

Evaluation of Some Suggested Gluten and Casein Free Diets for Autistic Children

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Abstract

This investigation aimed to suggest and evaluate some diets for gluten and casein free (GFCF) meals for autistic children. Daily meals were provided children on the autism spectrum for a period of 3 days, divided as follows: - GFCF meals were developed suitable for children of the autism spectrum for a period of three days, according to three meals a day, example (9 meals) which is the total of the total meals for the three days. The daily meals were analyzed diet using a food composition table to obtain the content of the meals from protein, fat, fiber, carbohydrates, vitamins and minerals. The results of analyzing suggested formulas were compared to the Dietary Reference Intake (DRI) tables for children and given the importance of minerals and vitamins. Obtained results suggested that the autistic patient should eat a meal from the second day of gluten and casein. It was clear that there were statistical differences where; $P < 0.05$ compared with the DRI According to the above results, this research suggested that gluten free, casein free (GF-CF) diet may be beneficial for autistic children patients.

Key words: autistic children, gluten free, casein free and keto diet.

Introduction

Autism spectrum disorder (ASD) describes a wide range of symptoms, including difficulty with social interaction and communication skills, as well as unusually repetitive behavior. Although the exact cause of ASD is still not known, it is believed that both genetic and environmental factors influence the onset and development of this disorder. Interaction between multiple genetic variants and epigenetic factors also increase the risk of having ASD. Trace elements are essential for many physiological functions, as they act as a cofactor in various enzymatic processes, and hence their biochemical regulation is of major importance. (Al Haddad *et al.*, 2022). Neurological patterns and severity are related to an etiology involving interactions between genes, environment, diet, and gender, as it is almost five times more common among boys than girls the incidence of ASD has dramatically increased during the last decades. Current estimates in the US assessed that one child to 45 has a diagnosis of ASD. (Skalny *et al.*, 2016).

A gluten-free and casein-free diet is one of the most common diets in autism, due to the possibility that people with autism may have what is known as leaky gut syndrome, in which undigested casein and gluten are leaked into the bloodstream, and these proteins interfere with the performance and function of the system naturally nervous; This affects behavior and mental function in autistic people, so removing foods containing gluten and casein from the diet may improve the behavior of people with autism, but it should be noted that some evidence for the effectiveness of this diet is not yet conclusive. The gluten-free casein diet (GFCF) and elimination diet, the two most popular diets adopted by families of children with autism in hopes of addressing the core symptoms of autism, are both based on eliminating potential allergens. An elimination diet involves an initial period of eliminating or "removing" many different foods, measuring symptoms, and then slowly adding them back in to identify foods that make autism symptoms worse. (Adams *et al.*, 2008).

Removing foods containing gluten and casein from the diet may improve the behaviors of people with autism, but it should be noted that some of the evidence for the effectiveness of this diet is not yet conclusive. The gluten and casein free diet (GFCF) and the elimination diet are the two most popular diets adopted by families of autistic children in hopes of addressing the underlying symptoms of autism.

Both diets are based on eliminating potential allergens. An elimination diet involves an initial period of eliminating or “eliminating” several different foods, measuring symptoms, and then slowly adding them back in to determine which foods worsen autism symptoms. (Cornish, 2002).

A gluten and casein-free diet may improve autism spectrum symptoms. Gluten is a type of protein found in wheat and barley, and casein is a protein found in milk. Autism spectrum patients are believed to have leaky gut syndrome, which may allow portions of gluten and casein to be allowed in leakage into the bloodstream that may affect the brain and central nervous system, and may lead to an increase in symptoms of autism, and there are also not enough studies to prove this relationship, but you can consult a nutritionist to help choose the right food for your child, and a nutritionist has proven that autism or others can If they have difficulty choosing food, a dietitian can determine what is appropriate for your child, help you determine the nutritional risks that may affect your child, determine the recommended nutritional supplements for autistic patients and guide the child on how to eat well and balanced (Karen,2018). Therefore, this investigation aimed to suggest and evaluate some diets formules (GFCF) for autistic children.

