foods appear at the end of lists of ingredients, along with other additives.	185	84.1	35	15.9
Monosodium glutamate is a flavor enhancer and caramel color or soya lecithin are emulsifiers.	148	67.3	72	32.7
That high intakes of ultra-processed foods are associated with overweight and obesity, higher odds of having metabolic syndrome, cardiovascular diseases, breast and all cancers.	184	83.6	36	16.4

Table 3. Consumption of ultra-processed foods and beverages by the students.

Ultra-Processed Foods	Once a day	%	Twice a day	%	3 times a day	%	2-4 times a week	%	5-7 times a week	%	Occ.	%
Biscuit/cookies of all kinds	45	20.5	49	22.3	14	6.4	30	13.6	7	3.2	75	34.1
Breakfast cereals (golden morn, cornflakes, etc)	37	16.8	7	3.2	7	3.2	52	23.6	0	0	117	53.2
Cakes (commercially produced and packaged)	8	3.6	14	6.4	7	3.2	51	23.2	0	0	140	63.6
Candies	22	10.0	7	3.2	7	3.2	33	15.0	**0**	**0**	151	68.6
Carbonated soft drinks (mirinda, sprite, coke, fanta, pepsi etc)	50	22.7	7	3.2	14	6.4	53	24.1	7	3.2	89	40.5
Chocolates	15	6.8	7	3.2	7	3.2	34	15.5	14	6.4	143	65.0
Cocoa drinks/beverages (milo, bournvita etc)	22	10.0	14	6.4	76	34.5	0	0	7	3.2	101	45.9
Commercial produced and packaged peanuts, cashew nuts	21	9.5	8	3.6	7	3.2	55	25.0	8	3.6	121	55.0
Commercially produced and packaged bread, buns, chin chin	21	9.5	29	13.2	14	6.4	79	35.9	16	7.3	61	27.7
Distilled alcoholic beverages (whisky, gin, rum, vodka)	22	10.0	8	3.6	14	6.4	44	20.0	7	3.2	125	56.8
Doughnuts	8	3.6	8	3.6	7	3.2	9	4.1	16	7.3	172	78.2
Energy bar	8	3.6	8	3.6	0	0	24	10.9	8	3.6	172	78.2
Energy drinks	29	13.2	29	13.2	0	0	44	20.0	7	3.2	111	50.5
Fish and chicken nuggets	22	10.0	1	.5	0	0	44	20.0	21	9.5	132	60.0
Fish roll	36	16.4	8	3.6	0	0	38	17.3	8	3.6	130	59.1
Fries	29	13.2	22	10.0	0	0	65	29.5	7	3.2	97	44.1
Frozen ready soups	22	10.0	14	6.4	8	3.6	38	17.3	7	3.2	131	59.5
Fruit drinks or juice of all brands	29	13.2	21	9.5	1	.5	37	16.8	8	3.6	124	56.4
Fruit yoghurt	15	6.8	14	6.4	8	3.6	16	7.3	8	3.6	159	72.3
Geisha	8	3.6	8	3.6	7	3.2	51	23.2	0	0	146	66.4
Ham	15	6.8	1	.5	37	16.8	0	0	0	0	167	75.9
Hot dogs and burgers	7	3.2	8	3.6	37	16.8	0	0	0	0	168	76.4
Ice cream	7	3.2	22	10.0	14	6.4	0	0	2	0.9	175	79.5
Instant sauces	15	6.8	14	6.4	23	10.5	0	0	0	0	168	76.4
Instant soups	8	3.6	7	3.2	14	6.4	24	10.9	7	3.2	160	72.7
Jams	15	6.8	31	14.1	0	0	0	0	8	3.6	166	75.5
Malt drinks (maltina, malta guinness, beta malt etc)	15	6.8	7	3.2	14	6.4	0	0	24	10.9	160	72.7
Margarine and spreads	8	3.6	7	3.2	14	6.4	38	17.3	14	6.4	139	63.2
Noodles (indomie, golden penny, tummy tummy etc)	21	9.5	7	3.2	14	6.4	72	32.7	15	6.8	91	41.4
Pan cake	21	9.5	7	3.2	7	3.2	23	10.5	14	6.4	148	67.3
Pasta (spaghetti, macaroni, etc)	7	3.2	22	10.0	7	3.2	58	26.4	29	13.2	97	44.1
Pizza	14	6.4	8	3.6	7	3.2	2	.9	14	6.4	175	79.5
Processed peas	14	6.4	1	.5	14	6.4	9	4.1	14	6.4	168	76.4
Salted or sugar nuts	14	6.4	14	6.4	1	.5	9	4.1	14	6.4	168	76.4
Sausages (gala etc)	28	12.7	22	10.0	23	10.5	0	0	14	6.4	133	60.5
Sharwama	7	3.2	7	3.2	8	3.6	65	29.5	15	6.8	118	53.6
Smoked fish	14	6.4	21	9.5	8	3.6	37	16.8	15	6.8	125	56.8
Sodas	14	6.4	1	.5	21	9.5	23	10.5	15	6.8	146	66.4
Tinned fish (geisha and other brands)	14	6.4	7	3.2	1	.5	23	10.5	21	9.5	154	70.0
Tinned meat	15	6.8	8	3.6	23	10.5	0	0	14	6.4	160	72.7
Yoghurt	15	6.8	8	3.6	72	32.7	0	0	8	3.6	117	53.2