Materials and Methods

Materials:

Food Composition Tables Program Annalise’s Egypt, National Nutrition Institute, Cairo, 2nd Edition May 2006.

Methods:

Gluten Free Casein Free (GFCF) meals were designed for the autistic spectrum children for three days (3 meals /d)

Table (1): Meals design (GF-CF) for the first day

Meal	Food	Quantity	unit	Description
Before Breakfast	➤ A cup of orange juice	100 ml	2	Baladi
	• sweetened with honey	10 g	0.5	
Breakfast	➤ Cornmeal bread	50 g	1	Baladi
	➤ potatoes	150 g	1	Mashed
	• parsley	3 g	0.5	Fresh
	• butter	2 g	0.5	boiled
	➤ egg	50 g	1	Fresh
	➤ Cucumber	50 g	1	Fresh
	➤ Tomato	50 g	1	Fresh
Snack	➤ apple	100g	1	Fresh
Lunch	➤ Grilled tilapia fish	200g	1	Grilled
	➤ Packet pepper	100 g	1	peppery
	• spoon olive oil	10 g	0.5	Fresh
	➤ Green salad	50 g	1	Fresh
	• tomatoes	50 g	1	Fresh
	• onions	50 g	1	Fresh
	➤ Green Grapes	50g	1	Fresh
Dinner	➤ Gluten-free bread	150 g	1	Baladi
	➤ fava beans dish	150 g	1	stewed
	• cumin salt	2 g	0.5	
	• oil	2 g	0.5	
	➤ Vegetables	50g	1	Fresh
	• Cucumber	50g	1	Fresh
	• Pepper			
Snack	➤ Biscuits from corn flour	50 g	1	stewed

Table (2): Meals design (GF-CF) for The second day

Meal	Food	Quantity	unit	Description
Before Breakfast	➤ A cup milk casein-free	50 g	2	Fresh
	• banana	50 g		
	• honey	10 g		
kfastBrea	➤ loaf gluten free	150 g	1	Baladi Boiled
	➤ white beans	150 g	1	
	• Sunflower oil	30 g	0.25	
	➤ Rocca	50 g	1	
	➤ Cucumber	50 g	1	
Snack	➤ Carrot fruit	50g	1	Fresh
Lunch	➤ Kofta	150 g	1	Grilled Roasted peppery
	• Brown Tahini	20 g	1	
	➤ A plate of rice	100 g	1	
	➤ Salad dish			Fresh
	• cupucci	g°•	1	
	• tomatoes	50g	1	
	• watercress	50g	1	
Snack	➤ orange fruit	50g	2	Fresh
Dinner	➤ A slice of cornmeal toast	100 g	1	Fresh
	➤ Fig Jam	100 g	1	Boiled
	➤ A cup of milk	100 ml		
	soybean milk			
Snack	➤ Pineapple	50g	1	Fresh

Table (3): Meals design (GF-CF) for The third day

meal	Food	Quantity	unit	Description
before breakfast	➤ Guava fruit	50g	1	Fresh
Breakfast	➤ omelette	100 g	2	Fried
	eggs	20 g	0.25	
	• corn oil	150 g	1	Baladi
	➤ Cornbread			Fresh
	➤ Leafy vegetables	50 g	1	
	• Lettuce	50g	1	
• arugula				
Snack	➤ strawberry	100g		

Lunch	➤ duck breasts	150g	1	Boiled Roasted fried
	• Al Samra	50 g	0.5	
	• Tahini	125 g	2	Fresh Fresh
	➤ Pasta dish	25 g	0.5	
	• Sauce	20 g	0.25	
	• oil			
	➤ Green salad	50g	1	
• cucumber	50g	1		
• tomato				
Snack	➤ Figs	100g	2	Fresh
Dinner	➤ Soy cheese	150 g	1	Fresh
	➤ bell pepper	50 g	1	Fresh
	➤ Half a loaf of gluten-free bread	150 g	1	Baladi
	➤ potatoes	100g	2	mashed
Snack	➤ A cup of orange juice	100 ml	2	Fresh
• sweetened with honey	10 g	0.5		

Meals were analyzed using a food analysis program to determine the contents of meals from Protein, Fat, Carbohydrates, Fiber, Vitamins and Minerals. Data were compared to Daily Reference Intakes (DRI). All results were expressed as the mean \pm SD. Statistical analyses were performed with statistical package for social science for windows (SPSS, Version 11.0 Chicago, DL-USA).

Results and discussion

Proteins, Fats, Carbohydrates and Fibers content of casein free and gluten free meals:

As shown in Table (1), protein content at 1st day, 2nd day and 3^{ed} day were significant increased comparing to DRI with means values 93.27 ± 0.044 , 136.38 ± 0.022 , 121.68 ± 0.022 vs. 50.15 ± 0.124 g, respectively.

Fats content at 1st day 35.075 ± 0.023 g, while 2nd day and 3^{ed} day were significant increased comparing to DRI with means values 115.97 ± 0.047 and 165.69 ± 0.024 vs. 78.02 ± 0.016 g.

Therefore, Carbohydrate content between days were significant increased comparing to DRI with means values 309.66 ± 0.039 , 320.08 ± 0.015 and 439.049 ± 0.002 vs. 275.0140 ± 0.011 g respectively.

Fibers content at 2nd day 120.29 ± 0.01010 . In first while 3^{ed} days were significant increased comparing to DRI with means values 11.38 ± 0.009 vs. 18.99 ± 0.016 g, respectively.

These results were in agreement with (Pennesi *et al.*, 2012) who reported that mean of the fast mobility increased significantly in groups Proteins, Fats, Carbohydrates and Fibers. Whereas the rate of Proteins, Fats significantly increased. Also (Samadi *et al.*, 2014) protein and Carbohydrates content between days were significant increased comparing to DRI

Food composition Energy (KCal.) of casein free and gluten free:

Table (2) showed energy content at 1st day 1928.096 ± 0.069 while 2nd day and 3^{ed} day were significant increased comparing to DRI with means values 2870.45 ± 0.36 and 3736.142 ± 0.08 g, respectively.

Vitamins A (mcg), B1 (mg), B2 (mg) & C (mg) content of casein free and gluten free meals

Data in Table (3) were showed that in 1st, 2nd and 3^{ed} days, vitamin A has been significantly decreased, while vitamin B1 showed a significant increasing value in third day then second day 2.278 ± 0.0128 mg and 1.922 ± 0.002 mg, respectively comparing DRI.

Vitamin B2 values were showed a significantly decreasing in third, second and first days 0.942 ± 0.0016 mg, 0.9324 ± 0.0001 mg & 0.823 ± 0.001 mg, respectively comparing DRI.

Vitamin C values has been shown increased significantly in in first, second and third days 168.97 ± 0.016 mg, 165.206 ± 0.021 mg & 142.806 ± 0.021 mg, respectively comparing DRI.

These results are in agreement with (Johnson *et al.*, 2007) who reported that supplementation with separated vitamin C values has been shown increased significantly in casein free and gluten free, also (Genuis *et al.*, 2009) found that treatment with a combined or separated supplements of vitamin A and C caused a significant ($p < 0.05$) increase in final body weight.

Food composition content of potassium (mg), calcium (mg), magnesium (mg), phosphorus (mg) & Sodium (mg) of casein free and gluten free

Potassium has been significantly decreased in third, second and first days 4539.9 ± 0.023 , 4200.25 ± 0.04 & 3259.18 ± 0.013 , respectively comparing DRI Table (4).