Key: Occ = Occasionally.

Table 4. Anthropometric status of the students.

Variables	Frequency	Percentage
Body mass index (Kg/m^2)		
Underweight (Below 18.5)	101	45.9
Normal weight (18.5-24.9)	38	17.3
Overweight (25.0-29.9)	41	18.6
Obese (30.0 and above)	40	18.2

Table 5. Relationship between consumption of ultra-processed foods and anthropometric status of the students.

Parameters	Underweight	Normal	Overweight	Obese	P-value
Biscuit/cookies of all kinds	.011	-.477**	.007	.107	.000
Breakfast cereals (golden morn, cornflakes, amazing morning, quaker oats etc)	-.003	-.272**	.189**	.201**	.000
Cakes (commercially produced and packaged)	-.012	-.127	.143	.083	.061
Candies	-.004	.051	.156	.055	.454
Carbonated soft drinks (mirinda, sprite, coke, fanta, pepsi etc)	-.005	-.182**	.314**	-.128	.007
Chocolates	-.017	.011	.221	.025	.805
Cocoa drinks/beverages (milo, bournvita etc)	.004	-.347**	.241**	.101	.000
Commercial produced and packaged peanuts, cashew nuts	-.026	-.009	.365	.002	.890
Commercially produced and packaged bread, buns, chin chin	-.021	-.296	.313	.187	.758
Distilled alcoholic beverages (whisky, gin, rum, vodka)	-.008	-.210	.249	.157	.902
Doughnuts	-.023	-.134*	.151*	.207**	.048
Energy bar	-.039	-.097	.104	.162	.567
Energy drinks	-.043	-.326**	.346**	.097	.000
Fish and chicken nuggets	-.002	-.071	.124	-.006	.296
Fish roll	-.029	-.200**	.164*	.212**	.003
Fries	-.040	-.253	.245	.246	.555
Frozen ready soups	-.004	-.181**	.105	.258**	.007
Fruit drinks or juice of all brands	-.020	.002	.185	.070	.771
Fruit yoghurt	-.016	-.018	.000	.160	.809
Geisha	-.039	-.056	.106	.061	.562
Ham	-.030	-.216**	.249**	.177**	.001
Hot dogs and burgers	-.007	-.272**	.175**	.247**	.000
Ice cream	.015	-.111	.129	.154	.101
Instant sauces	-.008	-.195	.242	.113	.907
Instant soups	.000	-.088	.158*	.268**	.000
Jams	-.013	-.076	.087	.100	.844
Malt drinks (maltina, malta guinness, beta malt etc)	-.024	-.063	.225	.108	.720
Margarine and spreads	-.023	-.192	.176	.288	.064
Noodles (indomie, golden penny, tummy tummy etc)	.020	-.274	.245	.243	.070
Pan cake	-.001	-.281	.248	.103	.100
Pasta (spaghetti, macaroni, etc)	-.018	-.111	.285	.258	.793
Pizza	-.006	-.069	.213	.079	.929
Processed peas	-.035	-.012	.209	.096	.604
Salted or sugar nuts	-.009	-.139*	.263**	.122	.039
Sausages (gala etc)	-.036	-.162*	.182**	.076	.016
Sharwama	-.004	-.057	.212	.147	.956
Smoked fish	-.034	-.153*	.180**	.288**	.023
Sodas	-.033	-.160*	.395**	.288**	.017
Tinned fish (geisha and other brands)	-.032	-.241	.204	.223	.640
Tinned meat	-.058	-.185**	.201**	.228**	.006
Yoghurt	-.058	-.266**	.084	.116	.000

***Correlation is significant at the 0.05 level, ****Correlation is significant at the 0.01 level.

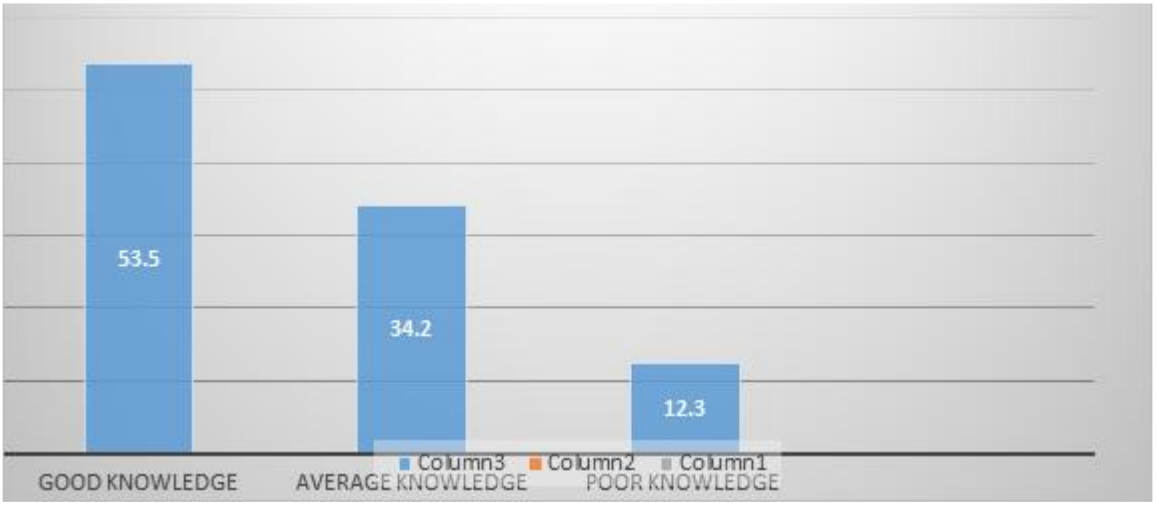


Figure 1. Knowledge grades of ultra-processed foods by the students.

negative significant relationship with normal weight (r=-.326, P=.000) and a moderate positive significant relationship with overweight (r=.346, P=.000). Fish roll showed a weak negative significant relationship with normal weight (r=-.200, P=.003) and weak positive significant relationships with overweight (r=.163, P=.003) and obesity (r=.212, P=.003). Intake of hot dogs and burgers showed a weak negative significant relationship with normal weight (r=-.272, P=.000) and a weak positive significant relationship with overweight (r=.175, P=.000) and obesity (r=.247, P=.000). Salted or sugar nuts exhibited a weak negative significant relationship with normal weight (r=-.139, P=.039) and a weak positive significant relationship with overweight (r=.263, P=.039). Similarly, a weak negative significant relationship was noted between intake of sausages and normal weight (r=-.162, P=.016) and a weak positive significant relationship with overweight (r=.182, P=.016). Smoked fish intake exhibited a weak negative significant relationship with normal weight (r=-.160, P=.023), a moderate positive significant relationship with overweight (r=.395, P=.023) and a weak positive significant relationship with obesity (r=.288, P=.023). Consumption of tinned meat showed a weak negative significant relationship with normal weight (r=-.185, P=.006) and weak positive significant relationships with overweight (r=.201, P=.006) and obesity (r=.228, P=.006). Similarly, yoghurt intake only exhibited a weak negative significant relationship with normal weight (r=-.266, P=.000).