Calcium values were showed an increasing signification in third, second and third days as follow 944.43 ± 0.04 , 424.15 ± 0.036 & 319.27 ± 0.019 comparing DRI Table (4).

Magnesium results showed decreased signification between days third, second then first day 412.05 ± 0.137 , 417.50 ± 0.027 & 144.81 ± 0.016 , respectively comparing DRI Table (4). While Phosphorus values showed increasing significant between days in second (1836.53 ± 0.062), first 1314.68 ± 0.021 , third 396.4 ± 0.030 comparing with DRI.

Table (4), showed significantly increasing for sodium values in third day 2310.81 ± 0.004 comparing with DRI. Significantly decreased has been shown in first day 1965.67 ± 0.184 then second day 179.07 ± 0.024 for sodium values.

It has been proven from these elements that calcium and sodium have an effective value that may have affected the improvement of children with autism.

The results of this study showed an effective effect on patients with autism spectrum children, moreover, the scientist (**Lázaro *et al.*, 2017**) agreement that calcium and sodium has been increasing signification comparing DRI.

Food composition content of Iron (mg), Zinc (mg) & copper (mg) of casein free and gluten free

Table (5), was showed significant increasing for iron values in third, second and first days 32.64 ± 0.001 , 26.61 ± 0.02 & 18.81 ± 0.01 , respectively comparing DRI.

Zinc values were increased in third day 20.8 ± 0.014 following second day 13.83 ± 0.03 , while first day showed a decrease significant 10.06 ± 0.02 compared to DRI.

Significant reduction for copper values between days first 1.61 ± 0.01 second 1.92 ± 0.01 and third 2.82 ± 0.043 compared to DRI.

Table (4): Proteins, Fats, Carbohydrates and Fibers content of casein free and gluten free meals

Nutrients	Protein (g)	Fat (g)	Carbohydrate(g)	Fibers (g)
Days				
1 st	93.27 ^c ± 0.044 0.023	35.075 ^d ± 0.023	309.66 ^c ± 0.039	011.38 ^d ± 0.009
2 nd	136.38 ^a ± 0.022	115.97 ^b ± 0.047	320.08 ^b ± 0.015	120.29 ^a ± 0.01010
3 ^{ed}	121.68 ^b ± 0.022	165.69 ^a ± 0.024	439.049 ^a ± 0.002	018.99 ^c ± 0.016
DRI	50.15 ^d ± 0.124	78.02 ^c ± 0.016	275.0140 ^d ± 0.011	28.0166 ^b ± 0.018

Mean values are expressed as Mean ± SD.

Mean values with different superscript letter in the same column are significantly different at P<0.05.

Table (5): Energy content of casein free and gluten free meals

Nutrients	Energy (KCal.)
Days	
1 st	1928.096 ^d ± 0.069
2 nd	2870.45 ^b ± 0.36
3 ^{ed}	3736.142 ^a ± 0.08
DRI	2000.14 ^b ± 0.145

Mean values are expressed as Mean ± SD.

Mean values with different superscript letter in the same column are significantly different at P<0.05.

Table (6): Vitamins A, B1, B2 & C content of casein free and gluten free meals

Nutrients	Vit A (mcg)	Vit B1 (mg)	Vit B2 (mg)	Vit c (mg)
Days				
1 st	369.961 ^d ± 0.001	1.081 ^d ± 0.011	0.823 ^c ± 0.001	168.97 ^a ± 0.016
2 nd	786.499 ^b ± 0.007	1.922 ^b ± 0.002	0.9324 ^b ± 0.0001	165.206 ^a ± 0.021`
3 ^{ed}	392.169 ^c ± 0.018	2.278 ^a ± 0.0128	0.942 ^b ± 0.0016	142.806 ^b ± 0.021
DRI	900.01 ^a ± 0.007	1.2 ^a ± 0.016	1.3042 ^a ± 0.011	90.01 ^c ± 0.007

Mean values are expressed as Mean ± SD.