DISCUSSION

The result on knowledge of UPFs and B noted in this study, particularly where a little above half of the students had good knowledge, was inconsistent with the 22.8% reported by Nwogwugwu (2021). The observed difference in knowledge could be due to the study population. The present study sampled undergraduates, while the reference study sampled adults. Thus, age and educational background could have contributed to the difference. Consistent with the findings on consumption of ultra-processed foods and beverages, Ihensekhien and Oluwagbemileke (2024) reported that sweet or savoury packaged snacks were consumed often. In contrast, confectionery (chocolate and candies), mass-produced packaged breads and buns, cookies/biscuits, pastries, cakes and cake mixes, breakfast cereals, energy bars, poultry/fish nuggets and sticks, sausages, burgers, hot dogs, instant noodles, energy and sports drinks, milk drinks, fruit yoghurts and fruit drinks, cocoa/chocolate drinks, sweetened juices, carbonated soft drinks, soda, cola, ice cream and infant formulas were usually consumed. Their results also corroborated the findings on UPFs and B consumed 2-4 times or 5-7 times a week. The UPFs and B reported to have been consumed occasionally in this study were also congruent with pies, pasta and pizza dishes, and distilled alcoholic beverages (whisky, gin and rum) reported to have been consumed sometimes (Ihensekhien and Oluwagbemileke, 2024). The present study results indicated that even though some of the UPFs and B were consumed daily, 2-4 or 5-7 times and occasionally, the proportion of students who took them varied. This is probably due to the accessibility and affordability of those foods and drinks. While some are available every day within the school environment, others may only be available and even affordable on weekends and some festive occasions. A few years before this study and the reference study, Oguizu and Celestine (2021) reported that 65.6% and 71.8% of the adolescents they studied took cakes and cookies/biscuits every day. Additionally, they found that soft drinks, packaged breads and instant noodles were consumed by 74.7%, 68.8% and 59.9% of the adolescents from time to time, respectively.

These findings revealed that these ultra-processed foods and beverages are ubiquitous in every food environment and accessible across all age categories.

The present study findings on prevalence of underweight among the students were higher than the 21.2% reported among WRA aged 15-29 years in Nigeria, but lower than the 6.4% reported for Southeast, Nigeria (FGoN and IITA, 2024). The observed difference could be due to the sample sizes used by the studies. The present study sampled 220 students, while the reference study was a national survey. The result was also inconsistent with the 11.5% reported for 514 medical students aged 18-27 years from Aleppo University, Syria (Alhashemi *et al*., 2022). Differences in sample sizes, location and background of the participants in both studies may have led to the different results. According to UNICEF (2025), obesity now exceeds underweight in all regions of the world except in sub-Saharan Africa and South Asia. This was inconsistent with the present study where more students were reported to be underweight than overweight and obesity sum together (36.8%). In contrast, Alhashemi *et al*. (2022) reported a higher prevalence of overweight/obesity (22.1%) than underweight. Among 240 medical students aged 17-27 years from three Universities in Cameroon, Bede *et al*. (2020) reported a contrasting result of 4.9% underweight and 24.6% overweight and obesity. The lower prevalence of thinness reported in their study carried out in a sub-Saharan African country may be a result of the background of their subjects. Medical students may have good knowledge of nutrition, unlike their counterparts from other disciplines that are not related to health. That might have contributed to the lower prevalence noted in comparison with the present study. Globally, one in five children and adolescents aged 5-19 years (20%) or 391 million are overweight (UNICEF, 2025). In Nigeria, 21.0% and 24.1% of WRA aged 15-29 years were underweight and overweight/obese, respectively. In Southeast, the proportions were 6.4% and 36.9%, respectively (FGoN and IITA, 2024). This national report was inconsistent with the present study.

The moderate negative significant relationship noted between biscuits/cookies intake and normal weight implied that as their intakes decrease, the student weight decreases or they tend to be of normal weight. In contrast, high consumption of breakfast cereals led to weight gain. The same deductions were made for the consumption of other UPFs and B such as carbonated drinks, cocoa drinks, doughnuts, energy drinks, fish roll, hot dogs and burgers, salted or sugar nuts, sausages, tinned meat and yoghurt. All these foods and drinks are ultra-processed. Generally, high intakes of them were related to overweight and obesity, while low intake led to maintenance of normal weight. Consistent with the relationships identified in this study, many studies have reported strong associations between high UPF and B intake and overweight/obesity. For instance, Vandevijvere *et al*. (2019) reported that for every standard deviation increase in ultra-processed drink volume sales, mean BMI increased by 0.195kg/m^2 for men (p=<.001) and 0.072kg/m^2 for women (P=.003). Among the UK population, Raufer *et al*. (2020) found that increased intake of UPF was associated with 1.66kg/m^2 higher BMI, 3.56cm greater waist circumference and 90% higher odds of being obese compared with reduced intake. Additionally, a higher UPF consumption was positively associated with incident abdominal obesity among older adults in Spain (Sandoval-Insausti *et al*., 2020). Pagllai *et al*. (2021), in a systematic review and meta-analysis of 23 studies, concluded that increased consumption of UPFs was associated with worse cardiometabolic risk profile and a higher risk of cardiovascular disease, cerebrovascular disease, depression and all-cause mortality. A significant association between UPF intake and overweight and obesity was noted (Askari *et al*., 2020). Ultra-processed foods and beverages are packaged with sugars, salt and fat, hence are energy-dense. Therefore, they tend to cause short-term increases in body weight and fat (Hall *et al*., 2019). Thus, Collins (2019) opined that it appears that a good place to start in reaching or maintaining a healthy weight is to eliminate or at least reduce UPFs and B in the diets and replace them with varieties of unprocessed or minimally processed nutrient-dense alternatives.

Conclusion

The study found that knowledge of ultra-processed foods and beverages was high. However, this knowledge did not translate into good dietary practice because the intake of those foods and beverages was high among the students. Therefore, it is not surprising to note their relationship with weight status. Negative relationships were reported between their intakes and normal weight, while positive relationships existed between UPFs and B and overweight and obesity. This shows that excessive intakes of UPFs and B may affect long-term health.

Recommendations

The school food environment for children, adolescents and adults should be improved by limiting the availability, marketing and purchase of UPFs and B. Specific actions include restrictions on marketing of UPFs and B, food labelling, taxes on unhealthy foods and beverages and food reformulations to limit unhealthy ingredients and harmful substitutes. Secondly, the implementation of policies to improve the availability and affordability of locally produced nutritious foods. Systems and infrastructure should be strengthened to support the production, processing and distribution of nutritious and healthy foods. Thirdly, is the implementation of nutrition education to encourage social and behaviour change initiatives. This will help to raise awareness of the harm caused by diets high in UPFs and B. Finally, strengthen

national and local data and surveillance systems to monitor the food environment, diets and overweight and obesity among children, adolescents and adults using standardised indicators and data collection methods.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

REFERENCES

Alhashemi, M., Mayo, W., Alshaghel, M. M., Brimo Alsaman, M. Z. & Haj Kassem, L. (2022). Prevalence of obesity and its association with fast food consumption and physical activity: A cross-sectional study and review of medical students' obesity rates. *Annals of Medicine and Surgery*, 79, 104007. https://doi.org/10.1016/j.amsu.2022.104007