Mean values with different superscript letter in the same column are significantly different at P<0.05.

Table (7): Minerals contents of potassium, calcium, magnesium, phosphorus & Sodium of casein free and gluten free

Nutrients Days	Potassium (mg)	Calcium (mg)	Magnesium (mg)	Phosphorus (mg)	Sodium (mg)
1 st day	3259.18 ^b ± 0.013	319.27 ^c ± 0.019	144.81 ^c ± 0.016	1314.68 ^b ± 0.021	1965.67 ^b ± 0.184
2 nd day	4200.25 ^a ± 0.04	424.15 ^b ± 0.036	417.50 ^a ± 0.027	1836.53 ^a ± 0.062	179.07 ^c ± 0.024
3 rd day	4539.9 ^a ± 0.023	944.43 ^a ± 0.04	412.05 ^b ± 0.137	396.4 ^c ± 0.030	2310.81 ^a ± 0.004
DRI	470.14 ^a ± 0.015	130.4 ^d ± 2.074	420.0 ^a ± 0.000	126.2 ^d ± 2.59	2300.02 ^a ± 0.02

Mean values are expressed as Mean ± SD.

Mean values with different superscript letter in the same column are significantly different at P<0.05.

Table (8): Food composition content of iron, zinc & copper of casein free and gluten free

Nutrients Days	Iron (mg)	Zinc (mg)	Copper (mg)
1 st day	18.81 ^c ± 0.01	10.06 ^d ± 0.02	1.61 ^d ± 0.01
2 nd day	26.61 ^b ± 0.02	13.83 ^b ± 0.03	1.92 ^c ± 0.01
3 rd day	32.64 ^a ± 0.001	20.8 ^a ± 0.014	2.82 ^b ± 0.043
DRI	18.08 ^c ± 0.13	11.07 ^c ± 0.19	9.14 ^a ± 0.17

Mean values are expressed as Mean ± SD.

Mean values with different superscript letter in the same column are significantly different at P<0.05.

According to the above results, this research suggested that gluten free, casein free (GF-CF) diet may be beneficial for autistic children patients.

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تقييم بعض الوجبات الغذائية المقترحة الخالية من الكازين والجلوتين للأطفال مرض التوحد

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هدفت الدراسة إلى اقتراح وتقييم بعض الوجبات الغذائية للوجبات الخالية من الجلوتين والكازين (GF-CF) للأطفال المصابين بالتوحد. تم تقييم وجبات يومية للأطفال المصابين بطيف التوحد لمدة 3 أيام، مقسمة على النحو التالي (GF-CF) :-تم تطوير وجبات مناسبة للأطفال من طيف التوحد لمدة ثلاثة أيام، وفقا لثلاث وجبات يوميا، على سبيل المثال 9 وجبات وهو مجموع الوجبات للأيام الثلاثة. تم تحليل الوجبات اليومية باستخدام جدول تحليل غذائي للحصول على محتوى الوجبات من بروتين – دهون – ألياف – كربوهيدرات – فيتامينات – أملاح معدنية، تمت مقارنة نتائج تحليل الأطعمة الخاصة بوجبات الأطفال المصابين بطيف التوحد بجداول (DRI) للأطفال ونظرا لأهمية المعادن والفيتامينات، نقترح أن يتناول مريض التوحد وجبة من اليوم الثاني من الجلوتين والكازين كان من الواضح أن هناك اختلافات إحصائية حيث ؛ $P < 0.05$ مقارنة مع DRI وفقا للنتائج المذكورة أعلاه، قد يكون هذا النظام الغذائي الخالي من الجلوتين والكازين (GF-CF) قد يكون مفيداً لمرضى الأطفال المصابين بالتوحد.

الكلمات المفتاحية: أطفال التوحد، وجبات خالية من الجلوتين، وجبات خالية من الكازين، وجبات الكيتو، النظام الغذائي