Asensi, M. T., Napoletano, A., Sofi, F., & Dinu, M. (2023). Low-grade inflammation and ultra-processed foods consumption: a review. *Nutrients*, *15*(6), 1546. https://doi.org/10.3390/nu15061546

Askari, M., Heshmati, J., Shahinfar, H., Tripathi, N., & Daneshzad, E. (2020). Ultra-processed food and the risk of overweight and obesity: a systematic review and meta-analysis of observational studies. *International journal of obesity*, *44*(10), 2080-2091. https://doi.org/10.1038/s41366-020-00650-z

Baker, P., Machado, P., Santos, T., Sievert, K., Backholer, K., Hadjikakou, M., Russell, C., Huse, O., Bell, C., Scrinis, G., & Lawrence, M. (2020). Ultra-processed foods and the nutrition transition: Global, regional and national trends, food systems transformations and political economy drivers. *Obesity reviews*, *21*(12), e13126. https://doi.org/10.1111/obr.13126

Bede, F., Cumber, S. N., Nkfusai, C. N., Venyuy, M. A., Ijang, Y. P., Wepngong, E. N., & Kien, A. T. N. (2020). Dietary habits and nutritional status of medical school students: the case of three state universities in Cameroon. *Pan African Medical Journal*, 35, 1-10. https://doi.org/10.11604/pamj.2020.35.15.18818

Calcaterra, V., Cena, H., Magenes, V. C., Vincenti, A., Cmola, G., Beretta, A., Napoli, I. D & Zuccotti, G. (2023). Sugar-sweetened beverages and metabolic risk in children and adolescents with obesity: A narrative Review. *Nutrients*, 15(3), 702. https://doi.org/10.3390/nu15030702

Cascaes, A. M., Jorge da Silva, N. R., Fernandez, M. D. S., Bomfim, R. A. & Vaz, J. D. S. (2023). Ultra-processed food consumption and dental caries in children and adolescents: A systematic review and meta-analysis. *British Journal of Nutrition*, 129, 1370-1379. https://doi.org/10.1017/S0007114522002409

Collins, F. (2019). Ultra-processed diet leads to extra calories and weight gain. Bethesda, U. S. National Institute of Health. https://directorsblog.nih.gov/2019/05/21

De Amicis, R., Mambrini, S. P., Pellizzari, M., Foppiani, A., Bertoli, S., Battezzati, A. & Leone, A. (2022). Ultra-processed foods and obesity and adiposity parameters among children and adolescents: A systematic review. *European Journal of Nutrition*, 61(5), 2297-2311. https://doi.org/10.1007/s00394-022-02873-4

Farhangi, M. A., Niknniaz, L. & Khodarahmi, M. (2020). Sugar-sweetened beverages increases the risk of hypertension among children and adolescents: A systematic review and dose-response meta -analysis. *Journal of Translational Medicine*, 18(1, 5), 344. https://doi.org/10.1186/s12967-020-02511-9

Federal Government of Nigeria (FGoN) & International Institute for Tropical Agriculture (IITA) (2024). National Food Consumption and Micronutrient Survey 2021. Final Report. Abuja and Ibadan, Nigeria: FGoN and IITA. 550pp.

Food and Agriculture Organisation, International Fund for Agricultural Development, United Nations Children's Fund, World Food Programme & World Health Organization (FAO, IFAD, UNICEF, WFP & WHO). (2025). The State of Food Security and Nutrition in the World 2025. Addressing high food price inflation for food security and nutrition. https://doi.org/10.4060/cd6008en

Hall, K. D., Ayuketah, A., Brychta, R., Cai, H., Cassimatis, T., Chen, K.Y. & Chung, S.T. (2019). Ultra-processed diets cause excess calorie intake and weight gain: A one-month in-patient randomized controlled trial of ad libidum food intake. *Cell Metabolism*, 30(1), 67-77. https://doi.org/10.1016/j.cmet.2019.05.008

Herforth, A., Wiesmann, D., Martinez-Steele, E., Andrade, G. & Monteiro, C. A. (2025). Dichotomous healthy diet indicators to reflect WHO dietary guidance. Paper presented at the 23rd International Conference on Nutrition, Paris, 27 August, 2025.

Hoiberg, D. H. (2010). Aba. In Encyclopedia Britannica. Volume 1:A-AK- Bayes, 15th edition. Encyclopedia Britannica, Inc.

Ihensekhien, I. & Oluwagbemileke, F. B. (2024). Assessment of ultra-processed foods consumption and overall dietary pattern of undergraduate students in Ondo city, Ondo State. *International Journal of Home Economics*, 17(2), 36-47.

Jones, W. (2023). Significance of anthropometry and its practical application in different fields. *Journal of Ergonomics*, 13, 346.

Liu, J., Chen, T., Chen, M., Ma, Y., Ma, T., Gao, D., Li, Y., Ma, Q., Chen, L., Wang, X., Zhang, Y., Ma, J. & Dong, Y. (2022). Sugar-sweetened beverages and depressive and social anxiety symptoms among children and adolescents aged 7-17 years stratified by body composition. *Frontiers in Nutrition*, 9, 888671. https://doi.org/10.3389/fnut.2022.888671

Monteiro, C. A., Cannon, G., Lawrence, M., Costa Louzada, M. L. & Pereira Machado, P. (2019b). Ultra-processed foods, diet quality and health using the NOVA classification system, Rome, FAO.

Monteiro, C. A., Cannon, G., Levy, R. B., Moubarac, J-C., Louzada, M. L. C., Rauber, F. & Khandpur, N. (2019a). Ultra-processed foods: What they are and how to identify them. *Public Health Nutrition*, 22(5), 936-941. https://doi.org/10.1017/S1368980018003762

Monteiro, C. A., Cannon, G., Moubarac, J. C., Levy, R. B., Louzada, M. L. C. & Jaime, P. C. (2018). The UN Decade of Nutrition, the NOVA food classification and the trouble with ultra-processing. *Public Health Nutrition*, 21(1), 5-17. https://doi.org/10.1017/S1368980017000234

Nguyen, M., Jarvis, S. E., Tinajero, M. G., Yu, J., Chiavarolli, L., Mejia, S. B., Khan, T. A., Tobias, D. K., Willet, W. C., Hu, F. B., Hanley, A. J., Birken, C.S., Sievenpiper, J. L. & Malik, V. S. (2023). Sugar sweetened beverage consumption and weight gain in children and adults: A systematic review and meta-analysis of prospective cohort studies and randomized controlled trials. *American Journal of Clinical Nutrition*, 117(1), 160-174. https://doi.org/10.1016/j.ajcnut.2022.11.008

Nwachukwu, A. (2021). Administrative divisions of Abia State: A historical overview. *Journal of Africa Studies*, 45(3), 112-124.

Nwogwugwu, J. C. (2021). Consumption of ultra-processed

foods, knowledge, dietary pattern and anthropometric status of adults in Ohafia Local Government Area, Abia State. https://repository.mouau.edu.ng

Nwosu, A. (2023). Establishment and development of Abia State Polytechnic, Aba. *Journal of Educational Administration in Nigeria*, 32(1), 45-60.

Oguizu, A. D., & Celestine, E. U. (2021). Consumption of ultra-processed foods and anthropometric status of adolescents in Aba North L. G. A., Abia State. *Nigerian Journal of Nutritional Sciences*, 42(2), 88-91.

Okechukwu, I. (2022). The evolution of Local Government Areas in Southeastern Nigeria. *Nigerian Journal of Political Science*, 29(2), 75-89.

Okoro, C. (2024). Enrollment trends in Abia State Polytechnic: A review of the past and present. *Abia State Polytechnic Journal of Education*, 2(1), 1-10.

Pagllai, G., Dinu, M., Madarena, M. P., Bonaccio, M., Lacoviella, L. & Sofi, F. (2021). Consumption of UPFs and health status: A systematic review and meta-analysis. *British Journal of Nutrition*, 125(3), 308-318. https://doi.org/10.1017/S0007114520002688

Pengpid, S., & Peltzer, K. (2019). High carbonated soft drink intake is associated with health risk behavior and poor mental health among school-going adolescents in six Southeast Asian countries. *International Journal of Environmental Research and Public Health*, 17(1), 132. https://doi.org/10.3390/ijerph17010132

Petridi, E., Karatzi, k., Margriplis, E., Charidemou, E., Philippou, E. & Zampelas, A. (2024). The impact of ultra-processed foods on obesity and cardio-metabolic comorbidities in children and adolescents: A systematic review. *Nutrition Reviews*, 82(70, 913-928. https://doi.org/10.1093/nutrit/nuad095

Raufer, F., Martinez-Steele, E., Louzada, M. L.C., Millet, C., Monteiro, C. A. & Levy, R. B. (2020). Ultra-processed foods consumption and indicators of obesity in the UK population (2008-2016). *PLoS ONE*, 15(5), e0232676. https://doi.org/10.1371/journal.pone.0232676

Raza, A., Fox, E., Morris, S. S., Kupka, R., Timmer, A., Dalmiya, N. & Fanzo, J. C. (2020). Conceptual framework of food systems for children and adolescents. *Global Food Security*, 27, 100436. https://doi.org/10.1016/j.gfs.2020.100436

Reales-Moreno, M., Tonin, P., Escorihuela, R. M., Solanas, M., Fernandez-Barres, S., Romaguera, D. & Contreras-Rodriguez, O. (2022). Ultra-processed foods and drinks consumption is associated with psychosocial functioning in adolescents. *Nutrients*, 14(22), 4831. https://doi.org/10.3390/nu14224831

Rondinella, D., Raoul, P. C., Valeriani, E., Venturini, I., Cintoni, M., Severino, A., Galli, F.S., Mora, V., Mele, M. C., Cammarota, G., Gasbarrini, A., Rinninella, E. & Laniro, G. (2025). The detrimental impact of ultra-processed foods on the human gut microbiome and gut barrier. *Nutrients*, 17(5), 859. https://doi.org/10.3390/nu17050859

Sandoval-Insausti, H., Jimenez-Onsurbe, M., & Donat-Vargas, C. (2020). Ultra-processed foods consumption is associated with abdominal obesity: A prospective cohort study in older adults. *Nutrients*, 12(8), 2368. https://doi.org/10.3390/nu12082368

Shi, Z., Malki, A., Abdel-Salem, G., Liu, J. & Zayed, H. (2020). Association between soft drink consumption and aggressive behavior among a quarter million adolescents from 64 countries based on the global school-based student health survey. *Nutrients*, 12(3), 694. https://doi.org/10.3390/nu12030694

United Nations Children' Fund (UNICEF) & Global Alliance for Improved Nutrition (GAIN) (2019). Food systems for children and adolescents. Working together to secure nutritious diets, UNICEF, Florence, 2019.

United Nations Children's Fund (UNICEF). (2025). Feeding profit. How food environment are failing children. Child Nutrition Report 2025, UNICEF, New York, September, 2025.

Vandevijvere, S., Jaacks, L. M. & Monteiro, C. A. (2019). Global trends in UPFs and drink products sales and their association with adult BMI trajectories. *Obesity Reviews*, 20(2), 10-19. https://doi.org/10.1111/obr.12860

Warner, J. O. (2024). Artificial food additives: Hazardous to long-term health? *Archives of Disease in Childhood*, 109(11, 18), 882-885.

World Health Organization (WHO). (2005). Physical status. The use and interpretation of anthropometry. Technical Report Series no. 5.

Yamane, T. (1967). Statistics: An introductory analysis (2nd edition). New York: Harper and Row.